

A-20 Thematic Poster - A Wonder Drug for Healthy Aging: Physical Activity

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 505

80 Chair: Loretta DiPietro, FACSM. *The George Washington University, Washington, DC.*
(No relationships reported)

81 Board #1 May 31 9:30 AM - 11:30 AM
Intermittent Walking has Similar Effects on 24-Hour Glycemia as a Calorically Equivalent Continuous Walk in Older Adults

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Reported Relationships: K. Lyden: Consulting Fee; PAL Technologies.

Older adults spend more time engaged in sedentary behavior (SB) than any other segment of the population. Interrupting sedentary time with short bouts of walking improves 24-hour glycemic control compared to uninterrupted sitting. However, it is not known if short-walking bouts are as beneficial to 24-hour glycemia as a single bout of continuous exercise. **Purpose** To compare the effectiveness of multiple, short intermittent walking bouts and one, calorically equivalent continuous bout of walking on 24-hour glycemia in older adults. **Methods** Healthy, overweight/obese older adults (N=18, 67 ± 5 y, BMI = 32.2 ± 4.3 kg/m²) completed two, 24h conditions in a whole room indirect calorimeter; 1) Intermittent walking (IW): 1.5 min of moderate intensity treadmill walking (36 min total) every 30 minutes and 2) continuous walking (CW): 36 min continuous, moderate intensity treadmill walking performed in the morning (~8AM). Outside of the prescribed walking times, subjects remained in SB for the remainder of the waking day. Continuous glucose monitoring was used to measure interstitial glucose concentrations every 5 minutes. Energy and macronutrient intake was standardized between conditions. **Results** 24-hour energy expenditure (2257 ± 329 vs. 2165 ± 302 kcal, mean ± SD) and RQ (0.84 ± 0.03 vs. 0.84 ± 0.03) were similar during IW and CW, respectively. Peak postprandial glucose following dinner was lower (p<0.05) during IW (120.4 ± 10.7 mg/dl) compared to CW (135.3 ± 15.3 mg/dl). No differences were observed in any other 24 hour glycemia variables, including 24 hour area under the glucose curve (IW = 154862 ± 12724 mg/dl, CW = 158096 ± 15156 mg/dl), glycemic variability (standard deviation of 24 hour glucose concentrations) (IW = 12.2 ± 4.4 mg/dl, CW = 12.2 ± 4.2 mg/dl), and peak postprandial glucose concentrations following breakfast (IW = 144.0 ± 22.7 mg/dl, CW = 144.8 ± 27.2 mg/dl) and lunch (IW = 137.9 ± 17.1 mg/dl, CW = 139.2 ± 17.8 mg/dl). **Conclusion** These results suggest IW had similar effects as CW on 24-hour glycemia, although the postprandial glucose response to meals consumed later in the day may be lower with IW. IW may improve cardiometabolic health in older adults.

82 Board #2 May 31 9:30 AM - 11:30 AM
Mobility Improvement After an Exercise Program for Older Adults: Role of Initial Mobility

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Basic mobility tasks are often used to assess improvement in response to physical activity interventions for older adults. However, it can be argued that if strength and endurance capacities are adequate prior to engaging in a program of exercise, further increases in capacity are not expected to alter basic tasks. Usual Gait Speed (UGS), 6 Minute Walk (6MW), and Timed Up and Go (TUG) are often used in research evaluate the efficacy of an exercise training program for older adults. However, the change in these measures has not been evaluated in relation to initial mobility. **PURPOSE:** To evaluate the improvement in basic mobility tasks in response to a ten-week community based exercise program for older adults with high or low functional ability. **METHODS:** Sixty-one older adults (age= 72.7 yrs±7.9); BMI=32.3±7.2) completed the 10-week Physical Activity for Seniors for Life (PALS) group exercise and lifestyle behavior change program. TUG (time in seconds to rise from a chair, walk 3 meters, return to chair and sit), 6MW (distance covered in 6 minutes), and UGS (meters/second to walk 6 m distance) were measured before and after the exercise program. Participants were divided into upper and lower functional groups based on the median for each mobility task. Repeated measures ANOVA and Effect Size (Cohen's d) were used to examine mean differences within the two groups. **RESULTS:** After the exercise program, the lower functional group showed significant improvement in all basic mobility tasks (p<0.001). The upper functional group showed significant improvement

in 6MW (p<0.001) and TUG (p=0.006), with no significant change in UGS (p=0.816). Importantly, the lower functional group demonstrated much higher effect sizes in all three tests (6MW: 763 vs 1121 feet, d=0.936; TUG: 13.3 vs 11.2 seconds, d=0.858; UGS: 6.3 vs 5.4 seconds d=0.800), pre, post respectively, while the higher functional group showed only moderate or low effect sizes, 6MW (1414 vs 1522 feet, d=0.562), TUG (9.1 vs 8.3 seconds d=0.577), UGS (4.65 vs 4.62 seconds d=0.041) pre, post respectively. **CONCLUSION:** These results suggest that UGS may be better suited for use with a frail population, while TUG and 6MW may be useful across a wider range of functional ability in older adults.

83 Board #3 May 31 9:30 AM - 11:30 AM
Unemployed Older Adults' Social Participation was Associated with More Physical Activity and Less Sedentary Time

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PURPOSE: Social participation provides health benefits for older adults, but it is not known whether social participation is associated with their being more physically active or less sedentary. We examined these associations in a population-based sample of older Japanese adults.

METHODS: A mail survey conducted in 2010 and gathered data from 1146 community-dwelling, non-working older adults (mean age: 70.1 years, 43% men) on social participation, physical activity, sedentary time and socio-demographic characteristics. Median splits were used to categorize social participation, physical activity and sedentary behavior as either 'higher' or 'lower'. Multivariate logistic regression analyses were used to calculate odds ratios (ORs) for the associations of higher versus lower social participation with being physically active and having higher sedentary time. Similar analyses were conducted after classifying sedentary behaviors into two distinct types: passive sedentary behaviors (consisting of "television viewing", "sitting around", and "listening or talking while sitting") and mentally-active sedentary behaviors (consisting of "computer use" and "reading books or newspapers")

RESULTS: Those with higher social participation had a significantly greater odds of higher physically activity (OR=2.10, [95% confidence interval (CI): 1.44-3.06] among men; OR=1.93, [1.39-2.68] among women); and a significantly lower odds of higher sedentary time among men (OR=0.62, [0.42-0.90]), but not among women (OR=0.80, [0.58-1.11]). Those with higher social participation had significantly lower passive sedentary time (OR=0.55, [0.38-0.81] for men; OR=0.72 [0.51-0.99] for women), but this was not the case for mentally-active sedentary time (OR=1.36, [0.91-2.02] for men; OR=1.17 [0.83-1.63] for women).

CONCLUSIONS: Promoting social participation among older adults may be effective for increasing their physical activity and reducing sedentary time.

84 Board #4 May 31 9:30 AM - 11:30 AM
Effects of Stair Climbing on Leg Muscle Strength in Older Adults Attending Physical Activity Programs

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Purpose: Stair climbing can be a strenuous task and stair accidents/injury are common among older adults. We evaluated the effectiveness of daily stair climbing on leg muscle strength in older adults participating in weekly community physical activity programs for 6 months. **Methods:** Seventy-four healthy older adults (50 women, 24 men, mean age, 73.5 ± 5 years) were recruited. Participants attended weekly physical activity programs at their community center and recorded their daily walking and stair climbing steps using a pedometer, Omron, HJA-403C, which detects both types of steps. Prior to and after the 6-month study period, height, weight, and leg strength (i.e., abductor muscle strength, adductor muscle strength, and knee extensor strength) were measured. During the study period, the instructors encouraged participants to engage in stair climbing by explaining the health benefits, providing information on locations of stairs nearby, and listening to participants' experiences on routine stair use. A paired t-test was used to determine the changes in steps and leg strength before and

after the 6-month study period, and Pearson correlation analysis was used to identify correlations between the stair climbing steps and leg strength. **Results:** Forty-nine participants (34 women, 15 men) completed the study. At the baseline, the participants recorded an average of 120 stair steps per day, which was approximately 2% of their daily total walking steps. After the 6-month study period, the mean walking steps ($6,607 \pm 3,235$ steps vs. $7,556 \pm 2,715$ steps) and stair steps (119 ± 90 steps vs. 166 ± 123 steps) increased significantly ($p \leq 0.01$). There were no significant changes in leg muscle strength (Pre-test vs. Post-test: Adductor, 0.35 ± 0.11 vs. 0.35 ± 0.10 kg/kg, Abductor 0.41 ± 0.11 vs. 0.44 ± 0.10 kg/kg). However, in men the correlation coefficient between the stair steps and abductor muscle strength was observed (Pre-test: $r=0.428$, $p=0.04$, Post-test: $r=0.556$, $p=0.03$). **Conclusions:** Stair-use campaigns increased routine daily stair use (about 50 steps) in older adults. This did not significantly change leg muscle strength, however in men the relationship between the stair steps and abductor muscle strength was observed. In a future study, cross-sectional evaluations of stair steps and leg muscle strength will be examined.

85 Board #5 May 31 9:30 AM - 11:30 AM
Effects of Tai Chi on Mobility in Older Adults with Multisite Pain

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Chronic pain is associated with impaired mobility and risk of falls in older adults. **PURPOSE:** To examine the effects of Tai Chi on mobility in older adults with multisite pain and risk of falls. **METHODS:** Fifty-four community-dwelling older adults (≥ 65 years) with multisite pain who reported falling in the previous year or using an assistive device were randomized to gentle body exercise or mind-body exercise (Tai Chi), each offered twice weekly for 12 weeks. Assessments were performed at baseline and within 2 weeks after completing the intervention. Mobility was measured in 2 conditions: single-task walking and dual-task walking with a cognitive attentional challenge, by using a 16-foot sensorized gait mat. Paired t-tests were used to assess changes within each group, and student t-tests were used to assess differences between groups. **RESULTS:** Twenty-three participants in the body exercise group and twenty-two participants in the Tai Chi group completed the study. The body exercise intervention did not change any gait measures. However, the Tai Chi intervention significantly improved single-task stride time (from 1.20 ± 0.11 s to 1.16 ± 0.10 s, $p < 0.05$) and swing time (from 31.77 ± 3.20 % to 32.23 ± 2.82 %, $p < 0.05$), and decreased dual-task gait asymmetry (from 5.40 ± 3.92 to 2.87 ± 3.07 , $p < 0.05$). Also, comparing the 2 interventions, participants in the Tai Chi group versus the body exercise group significantly decreased dual-task gait asymmetry from baseline to the post-intervention assessment (body exercise: 0.33 ± 3.54 vs. Tai Chi: -2.53 ± 4.41 , $p < 0.05$). **CONCLUSION:** Tai Chi improved several single-task and dual-task gait measures in older adults with multisite pain and risk for falls. A larger study is required to examine the effectiveness of Tai Chi on mobility and fall risk in older adults with multisite pain. (Supported by NIH Grant R21 AG043883)

86 Board #6 May 31 9:30 AM - 11:30 AM
A 3-Month Dalcroze Eurhythmics Intervention May Improve Gait Speed in Community Dwelling Elderly Participants

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Falls lead to lower quality of life, reduced independence, and increased mortality in the elderly. Many falls occur while walking, especially when performing other tasks simultaneously. Dalcroze eurhythmics (DE) is a music-based movement training program that emphasizes multitask coordinated movement. A previous 6-mo DE study in the elderly demonstrated significant improvements in gait and balance. However, the effects of a short-term DE intervention on fall risk-related outcomes is unknown. **PURPOSE:** To determine if a 3-mo DE intervention improves measures of gait and balance, self-perceptions of health, and fear of falling in a community-dwelling elderly cohort. We hypothesized that improvements would be detected in all outcome measures after the intervention. **METHODS:** 9 participants (8 females, 1 male; age 79.0 ± 12.3 y) completed the intervention. DE sessions, led by a certified DE instructor, were held 1x/wk at a community senior program. Pre and post-testing sessions occurred 1 wk before the program began, and 1 wk after the last session, respectively. Gait speed (m/sec) was determined by the 6-m walk test (6MWT). Dual-

task gait speed was determined from repeating the 6MWT, but while participants counted backward from 50. Balance and coordinated stability was assessed using a Swaymeter test. Participants' perceptions of overall, physical, and mental health was assessed by SF-12 questionnaires. Fear of falling was assessed with the Tinetti Falls Efficacy Scale. Paired t-tests were used to compare mean differences. **RESULTS:** Gait speed improved significantly post-intervention (0.92 ± 0.11 vs 1.04 ± 0.12 m/sec, $p=0.004$). Dual-task gait speed also improved (0.77 ± 0.09 vs 0.92 ± 0.11 m/sec, $p=0.0005$). Trends toward significance existed for improvements in SF-12 total score (91.5 ± 4.4 vs 100.6 ± 3.9 , $p=0.08$), and mental component score (52.8 ± 3.3 vs 58.0 ± 2.3 , $p=0.06$), and Swaymeter results (10.0 ± 1.5 vs 7.9 ± 1.7 deviations, $p=0.07$). No differences were found for SF-12 physical component scores or in fear of falling after the intervention. **CONCLUSION:** Participating in Dalcroze eurhythmics for 3 mo may improve gait speed under single and dual task conditions. This movement training approach could be considered for use by community senior programs as a possible fall risk reduction intervention for the elderly.

87 Board #7 May 31 9:30 AM - 11:30 AM
Yearlong Walking Exercise Improves Depression and Health-related Quality of Life in Older Adults

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Previous studies suggest that moderate-intensity aerobic exercise and strength training are effective for improving depression and health-related quality of life (HRQL) in older adults. However, the effects of long-term walking exercise on depression and HRQL in older adults has not been determined. **PURPOSE:** The purpose of this study was to assess the effectiveness of 12 months of walking exercise in improving depression and HRQL in older adults. **METHODS:** We divided 180 apparently healthy older adults into 2 non-randomized groups: a 12-month walking exercise group ($n = 110$, 60 men and 50 women; mean age, 72.2 ± 6.4 years) and a non-walking exercise group ($n = 70$, 39 men and 31 women; mean age, 72.6 ± 3.8 years). The Center for Epidemiological Studies Depression Scale (CES-D) and the Medical Outcomes Study 36-Item Short-Form Health Survey version 2 (SF-36v2) were used to measure depressive symptoms and HRQL. In Japanese, SF-36v2 scores are summarized in physical HRQL scores (physical component summary [PCS]), mental HRQL scores (mental component summary [MCS]), and role / social HRQL scores (role / social component summary [RCS]) (Suzukamo et al. 2011). Therefore, in the analysis of SF-36v2 scores, we evaluated PCS, MCS, and RCS. **RESULTS:** Participants in the walking exercise group showed significant improvement in CES-D scores (11.0 ± 4.1 points vs. 9.7 ± 4.8 points, $p < 0.001$), MCS scores (54.5 ± 9.1 vs. 56.8 ± 8.6 , $p = 0.005$), and RCS scores (49.4 ± 9.4 vs. 52.8 ± 9.0 , $p < 0.001$) compared to the baseline values. Overall, the average step counts per day of the walking exercise group participants significantly increased, compared to the baseline values (7747 ± 1782 steps / day vs. 8736 ± 2701 steps / day, $p < 0.001$). **CONCLUSIONS:** Twelve months of walking exercise may be effective for improving CES-D, MCS, and RCS scores in older adults.

88 Board #8 May 31 9:30 AM - 11:30 AM
Physical Activity and Sedentary Behavior of Older Adults Related to Physiological Metrics of Walking Effort

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Older adults spend nearly ten hours of the waking day in sedentary activities that increase risk for chronic disease progression and loss of physical function. It is important to understand how the physiological demands of ambulation contribute to ambulatory and sedentary behavior so effective interventions can be implemented in this at-risk population. **PURPOSE:** To determine whether neuromuscular, pulmonary, and cardiac demand during a fixed-paced walk explain variance in sedentary behavior and walking activity in community-dwelling older adults. **METHODS:** Twelve women and thirteen men, 77 ± 9 yr, 74.6 ± 15.5 kg, 26.0 ± 4.3 kgm², performed a four-minute, steady-state walk on a treadmill at 1.25 m s⁻¹ while activation of the vastus lateralis muscle, heart rate, and minute ventilation were recorded. ActivPAL accelerometers were used to record time spent walking and sedentary over 96 consecutive hours. Sleep logs were used to calculate time spent awake during the monitoring period. Walking time and sedentary time were then recorded as percent of the waking day. Stepwise regression determined whether peak muscle activation, minute ventilation, and heart rate predicted sedentary and walking time. **RESULTS:**

Participants spent $56 \pm 11\%$ (9.0 ± 1.9 hr) of the waking day sedentary and $12.5 \pm 3.0\%$ (2.0 ± 0.5 hr) walking. Partial correlations from stepwise regression showed that sedentary time was positively related to muscle activation during walking ($r = 0.56$, $p = 0.011$), but not to ventilation ($r = 0.23$, $p = 0.346$) or heart rate ($r = 0.03$, $p = 0.915$). In contrast, walking time was inversely related to minute ventilation ($r = -0.57$, $p = 0.008$), but was not related to muscle activation ($r = -0.04$, $p = 0.881$) or heart rate ($r = 0.14$, $p = 0.569$). **CONCLUSIONS:** Physical activity and sedentary behavior are independent disease risk factors and this study's results indicate that different aspects of physical function may contribute to their variability in older adults. Time spent sedentary was related to the degree of neuromuscular demand during walking suggesting that older adults who have high muscle activation during ambulation are more likely to engage in sedentary behavior. Time spent walking was inversely related to pulmonary demand suggesting that those who walk with a high ventilatory rate are less likely to engage in walking activity.

A-21 Thematic Poster - Children and Adolescents

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 304

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(No relationships reported)

90 Board #1 May 31 9:30 AM - 11:30 AM

Fitness and Body Composition Outcomes in Adolescent Athletes Consuming Chocolate Milk or Gatorade Post-Exercise

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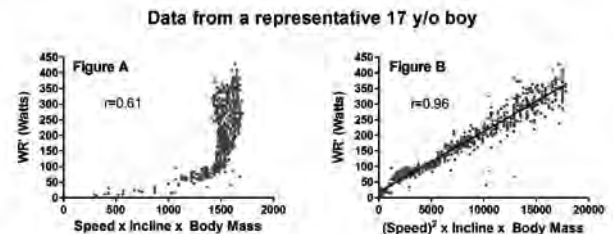
Purpose. This study examined fitness and body composition outcomes for adolescents consuming chocolate milk (CM) or a carbohydrate/electrolyte (CHO) drink throughout a school-sponsored summer strength and conditioning program. **Methods.** Participants were 100 high school athletes (M age = 15.1, $SD = 1.3$; 78% male; 46% Afr. Amer.). Measures included a bench press (BP), squat, power clean, bodyweight, and hand-held BIA body fat assessment. BP and squat were combined for a composite strength score (CSS). Participants completed 4 days/week of strength and conditioning training for 6 weeks. The workouts consisted of a 1-hour free weight resistance training session followed by 1-hour of on-field agility drills and conditioning sprints. Participants were randomly-assigned to receive either CM (16 oz, 300 Cal, 5g fat, 360 mg Na, 44 g carbs, 16 g protein) or CHO (28 oz, 0 g fat, 320 mg Na, 42 g carbs, 0 g protein) immediately post-exercise. **Results.** A 2-way repeated measures ANOVA showed no bodyweight changes from pre- to post-test ($p = .071$, $d = .06$). Additionally, there was not a significant change in body fat percentage ($p = .89$, $d = .03$). No interactions presented by condition for weight ($p = .49$, $\eta_p^2 = .005$) or body fat ($p = .43$, $\eta_p^2 = .006$). Both groups showed an improvement in power clean ($p < .001$, $d = .22$) across time with no interactions. However, the CSS showed a significant condition by time interaction ($p = .044$, $\eta_p^2 = .08$) wherein the CHO group did not significantly increase over time ($p = .406$) while the CM group significantly improved in CSS from pre- to post-test ($t = -4.153$, $p < .001$). Paired samples t-tests of the separated BP and squat showed that the CHO group significantly decreased in mean BP (7.26 lbs, $p = .044$) but had no change in squat (17.7 lbs, $p = .154$). The CM group showed significant increases in both BP (9.06 lbs, $p = .039$) and squat (36 lbs, $p < .001$). **Discussion.** This is the first study comparing the impact of CM and CHO on athletic outcomes in an adolescent population in a field-based environment. The use of CM appears to have provided a moderate benefit for increases in strength. This study replicates the findings of laboratory studies, and extends them by showing a benefit in adolescent athletes in a naturalistic setting. Future research will benefit from longer study durations with larger numbers of participants.

91 Board #2 May 31 9:30 AM - 11:30 AM

A Novel Approach To Calculate Work Rate On A Treadmill (TM) In Early-and Late-pubertal Children

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Childhood obesity and children who survive previously fatal diseases and conditions highlight the need for rigorous metrics of fitness in children and across the lifespan. Cardiopulmonary exercise testing (CPET) data in children must be scaled to the magnitude of the metabolic perturbation. In CPET using cycle ergometry (CE), the external work (WR) is readily determined. With TM testing WR is hard to estimate from its key elements of speed, incline, and body mass (S, I, M) given the complexity of the mechanics of energy cost as S and I change. **PURPOSE:** To estimate WR associated with TM exercise (S,I,M) in early and late pubertal boys. **METHODS:** Our strategy involved: 1) Using CE to establish the regression coefficient (a) and intercept (b) from the linear equation $\dot{V}O_2 = aWR + b$; 2) assuming the same relationship we estimated work rate (WR') from the $\dot{V}O_2$ measured on TM using S, I, M (Fig A) and S^2 , I, M (Fig B); 3) analyzed the regression parameters from the function $WR' = a(S^2, I, M) + b$ in 10 early pubertal (mean age 9.8 y/o, tanner stage 1-2) and 10 late pubertal boys (15.8 y/o, tanner stage 4-5), performed CPET on CE and TM. **RESULTS:** WR' was moderately and non-linearly correlated with S I M (mean $r = 0.61$, Fig A). However mean $r = 0.96$ and linear relationship was found with $WR' = a(S^2 I M) + b$, (Fig B). Further, the slope (a) was significantly higher in the younger (0.0395 ± 0.006) compared with the older boys (0.0316 ± 0.008 , $p = 0.017$). **CONCLUSION:** This approach enables CPET data interoperability between TM and CE. WR' seems to be a square function of S, making it a linear function of kinetic energy (MS^2). CPET slopes (e.g., $\Delta\dot{V}O_2/\Delta WR$ or $\Delta HR/\Delta WR$) can be calculated and provide useful insights into disease mechanisms and progression in children and adults, when maximal efforts are questionable. The maturational related differences between WR' and SIM suggest a biological difference in the efficiency of muscular work as children grow and develop. Supported by NIH P01HD-048721 & PERC System Biology Fund



92 Board #3 May 31 9:30 AM - 11:30 AM

Effectiveness of the Scaling Method in Normalizing Strength Measurement of U.S. Children And Youth

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PURPOSE: Studies have shown that body size may affect athletes' performance in fitness tests. Thus, individuals with larger body mass (BM) often exhibit a greater amount of muscle tissue and perform well on certain fitness tests when the load is "absolute" (i.e., the load, e.g., a 10 kg dumbbell, keeps the same across the test takers). To account for this effect, it is common practice to normalize athlete performance by simply dividing the outcome variable by BM. Yet, the effectiveness of this approach has not been well studied in children and youth. Using the data from the 2012 NHANES National Youth Fitness Survey (NNYFS), this study was to explore and evaluate possible scaling methods to eliminate the effect of body mass on children's performance in fitness tests, especially strength tests. **METHODS:** 1640 participants (50.2% male; aged 3-15 yr.) took part in the physical fitness tests. Lower body muscle strength (LBMS) was derived from knee extension tests and hand grip strength (HGS) was determined by the handgrip dynamometer. Five different scaling methods (dividing the outcome variable by BM, BM^2 , BM^3 , square root (SQRT) of BM, and natural logarithm (ln) of BM) were applied and the correlations between test results and BM (kg) before and after scaling were examined in each method. **RESULTS:** Results from the correlation analysis showed that BM is highly correlated with strength measures in both boys (LBMS: .702, HGS: .793) and girls (LBMS: .666,

HGS: .790). By dividing by BM, the overall correlation coefficients were significantly decreased (LBMS: .687 to -.102, HGS: .780 to -.258) and the body size effect was better adjusted in boys (LBMS: -.044, HGS: -.171) than in girls (LBMS: -.173, HGS: -.412) using the scaling method.

	Scaling Method	LBMS (pounds)	HGS (kg)
Boy	None	.702	.793
	/BM	-.044	-.171
	/BM ²	-.658	-.823
	/BM ³	-.673	-.776
	/SQRT(BM)	.444	.530
	/ln(BM)	.596	.695
Girl	None	.666	.790
	/BM	-.173	-.412
	/BM ²	-.698	-.834
	/BM ³	-.716	-.778
	/SQRT(BM)	.348	.417
	/ln(BM)	.529	.653
Overall	None	.687	.780
	/BM	-.102	-.258
	/BM ²	-.676	-.824
	/BM ³	-.693	-.774
	/SQRT(BM)	.406	.483
	/ln(BM)	.569	.669

CONCLUSION: The effect of body size on measurement of LBMS and HGS could be adjusted by simply dividing by BM and the effect was more significant in boys.

93 Board #4 May 31 9:30 AM - 11:30 AM
Interpopulation Variations in Height Growth: a Potential Explanation for Differences in Adolescent Swim Performance

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Maturation-based superiority in adolescent sport performance has been well documented. Because the timing of maturational events differs among ethnic or geographically-disparate populations, we hypothesized that interpopulation variations in physical growth patterns may be related to differences in athletic performance. **PURPOSE:** To determine the relationship between height growth and swim performance progression for two geographically disparate populations (Japanese, JPN; and the U.S., US) and the extent to which interpopulation variations in height growth are related to respective swim performance progression. **METHODS:** Growth reference data were acquired for JPN (MEXT, 2000) and US (Kuczumski et al., 2002). All performance times (sec) in 50-meter long course freestyle (50Fr) for JPN (N = 46900) and US (N = 60739) in 2008 were compiled from each swimming federation's database. For each age within each sex, a t-test was performed to compare 50Fr between JPN and US. Pearson correlation coefficient was used to evaluate 1) the strength of the relationship between age-related median height and median 50Fr for each sex within each country and 2) the extent to which interpopulation variations in age-related height growth (expressed as JPN to US ratio) are related to those in age-related 50Fr progression for each sex. **RESULTS:** As compared with the respective US cohort, age-related peak height gains occur approximately two years earlier for JPN (10 vs 12 yr in girls; 12 vs. 14 yr in boys). The 50Fr was faster for JPN girls aged 7 to 11 yr and JPN boys aged 7 to 9 yr ($p < 0.001$), not different for girls at 12 yr and boys at 10 and 11 yr, and slower at 13 yr and older for JPN girls and 12 and older for JPN boys ($p < 0.001$). Median height was correlated with median 50Fr during adolescent ages for US girls and boys ($r(12) = -0.97, p < 0.001$), JPN girls and boys ($r(9) = -0.97, p < 0.001$). The JPN to US ratio in height growth was also correlated with that in 50Fr progression in girls ($r(9) = 0.71, p = 0.015$), but not in boys ($r(9) = 0.49, p = 0.12$). **CONCLUSIONS:** Maturation-related superiority in swim performance is not only observable within a population but also between populations. Interpopulation variations in the timing of maturational events (as measured by age-related peak height gain) partially explain differences in adolescent athletic performance.

94 Board #5 May 31 9:30 AM - 11:30 AM
Activity Profile of Pokemon GO in College Students
 Charles Fountaine, Emily Springer, Jasmine Sward. *University of Minnesota Duluth, Duluth, MN.* (Sponsor: John R. Keener, FACSM)
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 (No relationships reported)

Since its debut in July 2016, Pokemon GO has been a wildly popular mobile gaming app. In contrast to many previous exergames, Pokemon GO requires the user to be physically active. However, the extent to which Pokemon GO contributes to physical activity is unknown. **PURPOSE:** to investigate the activity profile of playing Pokemon GO for 60 minutes in college students.

METHODS: College students (n=24, n=15 female) were fitted with an accelerometer, pedometer, and heart rate monitor to assess the activity demands during a 60-min bout of playing Pokemon GO. Troiano accelerometer cut points were utilized to estimate time spent in sedentary, light, moderate, and vigorous physical activity.

RESULTS: Descriptive statistics for heart rate (average and peak), total steps, and time (min) spent in sedentary, light, moderate, and vigorous physical activity are displayed in the table below. On average, 82.7% \pm 10.1% of the play time was spent in moderate-intensity physical activity.

CONCLUSIONS: The results of this study suggest that playing one hour of Pokemon GO can be an effective means of accumulating recommended levels of physical activity.

Avg. HR (bpm)	Peak HR (bpm)	Steps	Sedentary (min)	Light (min)	Moderate (min)	Vigorous (min)
100.3 \pm 11.3	133.8 \pm 17.7	5992.1 \pm 578.8	4.9 \pm 3.0	6.1 \pm 3.9	50.1 \pm 5.3	0.15 \pm 0.4

95 Board #6 May 31 9:30 AM - 11:30 AM
Associations Among Perceived Motor Competence, Motor Competence, Physical Activity, And Health-related Physical Fitness Of Children Ages 10-15 Years Old.

Emily M. Post¹, Dawn P. Coe, FACSM², Eugene C. Fitzhugh², Jeffrey T. Fairbrother². ¹The Ohio State University, Columbus, OH. ²The University of Tennessee, Knoxville, TN. (Sponsor: Dr. William Kraemer, FACSM)
 (No relationships reported)

PURPOSE: To examine the associations among perceived motor competence (PMC), motor competence (MC), moderate to vigorous physical activity (MVPA), and health-related physical fitness during middle childhood and early adolescence. **METHODS:** Participants were 47, 10-15-year-old youth (12.2 \pm 1.64 yrs, 50.2 \pm 16.2 kg, 157 \pm 13.1 cm). Each participant made two visits, separated by at least 7 days, in East Tennessee or northwest Ohio, during which they completed the Bruininks-Oseretsky Test of Motor Proficiency, 2nd Edition, Harter's PMC questionnaire (Harter, 1978), and the FITNESSGRAM battery for health-related physical fitness. Actigraph GT3X+ accelerometers were worn for seven days to measure MVPA. **RESULTS:** There were significant ($p \leq 0.05$) positive correlations between physical fitness and both MC ($r_s = 0.44, p < 0.01$) and PMC ($r_s = 0.32, p < 0.05$). Additionally, a significant positive correlation was discovered between PMC and MC ($r_s = 0.47, p < 0.05$). There were no significant correlations between average daily MVPA and the other variables.

CONCLUSION: Results indicated that higher MC and PMC were associated with higher levels of health-related physical fitness. The interrelationship of these three variables was consistent with previous studies linking the development of fundamental motor skills to participation in complex movement behaviors, such as sports and other lifetime fitness activities, and the development and strengthening of PMC (Stodden & Robertson, 2009; Hands et al., 2008; Cliff et al., 2011; Zask et al., 2012; Barnett et al., 2010).

96 Board #7 May 31 9:30 AM - 11:30 AM
Tracking Physical Activity and Sedentary Behavior in Adolescents using a Mobile Application
 Todd Buckingham, Karin Pfeiffer, FACSM. *Michigan State University, East Lansing, MI.*
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 (No relationships reported)

During adolescence, sedentary time tends to increase while physical activity (PA) declines. Self-report measures of adolescents' activities are often prone to recall bias and are limited by their inability to detect simultaneous activities. Real-time measurements (Experienced Sampling Method, ESM) may address these limitations

by assessing activities when they take place. **PURPOSE:** To describe adolescents' after-school behaviors through use of a mobile application using ESM. The secondary purpose was to examine the feasibility and acceptability for adolescents to track their after-school PA and sedentary behaviors.

METHODS: Participants completed surveys on the behavior in which they were engaged at the time the survey was sent, using an app on their mobile device. The surveys occurred randomly, three times, from 3:30-9pm, for seven days. Participants also completed a 15-minute, telephone-based follow-up interview to assess ease and likeability of using the app on 5-pt scales (1=very easy, 5=very hard; 1=disliked a lot, 5=liked a lot). **RESULTS:** Thirty adolescents, 11-15 years old, submitted 560 surveys using the mobile device app (89% response rate). The adolescents most often reported engaging in "Other" activities (e.g., shopping, sitting) at 16.8% of total responses, followed by physical activity (14.3%). The least common activity was using their computer (1.6%). Two participants reported engaging in multiple activities at the same time (0.5%). Participants indicated the app was very easy to use (mean=1.5), and that they liked using the app (mean=3.9). On average, adolescents completed the survey in 0:08:06. However, from the time the survey was sent to the time they began the survey, it took the adolescents nearly 3 hours to begin.

CONCLUSIONS: To be considered ESM, participants must answer surveys immediately after they are sent. Although the mobile app appears to be appealing and easy to use, adolescents did not always answer the surveys in a manner that qualifies as ESM. Mostly, this was due to participants' lack of reliable access to their own mobile device. ESM may be an improvement over self-report recall surveys, but future investigators should note the limitations of using ESM with adolescents. Supported by the Michigan State University College of Education Summer Research Fellowship

97 Board #8 May 31 9:30 AM - 11:30 AM
Fitness, Adiposity, Sports Participation, and Arterial Stiffness in Youth With Chronic Diseases or Physical Disabilities.

Tim Takken¹, Kristel Lankhorst², Frank Backx¹, Anne Visser-Meily¹, Eero A. Haapala³. ¹UMC Utrecht, Utrecht, Netherlands. ²HU University of Applied Sciences, Utrecht, Utrecht, Netherlands. ³University of Jyväskylä, Jyväskylä, Finland. (Sponsor: Jos J de Koning, FACSM, FACSM)
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(No relationships reported)

PURPOSE: To investigate the associations of cardiorespiratory fitness, body adiposity, and sports participation, with arterial stiffness in 140 children and adolescents with chronic diseases or physical disabilities.

METHODS: Cardiorespiratory fitness was assessed using maximal exercise test with respiratory gas analyses either using shuttle run, shuttle ride, or cycle ergometer test. Cardiorespiratory fitness was defined as peak oxygen uptake (VO_{2peak}) by body weight or fat free mass (FFM). Body adiposity was assessed using waist circumference, body mass index standard-deviation score (BMI-SDS), and body fat percentage. Sports participation was assessed by a questionnaire. Aortic pulse wave velocity (PWV) (PWVao), as a measure of arterial stiffness, and augmentation index (AIX%), as a measure of peripheral arterial tone, were assessed by a non-invasive oscillometric tonometry device.

RESULTS: VO_{2peak} / body weight (standardized regression coefficient $\beta=-0.222$, 95% CI=-0.386 to -0.059, $P=0.002$) and VO_{2peak} / FFM ($\beta=-0.173$, 95% CI=-0.329 to -0.017, $P=0.030$) were inversely and waist circumference directly ($\beta=0.245$, 95% confidence interval (CI)=0.093 to 0.414, $P=0.002$) associated with PWVao. However, the associations of the measures of cardiorespiratory fitness with PWVao were attenuated after further adjustment for waist circumference. A higher waist circumference ($\beta=-0.215$, 95% CI=-0.381 to -0.049, $P=0.012$) and a higher BMI-SDS ($\beta=0.218$, 95% CI=-0.382 to -0.054, $P=0.010$) were related to lower AIX%.

CONCLUSIONS: Poor cardiorespiratory fitness and higher waist circumference were associated with increased arterial stiffness in children and adolescents with chronic diseases and physical disabilities. The association between cardiorespiratory fitness and arterial stiffness was partly explained by waist circumference.

A-22 Thematic Poster - Diseased Muscle: Cancer and Muscle Dystrophy

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 404

98 Chair: Christopher G. Ballmann. *Samford University, AL.*
(No relationships reported)

99 Board #1 May 31 9:30 AM - 11:30 AM
The Effects Of Creatine And Creatinine On Rates Of Apoptosis In Doxorubicin-treated Myoblasts

Eric C. Bredahl, Sarah A. Kottensette, Nathaniel R. Marshall, Meghan K. Wagner, Kristen Drescher, Joan M. Eckerson. *Creighton University, Omaha, NE.* (Sponsor: Joan Eckerson, FACSM)
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(No relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent that is associated with a number of deleterious side effects, including skeletal muscle dysfunction and skeletal muscle wasting. Although the exact mechanisms behind the observed myotoxicity have yet to be fully understood, the direct effect of DOX can generally be attributed to the generation of reactive oxygen species (ROS) and interference with DNA replication. Conversely, creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by muscle atrophy, which is a hallmark of DOX treatment. Yet, there has been no investigation into the effects of Cr or creatinine (CrN) on DOX-induced apoptosis. **PURPOSE:** To investigate the effects of Cr and CrN treatment on DOX-induced apoptosis. **METHODS:** Rat skeletal muscle cells (RKSMC) were cultured in skeletal muscle growth medium until they reached 90-95% confluency. Cells were then collected and seeded on to a 96-well plate at a density of 10,000 cells/ml containing fresh skeletal muscle growth media and allowed to recover for 24 hours. Cells were then exposed to fresh growth media containing either 1.5 μ M of DOX, 10 mM of Cr, 10 mM CrN, 1.5 μ M DOX + 10 mM Cr, or 1.5 μ M DOX + 10 mM CrN for an additional 24 hours. Rates of apoptosis were then assessed using an Annexin V apoptosis detection kit (BD Pharmagen) and high contrast staining. **RESULTS:** In the cells treated with DOX, 31 \pm 5.9% of imaged cells were undergoing apoptosis, which was significantly higher than the Cr (11.9 \pm 3.8%) and the CrN (10.1 \pm 4.9%) treated group ($P=0.04$ and $P=0.03$, respectively). No significant difference in rates of apoptosis was found between Cr+DOX, CrN+DOX, or the DOX treated groups. **CONCLUSION:** Initial evidence from this investigation does not support the use of Cr or CrN to protect against DOX-induced apoptosis.

100 Board #2 May 31 9:30 AM - 11:30 AM
Timecourse Of Alterations In Myofiber CSA And Oxidative Phenotype In Progression Of Cancer-cachexia

Nicholas P. Greene¹, Jacob L. Brown¹, Megan E. Rosa¹, David E. Lee¹, Thomas A. Blackwell¹, Haley N. McCarver¹, Richard A. Perry, Jr¹, Lemuel A. Brown¹, Wesley S. Haynie¹, Michael P. Wiggs², Tyrone A. Washington¹. ¹University of Arkansas, Fayetteville, AR. ²University of Texas at Tyler, Tyler, TX. (Sponsor: Stephen F. Crouse, FACSM)
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(No relationships reported)

Cancer-cachexia (CC), loss of muscle mass in cancer, is directly responsible for 20-40% of cancer-related deaths depending on type of cancer. Currently no efficacious therapies exist to reverse CC leading to the conclusion that efforts need to be focused on prevention of CC. Unfortunately, few studies have been performed to fully examine the progression of CC across the timecourse of development. **PURPOSE:** To examine phenotypic alterations in skeletal muscle across the timecourse development of CC in a murine tumor implantation model. **METHODS:** 1×10^6 Lewis Lung Carcinoma cells (LLC) or Phosphate Buffered Saline (PBS, control) were injected into the hind-flank of C57Bl6/J mice at 8 wks age, and tumor allowed to develop for 1, 2, 3 or 4 wks. Muscle fiber size was assessed by cross sectional area (CSA) of individual myofibers following H&E staining and muscle oxidative phenotype by succinate dehydrogenase (SDH) staining in sections of tibialis anterior muscle. Stress kinase signaling through p38 MAPK relative phosphorylation was assessed by immunoblot. A One-Way ANOVA was utilized to detect statistical significance with a Student-Newman-Keuls post hoc analysis to delineate differences between groups, significance was set at $P=0.05$. **RESULTS:** Mean myofiber CSA was significantly reduced by 3 wk following tumor implantation compared to PBS control ($795 \pm 22 \mu m^2$ in 3 wk vs. $957 \pm 70 \mu m^2$ in PBS) and further reduced 4 wks post tumor implantation ($556 \pm 43 \mu m^2$). Percent of SDH positive (oxidative) myofibers was lower at 4 wks post implantation compared to all other groups ($44 \pm 0.04\%$ in 4 wk compared to $68 \pm 0.05\%$ in PBS). Relative p38

MAPK phosphorylation was significantly greater in 4 wk post implantation compared to PBS, 1 and 2 wk (~3.4-fold greater than PBS in 4 wk), with no other significant differences among groups. **CONCLUSION:** Small changes in myofiber CSA can be seen as soon as 3 wk following tumor implantation in the LLC model. Reductions in portion of oxidative myofibers and increases in p38 MAPK signaling are not seen until 4 wks following tumor implantation. p38 MAPK isoforms α and β have been implicated in promoting atrophic signals through Atrogin/MURF and autophagy genes, and may in part explain the greater drop in myofiber CSA seen 4 wks following tumor implantation.

Funded by Arkansas Bioscience Institute

101 Board #3 May 31 9:30 AM - 11:30 AM
Effects Of Creatine Supplementation On Doxorubicin-induced Myotoxicity

Zoltan A. Torok, Raquel B. Busekrus, David S. Hydock,
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(No relationships reported)

Doxorubicin (DOX) is an effective chemotherapy treatment associated with several deleterious side effects, including skeletal muscle dysfunction. Previous research from our lab has shown that ex vivo creatine (Cr) pretreatment, prior to DOX incubation, attenuated DOX-induced fatigue in the EDL, but not the SOL. The effects of in vivo supplementation on DOX myotoxicity, however, are currently unknown. **PURPOSE:** To investigate the effects of in vivo Cr supplementation on DOX myotoxicity. **METHODS:** Male Sprague-Dawley rats were randomly assigned to the control (CON), doxorubicin (DOX), or creatine + doxorubicin (CR+DOX) group. CR+DOX received rodent chow supplemented with 3% creatine monohydrate and the CON and DOX received standard rodent chow. After two weeks of feeding, CR+DOX and DOX groups received a bolus (15 mg/kg) intraperitoneal (i.p.) DOX injection and CON received an i.p. saline injection as a placebo. Dietary interventions then continued for 5 more days. Forelimb grip strength was then measured as an indicator of in vivo muscle function and muscle fatigue was analyzed ex vivo using a 100 second fatigue protocol. **RESULTS:** When compared to CON, a significantly lower grip strength was observed in DOX (-23%, $p < 0.05$), and creatine monohydrate feeding attenuated this decrement in grip strength (-15% CR+DOX vs. CON, $p > 0.05$). In isolated muscle experiments to explore fatigue, solei (primarily type I muscle) from CON produced significantly less force than baseline at 60 s ($p < 0.05$) and solei from DOX produced significantly less force than baseline at 30 s ($p < 0.05$); however, CR+DOX produced significantly less force than baseline at 60 s ($p < 0.05$) suggesting that Cr feeding attenuated DOX-induced fatigue in type I muscle. In the primarily type II EDL, a significant decline in force production from baseline was observed at 50 s in CON and CR+DOX ($p < 0.05$) and at 20 s in DOX ($p < 0.05$) suggesting that Cr attenuated DOX-induced fatigue in type II muscle. **CONCLUSIONS:** A diet supplemented with Cr attenuated the decrease in grip strength and increase in fatigue that accompanies DOX treatment. These findings suggest that Cr supplementation may have use in managing DOX myotoxicity in cancer patients.

102 Board #4 May 31 9:30 AM - 11:30 AM
The Effect Of Resistance Training During Chemotherapy On Grip Strength In Rats.

Mackenzie D. Twaddell, Alison Tigner, Meghan K. Wagner, Eric Bredahl, Joan Eckerson, FACSM. *Creighton University, Omaha, NE.* (Sponsor: Joan Eckerson, FACSM)

(No relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent associated with a number of harmful side effects, including cardiovascular and skeletal muscle dysfunction. Although it has been shown that aerobic and anaerobic exercise can minimize the degree of DOX-induced muscle dysfunction, few studies have examined the effect of resistance training (RT) during chemotherapy treatment on DOX-induced muscle dysfunction. **PURPOSE:** To examine the effect of RT exercise during DOX treatment on grip strength in rats. **METHODS:** Male Sprague-Dawley rats were randomly assigned to a RT (n=10) or sedentary (SED) group (n=10) for 10 wk. Animals in the RT group were housed in specialized cages where the food and water height was progressively elevated so that they achieved an erect bipedal stance to access their food and water. After the initial 10 wk training period, animals were further sub-divided into a RT+DOX (n=5), RT+saline (SAL) (n=5), SED+DOX (n=5), and SED+SAL (n=5). Rats in the RT groups continued to train for an additional 5 wk and, during this same time period, animals receiving DOX were given a weekly intraperitoneal injection (3 mg/kg) for 4 wk. Grip strength was measured every 5 wk during the 15 wk study using a rat grip strength meter. **Results:** At 5 wk, grip strength in the RT (16.3±1.5) group was significantly higher than the SED (18.3±1.05) group ($P=0.018$), however, there were no differences at 10 wk. Following the 5 wk treatment period with DOX or SAL, animals in the SED+SAL (14.6±0.9), RT+SAL (22.2±1.3), and RT+DOX (19.8±0.9) groups demonstrated significantly higher grip strength than those in the SED+DOX (16.8±1.0) group ($P < 0.0001$). **CONCLUSION:** These findings suggest that RT regimen during chemotherapy treatment may be effective for minimizing DOX-induced muscle dysfunction.

ACSM May 30 – June 3, 2017

103 Board #5 May 31 9:30 AM - 11:30 AM

Clarifying The Contradictory Data In The Effect Of Resveratrol In The Mouse Model Of DMD

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(No relationships reported)

PURPOSE: Resveratrol, a polyphenol found in grapes and red wine, that has been previously reported to improve muscle function in a mouse model of Duchenne muscular dystrophy, mdx mice. In 5-week old mdx mice after 8 weeks of treatment, significant improvements in rotarod performance and in situ peak tension of the triceps were observed. In addition, the total immune cell inflammation was significantly reduced, while significantly increasing IL-6 gene expression after 8 weeks of treatment. The aim of this study is to evaluate muscle and cardiac function of Resveratrol after 12 weeks of treatment using a comprehensive phenotyping platform. **METHODS:** This study was performed on two groups (n=11-12); group 1: Normal diet and group 2: diet with Resveratrol) of mdx mice in a blinded manner. Mice were randomized based on body weight and evaluated using a series of functional (In vitro force contractions, Echocardiography), behavioral (Grip strength, open field digiscan and Rota-rod), and histological evaluations. To unmask the mild phenotype of the mdx mice we subjected all mice to treadmill running (12 m/min; 30 min) bi-weekly except during data collection timepoints.

RESULTS: Resveratrol treatment showed no changes in body weight, forelimb and hindlimb grip strength measurements, or latency to fall in comparison to the control group after 12 weeks of treatment. There was, however, a significant decrease in the vertical activity on the open field digiscan behavioral measurement. In vitro force measurements of the EDL showed no significant change in the maximal force or specific force after treatment in comparison to the control mdx mice. Further, evaluation of cardiac function (% ejection fraction or fraction shortening) using echocardiography showed no significant changes. Histological analysis showed no change in the number of degenerating, regenerating, of inflammatory cells after 12 weeks of treatment.

CONCLUSIONS: This study has showed that Resveratrol did not alter the disease phenotype of the mdx mice. The inconsistency between studies may have been brought about by various factors such as the testing facility, the chows, experimenters performing the experiments to name a few. Therefore, it is essential to have independent laboratories validate the pre-clinical data prior to proceeding onto human clinical trial.

104 Board #6 May 31 9:30 AM - 11:30 AM
Reliable And Reproducible Evaluation Of Therapeutic Interventions In The MDX Mouse Model Of DMD

Kanneboyina Nagaraju¹, Arpana Sali², Adati Phadke², Jack Vandermeulen², Heather Gordish-Dressman². ¹School of Pharmacy and Pharmaceutical Sciences, Binghamton, NY. ²Children's National Medical Center, Washington, DC.

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(No relationships reported)

PURPOSE: Preclinical efficacy evaluation in mouse models of human diseases is an important component of drug development. It has been reported that phase II clinical trial success rates have fallen in recent years, with a lack of efficacy being the most frequent reason for failure. Since most of the selected candidate therapeutics have gone through preclinical efficacy testing, this failure could be due to 1) the poor predictive power of disease models, 2) questionable targets, 3) lack of rigor in preclinical trial design, 4) poor control for potential bias, or 5) variable reporting standards. The quality and reproducibility of preclinical trials depend on the thoroughness of the preclinical study, including the design, execution, analysis, and reporting of the preclinical data. Here we have developed a comprehensive phenotyping system to ensure success rate of preclinical candidate evaluations for DMD.

METHODS: We subjected mdx mice for following assessments at early (8 weeks) and late (12 months) stages of the disease to represent ambulatory and non-ambulatory stages of the human disease. We assessed **Non-Invasive Repeated measures** (Open field activity measurement, Grip strength measurement (GSM), Bodyweight, Inflammation assessed by cathepsin activity using optical imaging, and Echocardiography) and **Terminal Endpoint measures** (Muscle function test (in vitro force contractions), Histological evaluations, Fibrosis measurements, Serum enzymes analysis).

RESULTS: Sample size/power estimates showed that EDL muscle specific force, Grip strength and % SF by echocardiography require 5, 11 and 8 mice per group at early stages of the disease and 2 mice/group for all 3 parameters at 12 months' age. Fibrosis in the heart is less apparent at early stages and require more mice (136/group) in comparison to old age (2mice/group) Cardiac assessment showed that both

ejection fraction (EF) and fractional shortening (FS) significantly decreased by 11 months of age in the mdx mice. Evaluation of inflammation in live animals showed that inflammation is more at 2 months than at 12 months. **CONCLUSIONS:** Our data demonstrates that the quality and reproducibility of preclinical trials depend on not only on the parameter to be analyzed but also on the stage of the disease and sample size required to meaningfully interpret the data.

105 Board #7 May 31 9:30 AM - 11:30 AM
Exercise-Induced Leukocyte Infiltration in Skeletal Muscle under Chemotherapy
 Chia-Hua Kuo, FACSM. *University of Taipei, Taipei, Taiwan.*
(No relationships reported)

BACKGROUND: Weight training can cause muscle inflammation. However, inflammation mechanism is essential for increasing or maintaining muscle mass after challenge. **METHODS:** We examined leukocyte infiltration in rat muscle challenged by downhill running after adriamycin administration, which is used to systemically inhibit cell regeneration (2.5 mg/kg per body weight). **RESULTS:** Leukocyte infiltration in exercised muscle was completely eliminated in adriamycin-treated rats in exercised muscle. A significant proton leak was observed under adriamycin treatment. Results from long-term adriamycin treatment show a significant development of sarcopenia. **CONCLUSION:** Blocking cell proliferation eliminates muscle inflammation induced by exercise, which may account for development of sarcopenia and eventual death after prolonged chemotherapy.

106 Board #8 May 31 9:30 AM - 11:30 AM
The Effects of Impaired Arm Function on Quality of Life in Breast Cancer Survivors
 Sarah A. Sayyari¹, Bolette S. Rafn¹, Stanley H. Hung¹, Alison M. Hoens¹, Margaret L. McNeely², Chiara A. Singh³, Winkle Kwan⁴, Carol Dingee¹, Elaine C. McKeivitt¹, Urve Kuusk¹, Kristin L. Campbell¹. ¹*University of British Columbia, Vancouver, BC, Canada.* ²*University of Alberta, Edmonton, AB, Canada.* ³*Fraser Health Authority, Surrey, BC, Canada.* ⁴*BC Cancer Agency, Fraser Valley, BC, Canada.*
(No relationships reported)

PURPOSE: Treatment for breast cancer is associated with long-term impaired arm function typically characterized by pain, muscular weakness, poor range of motion or lymphedema, which can negatively impact quality of life (QoL). An appropriate definition for impaired arm function specific to women with breast cancer is needed to guide treatment decisions and evaluate efficacy of interventions. The purpose of this study is: 1) to explore the relationship between impaired arm function and QoL; and 2) to propose a definition for impaired arm function that may be utilized to identify women who could benefit from a targeted exercise intervention. **METHODS:** Women with breast cancer were assessed for self-reported arm function and QoL at pre-surgery and 12 months post-surgery. Arm function was measured by the QuickDASH (Score: 0-100) and QoL was measured by the Functional Assessment of Cancer Therapy Breast (FACT-B+4). The minimally clinically important difference (MCID) of 14 for QuickDASH was used as a cut-off point to categorize participants as having impaired arm function. Pearson's correlations were used to examine the association between arm function and QoL. Further, independent t-tests tested the difference in QoL between participants with and without impaired arm function. **RESULTS:** Thirty-seven women between ages 30-75 were enrolled. QuickDASH at 12-months post-surgery strongly correlated with the physical well-being subscale of the FACT-B+4 ($r=-0.58, p<0.01$). Moderate correlations were found between QuickDASH and the arm function subscale of the FACT-B+4 ($r=-0.49, p<0.01$) and the functional well-being subscale of the FACT-B+4 ($r=-0.33, p=0.05$). Applying the MCID of 14 points on QuickDASH displayed a difference in QoL between participants with and without impaired arm function in the same physical well-being ($p<0.01$) and arm function ($p<0.01$) subscales of the FACT-B+4. **CONCLUSIONS:** QoL and arm function strongly correlate at 12-months following surgery for breast cancer. Applying the MCID for QuickDASH is effective in identifying participants whose impaired arm function is associated with decreased QoL. Utilizing this cut-off point may help identify women whose arm function has not recovered after treatment for breast cancer and who could benefit from a targeted exercise intervention.

A-23 Exercise is Medicine®/Thematic Poster - EIM On Campus

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
 Room: 101

107 **Chair:** Carena Sue Winters, FACSM. *Slippery Rock University, Slippery Rock, PA.*
(No relationships reported)

108 Board #1 May 31 9:30 AM - 11:30 AM
University Physical Activity Classes: Impact on Students' Body Weight and 1.5-Mile Run Performance
 Wenhao Liu, FACSM, Ethan E. Hull, Istvan Kovacs. *Slippery Rock University, Slippery Rock, PA.*
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(No relationships reported)

PURPOSE: Weight gain among university students is observed widely, which may result in decline in cardiorespiratory fitness. On the other hand, regular physical activity (PA) participation is considered an effective means to maintain and improve body weight and cardiorespiratory fitness. This study investigated impact of PA classes on university students' body weight and 1.5-mile run performance. **METHODS:** Body weight and 1.5-mile run were assessed at the beginning (pretest) and end (posttest) of a semester for 126 students (mean age: 20.71±.99; 72 males and 54 females) who were enrolled in PA classes of a university in USA. Paired-samples t tests were used to examine differences in weight and 1.5-mile run performance between the two test points. In addition, based on the pretest performance in 1.5-mile run and ACSM's Fitness Categories for Maximal Aerobic Power (2014), students were categorized into three aerobic power groups by sex. Those with 1.5-mile run at top 20 percentiles were in Superior/Excellent Group (SEG), 40 to 79 percentiles in Good/Fair Group (GFG), and 1 to 39 percentiles in Poor/Very Poor Group (PVPG). Binomial tests were used to examine whether a significantly larger proportion of students in each group improved 1.5-mile run at the posttest. **RESULTS:** Performance in 1.5-mile run was improved significantly ($p < .01$) for males (11:47±2:07 vs. 11:29±1:47) and females (14:15±2:28 vs. 13:54±1:55) at the posttest. As for body weight, it remained unchanged ($p > .40$) for both sexes (males: 180.83±32.11 vs. 180.61±31.10; females: 140.75±18.20 vs. 140.58±17.74). In addition, for both sexes SEG had smaller portions of students improving their 1.5-mile run (male: 7 improved vs. 11 not; female: 5 vs. 6); GFG had non-significantly larger portions of students improving their 1.5 mile run (male: 17 improved vs. 8 not; female: 15 vs. 8); finally, significantly larger portions of students in PVPG improved their 1.5-mile run performance (male: 23 improved vs. 6 not, $p < .005$; female: 16 vs. 4, $p < .05$). **CONCLUSIONS:** PA classes are effective to control body weight among university students. In addition, PA classes can significantly improve students' 1.5-mile run performance, and it is especially true for students with relatively poor 1.5-mile run performance initially, especially those at the bottom 39 percentiles.

109 Board #2 May 31 9:30 AM - 11:30 AM
Pokemon Is Medicine: On (BYU) Campus
 Neil E. Peterson, Kielee L. Wiser, Hannah M. Schmidlein, Craig Nuttall, James D. LeCheminant. *Brigham Young University, Provo, UT.*
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The Exercise is Medicine (EIM) global health initiative includes an "On Campus" component that encourages faculty, staff, and students to work together toward improving the health and well-being of the campus and surrounding community. **PURPOSE:** To describe the implementation of EIM On Campus at a large U.S. university in the mountain west. **METHODS:** A multidisciplinary EIM On Campus leadership team was assembled, comprised of faculty members from nursing (2) and exercise science (1), as well as university students (2). A physical activity event (Pokethon 3k Fun Walk) was planned using the currently popular Pokemon theme and promoted through flyers, posters, word of mouth, social media, and homecoming parade float. The event was guided by the following principles in order to attract participation from those who might otherwise not be active: 1) free of cost, 2) open to all, 3) use of a currently popular theme (Pokemon), 4) safe 3k route with plenty of nearby parking, 5) late morning start time, 6) free "lures" activated at all "Pokestops" within the Pokemon Go game along the 3k route, and 7) numerous prizes given at random to incentivize participation rather than speed. **RESULTS:** The Pokethon 3k Fun Walk event was held during Fall 2016. A total of 140 people were involved in the event: 5 (3.6%) were EIM On Campus leadership members and event organizers, 23 (16.4%) were volunteers, and the remaining 112 (80.0%) were event participants. Of the 112 participants, 72 (64.3%) were community members and the remainder

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were university students. Verbal feedback included high levels of satisfaction and interest in making it into an annual event. **CONCLUSION:** The EIM On Campus leadership team successfully implemented an event to promote physical activity based on principles that would encourage participation. The next steps are to: 1) add more members to the EIM On Campus leadership team from diverse areas, 2) hold educational opportunities, and 3) implement the physical activity vital sign within the student health center.

110 Board #3 May 31 9:30 AM - 11:30 AM
**Exercise Is Medicine On Campus Week 2016:
 Increasing Campus-wide Integration And Coordination**

Zack Papalia, Melissa Bopp, FACSM, Christopher Bopp, Michele Duffey, Lori Gravish-Hurtack, Nancy I. Williams, FACSM. *Pennsylvania State University, University Park, PA.* (Sponsor: Melissa Bopp, PhD, FACSM)
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BACKGROUND: Exercise is Medicine on Campus (EIMOC) is an international initiative promoting physical activity (PA) participation on college campuses, targeting the decline in PA seen with the transition to college. Pennsylvania State University has been promoting EIMOC since 2010 and hosting annual EIMOC Week events since 2012. **PURPOSE:** To evaluate strategies for expanding EIMOC partnerships and collaborations across campus since 2015.

METHODS: EIMOC Week has been held each year since 2012. In an attempt to expand and enhance the impact of EIMOC, the EIMOC committee has worked to improve campus-wide integration and increase participation and support from other University entities. Following the 2016 EIMOC Week event, organizations that participated or provided support through the 2015-2016 campaign were interviewed regarding future goals, EIMOC impressions, barriers to collaboration, and general observations. Results were compiled, transcribed and coded for common themes. **RESULTS:** Organizations working with EIMOC (n=15) were divided into three categories: University entities, student organizations, and community outreach. University entities (n=7) included University divisions and departments (e.g. academic unit, colleges), student health services, and campus recreation. Student organizations (n=4) were primarily undergraduate and graduate students groups, such as clubs. Community outreach entities (n=4) included private businesses and other off-campus organizations. All of the organizations strongly supported the concept of EIMOC, and were interested (93%) in supporting EIMOC in a mutually-beneficial fashion (i.e. referrals, increasing membership). Future goals included expanded collaboration (53%) and a more defined partnership (40%). Common barriers to collaboration were time (80%), logistics (80%), available resources (40%) and departmental/university rules and regulations (47%).

CONCLUSIONS: The current study offered insight on the challenges and potential success in expanding EIMOC on a large campus. As this EIMOC initiative enters its 7th year, expanding its reach and improving University-wide collaborations are key for sustained impact. Identifying common strategic goals and pooling resources across multiple entities may prove essential to the future of EIMOC.

111 Board #4 May 31 9:30 AM - 11:30 AM
**To Use The Reach, Effectiveness, Adoption,
 Implementation, Maintenance (reach) Methodology To
 Evaluate Exercise Is Medicine- On Campus Program
 (eim-oc)**

Renee Jeffreys - Heil, Patricia Bauer, Eric Shamus, Mitchel L. Cordova, FACSM. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchel L. Cordova, FACSM)
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 (No relationships reported)

PURPOSE: To use the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) methodology to evaluate Exercise is Medicine- On Campus Program (EIM-OC).

METHODS: In 2015, the EIM-OC program at Florida Gulf Coast University (EIM@FGCU) was launched. The program consists of monthly EIM@FGCU events, a referral network, faculty/student research, and service learning projects (SLP). EIM-OC programs can be more than just referral networks, and offer multiple opportunities for students and faculty to utilize the EIM framework. This project uses the RE-AIM methodology to evaluate the effectiveness of 1 EIM-OC program.

RESULTS: *Reach:* During the 2015-2016 academic year, over 500 students attended EIM@FGCU on campus events, and 85 students were referred to the EIM@FGCU program by Student Health Services. Seven (7) different poster presentations were delivered and on average 22 ± 11 hrs of SLP were performed by exercise science (ES) students. *Effectiveness:* ES students in EIM@FGCU events report “. . . makes me want to learn more about adaptive training and working with various populations, clinical or otherwise”. Of the 85 students referred, 16 participated in baseline assessment. There were 2 undergraduate student presentations at national meetings,

5 faculty presentations, and 3 in process faculty publications. *Adoption:* Starting in the 2016-2017 academic year, there was an increase in the number of EIM@FGCU Events (2015-2016- N = 5 to 2016-2017 - N= 10) with two additional referral sites were added (Center for Academic Achievement, and Counseling and Physiological Services). *Implementation:* Program implementation was designed to be low through the utilization of student SLPs. This project is currently funded through internal campus resources (\$10,500). The cost per referral is \$584 per person; however, when students impacted by monthly events is included the cost drops to \$20 per person. *Maintenance:* The amount of faculty/student scholarship is increasing. The change in physiological markers of participants in the program will not be known until the end of this academic year.

CONCLUSIONS: Because EIM-On Campus programs have broader implications than a simple referral networks, methodologies such as RE-AIM can be utilized to determine project effectiveness.

112 Board #5 May 31 9:30 AM - 11:30 AM
**Exercise Is Medicine On Campus: Case Study Of
 Resistance Training On Chronic Low Back Pain**

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 (No relationships reported)

Low back pain (LBP) can be described as pain or discomfort in the lumbar spine. Due to the vast interconnected system of bones, muscles, nerves, discs, tendons and ligaments, this area of the body is susceptible to injury if not trained properly. “Sarah”, a 49 year old female with chronic LBP, volunteered to participate in an 8-week Community Fitness Partners program, a Westfield State University Exercise Is Medicine On Campus initiative. Sarah was given a whole body exercise prescription based on FITT recommendations by the American College of Sports Medicine for individuals with chronic LBP. **Purpose:** To determine the effectiveness of resistance training and stretching for the treatment of LBP. Improvements in cardiovascular endurance and lean muscle mass, as well as weight management, were desired goals from the program. **Methods:** The initial meeting included goal setting, a health and fitness screening and a Par-Q to determine the individual’s vital signs and whether she has a preexisting condition that would limit her participation in this exercise program. Subject characteristics included: Height= 1.65m Body Mass=57kg, BMI=21.9, and HRrest=56bpm. Sarah completed an 8-week full body concentric and eccentric resistance training program two times a week, along with at home physical activity and stretching. **Results:** Before participating in the program Sarah was not able to perform a single bilateral body weight squat through a full range of motion, without experiencing LBP. Sarah’s pre-test results were push-ups= 6 repetitions, curl ups(crunches)= 44 repetitions, body weight squat = 0 repetitions. Post-training, Sarah can now perform multiple bilateral body weight squats through full range of motion at the ankle, knee and hip joints without experiencing LBP. Her post measurements include: push-up = 10 repetitions, curl-up= 50 repetitions, body weight squat= 5 repetitions. **Conclusion:** Within an 8-week resistance training program, a combination of static, dynamic, and PNF stretching was used to treat LBP and increase strength as well as activities of daily living. Sarah is also more comfortable and confident with exercise and in particular resistance training. She has gone from never taking part in a resistance training workout regimen to completing a 8-week resistance training program.

113 Board #6 May 31 9:30 AM - 11:30 AM
**An Exploration Of Exercise Is Medicine-on Campus
 Marketing And Engagement**

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The Exercise is Medicine-on Campus (EIM-OC) initiative is growing across the nation, requiring a need to share programming and implementation outcomes to grow the limited body of empirical evidence. **PURPOSE:** The purpose of this study was to provide descriptive data on the EIM-OC programming and associated promotional efforts at a Midwestern Masters Comprehensive University. **METHODS:** During October (official EIM-OC month), promotional efforts were achieved through campus-wide flyers, website banners, and a marketing Presidential video with associated photos. To further awareness a website and social media feeds were established (Facebook, Twitter and Instagram) and articles were published in University newspapers. **RESULTS:** Grand Valley State University has 22,081 undergraduates, 3,046 graduate students, and 2,500 faculty/staff. The total student participants for the EIM events included; Walk with the President (210 total; 127 females, 75 males, 1 non identified; 12 freshmen, 30 sophomores, 87 juniors, 69 seniors, and 4 graduate), Zumba Party (109 total; 106 females, 3 males), Discovery Scuba (8 total), Wheelchair Basketball (33 total), Faculty/Staff Pedometer Challenge (460 total; 115 teams, 133,454,370 total steps), and Celebrating EIM at GVSU (116 total). Compared to

the previous month, October increased EIM-OC website page views 144% (502) and increased return visits 192%. In addition, the Student Recreation Center increased usage by 23.2% from Aug-Oct when compared to the same months in the previous year. Facebook garnered 170 "Likes," reaching 1,115 people and engaged 357, while Twitter amassed 90 followers. **CONCLUSION:** A large, diverse sample of students and faculty were reached via various marketing outlets. Such descriptive data is warranted to share evidence of successful implementation and marketing of EIM-OC programming for other institutions to emulate in the larger goal of increasing participation from Colleges/Universities across the country.

114 Board #7 May 31 9:30 AM - 11:30 AM
Physical Activity Counseling in College Students
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Exercise is Medicine (EIM) is a global health initiative focused on encouraging health care practitioners to include physical activity when designing treatment plans for patients. EIM on Campus (EIM-OC) calls on institutions of higher education to promote physical activity (PA) as a vital sign of health. **PURPOSE:** The purpose of this investigation was to determine where college students obtain physical activity information and rates of physical activity counseling from health care practitioners. **METHODS:** Participants were college student volunteers (n=537, 56.7% male, 75% Caucasian) that completed a fitness assessment and online survey. Aerobic fitness, muscular endurance, body composition (BMI and bioelectrical impedance) and blood lipids were assessed. The survey assessed participant demographics, current PA, PA counseling at on or off-campus clinics and typical sources of information about PA. Independent t-tests and chi squares examined differences in PA counseling by fitness outcomes. **RESULTS:** 62% of our participants reported some counseling for PA. There were no differences in rates of counseling by BMI nor VO₂max, however, individuals with higher percent body fat were more likely to report counseling from their healthcare provider (t=2.76, p=0.006). There were no differences in counseling by current moderate or vigorous PA. Females were more likely to be counseled than males (X² = 4.39, p=0.04). Reports of counseling were higher at off-campus clinics than on-campus clinics (X² = 42.2, p<.001). Among our population 5% of participants obtained PA information online, 16.5% from peers, 73% from magazines, 51% from apps, 91% from TV, 40% from family, 17.7% from fitness professionals and 45% from health care practitioners. **CONCLUSIONS:** The current study provides insight into healthcare provider counseling for PA among college students. Off-campus healthcare providers were more likely to provide counseling, indicating an area of possible focus for further study. College students are typically not looking to a health care practitioner for their PA information, indicating that further information is needed on the role of healthcare providers and on-campus health clinics in counseling for PA among this young adult, typically healthy population.

115 Board #8 May 31 9:30 AM - 11:30 AM
Exercise Self-efficacy And Social Support In Community Training: An Exercise Is Medicine On Campus Initiative
 Troy R. Doming, Nicole R. Lanoie, Frank A. Hoyle, Melissa W. Roti, FACSM. *Westfield State University, Westfield, MA.*
(No relationships reported)

Exercise self-efficacy, an individuals' perceived confidence as it relates to a specific behavior, is positively related to behavior change and long term exercise adherence. Social aspects of exercise can also contribute to exercise self-efficacy. This is especially important in regards to the adult population due to the difficulty of transitioning to the maintenance phase of behavior change. **Purpose:** To determine the benefits that an EIMOC initiated Community Fitness Partners program has upon self-efficacy and social support, as monitored and structured exercise programs have been shown to improve upon these aspects. Individual personal training was completed in a group setting to expose participants to additional sources of social support. This study aims to investigate the relationship between this community setting, social support and exercise self-efficacy. **Methods:** Subjects aged 44.0 ± 13.2y volunteered to participate in an 8 week structured group community fitness partner program. Subject characteristics include: body mass (74.0 ± 20.8 kg), height (1.65 ± 0.08 m), % BF (28.0 ± 8.2), HRrest (68 ± 10 bpm), and BPrest (124 ± 19 / 78 ± 9 mmHg). All subjects underwent pre and post participation screening to determine baseline and concluding health and fitness measures. Each individuals' perceived confidence levels related to exercise were determined by the Self-efficacy For Exercise (SEE) Scale (Resnick & Jenkins, 2000). Participants completed the Social Support and Exercise Survey to identify influences from friends and family regarding exercise participation (Sallis et al., 1987). Paired sample t-tests were used to determine differences pre to post program. **Results:** Pre and post measurements of SEE scores were 58.2 ± 18.8 and 63.7 ± 17.0 (p > 0.05). Pre and post measurements of family participation support

were 20.4 ± 11.4 and 24.0 ± 13.5 (p > 0.05), respectively while the friend participation support measured at 17.6 ± 7.5 and 19.2 ± 12.1 (p > 0.05). Although the social support and self-efficacy data did not reach statistical significance, there is still a notable positive trend. **Conclusion:** Overall most individuals experienced an increase in efficacy and social support values. Therefore, a group personal training protocol may be beneficial in the improvement of exercise self-efficacy and social support.

A-24 Thematic Poster - Energy Availability and Expenditure
 Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
 Room: 403

116 Chair: Melinda Manore, FACSM. *Oregon State University, Corvallis, OR.*
(No relationships reported)

117 Board #1 May 31 9:30 AM - 11:30 AM
Dietary Carbohydrate Restriction Is Necessary For High-Fat Diet Induced Alterations In Substrate Oxidation During Exercise

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(No relationships reported)

BACKGROUND: Manipulating the dietary intake of carbohydrate and fat results in differences in the circulating hormonal and metabolic milieu alongside differences in the myocellular substrate storage profile. These divergent metabolic profiles can dramatically impact substrate utilisation during exercise, with high fat low carbohydrate diets substantially elevating rates of fat oxidation compared to a low fat high carbohydrate diet. A caveat to prior studies employing a high fat diet is they are also typically restricted in carbohydrate, and so metabolic changes could be attributed to the manipulation of either macronutrient.

PURPOSE: To determine if a high fat diet both with (HF) and without restricting carbohydrate intake (N+HF) impacts substrate oxidation during exercise in endurance-trained women compared to a control diet that reflects normal intake (N).

METHODS: Over three separate periods of 5 days, in a randomised counterbalanced order, endurance trained women (means ± SD: age 34 ± 8 yrs; VO₂max 55.1 ± 2.5 ml/kg/min) were provided with 3 diets designed with the following macronutrient composition (% of energy intake [carbohydrate/fat/protein]): N (50/35/15); HF (20/65/15), and a hypercaloric (130% energy intake) N+HF (50/65/15). Post-diet intervention, in the overnight fasted state, subjects completed a 90min treadmill run at 65% VO₂max with indirect calorimetry employed over the exercise bout to determine substrate oxidation. Data was assessed for differences using a repeated-measures one-way ANOVA.

RESULTS: The relative contribution of fat oxidation to energy expenditure over the 90min exercise bout was significantly (p<0.01) greater after the HF trial (76 ± 9%) than N (57 ± 11%) or N+HF (59 ± 11%) with no significant differences between diets not limited in carbohydrate (N and NHF).

CONCLUSIONS: In contrast to when carbohydrate is restricted (HF), adding a comparable amount of fat to a control diet (NHF) did not augment fat oxidation during exercise. Thus the restriction of carbohydrate intake appears to be an obligatory step in eliciting dietary induced alterations in whole body substrate oxidation not greater fat provision. This work was funded through a BBSRCi CASE studentship with GlaxoSmithKline the industrial partner.

118 Board #2 May 31 9:30 AM - 11:30 AM
Metabolic and Behavioral Correlates of Low Energy Availability in Exercising Men
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(No relationships reported)

Low energy availability (EA) has been identified as a primary driver of metabolic and endocrine aberrations characterizing the female athlete triad. Although it has been established that men engaged in sports that favor leanness and/or low body weights are also at risk of low EA, little is known about the etiology and metabolic effects of low EA in habitually active men.

PURPOSE: To assess the relationship between EA and body composition, metabolism, eating behavior traits, and health-related outcomes in young, exercising men.

METHODS: Eighteen men (23.4±4.4 y; 81.8±10.2 kg; 9.8±3.5% body fat) participated in this cross-sectional study. EA was determined as the amount of energy remaining after subtracting the energy cost of exercise, both derived from 7-day diet and exercise logs, and was normalized for fat free mass (FFM) assessed by bioimpedance. Participants completed tests for resting metabolic rate (RMR) and aerobic fitness as well as questionnaires regarding exercise and diet habits, eating behaviors, and medical history. Based on their EA, participants were divided into tertiles: low EA (LEA): 19.9-31.5 kcal/kg FFM, moderate EA (MEA): 31.9-38.3 kcal/kg FFM, or high EA (HEA): 39.8-48.6 kcal/kg FFM.

RESULTS: BMI (LEA: 25.6±2.9 kg/m², MEA: 25.9±3.7 kg/m², HEA: 24.0±2.3 kg/m²) and body fat percentage (LEA: 11.0±4.6%, MEA: 10.5±2.8%, HEA: 8.3±2.8%) were similar among EA groups. The ratio of measured/predicted RMR was similar between LEA (0.96 ± 0.05) and HEA (0.93 ± 0.06) but lower in MEA (0.89 ± 0.06; p=0.03). Resting respiratory quotient was reduced in LEA (0.81 ± 0.09) when compared to MEA (0.90 ± 0.05; p=0.03) and HEA (0.93 ± 0.12; p=0.04). Compared to HEA, participants in LEA were more likely to report past weight fluctuations (p=0.05) and dieting (p=0.01). There were no differences among EA groups for eating behavior traits such as dietary restraint (p=0.29), emotional eating (p=0.36), and drive for thinness (p=0.40).

CONCLUSION: Despite being in an apparent energy deficit and showing evidence of increased fat oxidation, exercising men with LEA did not exhibit altered body composition or RMR suppression per se. Nevertheless, LEA seems to be connected to issues related to weight control and a history of dieting. Future research is needed to quantify the metabolic and endocrine consequences of LEA in exercising men.

119 Board #3 May 31 9:30 AM - 11:30 AM
Energy Availability Amongst Elite Rugby Union Players During Pre-Season Training

Katherine Black¹, Chloe Hindle¹, Claire Gibson¹, Joanne Slater¹, Dane Baker², Phil Healey², Rebecca McLay-Cooke¹, Rachel Brown¹, Brett Smith³. ¹University of Otago, Dunedin, New Zealand. ²Chiefs Super Rugby, Hamilton, New Zealand. ³University of Waikato, Hamilton, New Zealand.
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(No relationships reported)

In elite rugby union the pre-season training period is used to optimise players' strength, power, endurance and body composition. Given the increased training loads during this time, players could find themselves at risk of Low Energy Availability (LEA). A state of LEA can be caused by large energy expenditure in exercise (EEE) and/or low energy intake (EI), which reduces the amount of energy available for physiological functions. Despite the majority of the literature focusing on female athletes, it is possible that male athletes are also at risk of LEA, particularly during periods of increased training load such as pre-season.

PURPOSE: The purpose of this study was to examine the energy intake, energy expenditure and energy availability of elite male rugby union players during pre-season training.

METHODS: During this observational study, three-day diet records were collected for 23 Super Rugby players using video, photographs, checklists and recalls. Energy expenditure data was also collected via heart rate monitoring, GPS tracking and Activity Logs. Skinfold thicknesses (International Society for the Advancement of Kinanthropometry protocols) were used to assess body composition. Data was analysed based on groups established by training goals determined by the teams support staff: weight gain (n=8)/weight maintenance (n=8)/weight loss (n=7). One-way ANOVA was used to identify differences between groups, with post-hoc pairwise comparison of means, adjusted using Bonferroni.

RESULTS: For all participants exercise energy expenditure was 2,240 ± 1,140 kcal (mean ± SD). The average energy intake was 3799 ± 958 kcal.day⁻¹ for all participants. The weight loss group had significantly lower mean (± SD) energy availability (6.7 ± 6.4 kcal.kgFFM⁻¹.day⁻¹) than the weight maintenance (20.3 ± 7.6 kcal.kgFFM⁻¹.day⁻¹, p=0.003) and weight gain (28.6 ± 8.0 kcal.kgFFM⁻¹.day⁻¹, p<0.001) groups.

CONCLUSION: This research shows that NZ Super rugby players can, and do suffer from short-term LEA during the intense pre-season training period. However, as this study was observational, the results are only indicative of the three-day sampling period. Therefore, the duration of LEA cannot be determined from this study nor can any health or performance implications.

Supported by the University of Otago Research Grant

120 Board #4 May 31 9:30 AM - 11:30 AM

Energy Availability and Muscle Glycogen Levels in Division I Beach Volleyball Athletes

Marguerite B. Gilchrist¹, Toni M. Torres-McGehee¹, Meaghan Minori¹, Dawn M. Emerson², Kelly Pritchett³. ¹University of South Carolina, Columbia, SC. ²Kansas University, Lawrence, KS. ³Central Washington University, Ellensburg, WA.

(No relationships reported)

Beach volleyball is considered a lean body sport, which may increase the risk for low energy availability (LEA). There is currently limited research on beach volleyball athletes, particularly in terms of energy availability (EA) and muscle glycogen levels.

Purpose: To examine EA and muscle glycogen levels in beach volleyball athletes. A secondary purpose examined macronutrient intake. **Methods:** Local NCAA Division I female beach volleyball athletes (n=18; ages 19.9 ± 1.5 yrs; weight: 63.3 ± 5.1 kg; height: 174.5 ± 5.6 cm) participated in the study. EA and energy expenditure were measured via a 7-day food and activity log. Resting metabolic rate (RMR) was measured via indirect calorimetry. Muscle glycogen levels were evaluated for the gastrocnemius (GS), rectus femoris (RF) and biceps brachii (BB) pre and post-practice using the MuscleSound ultrasound device. **Results:** When examining RMR, 55.6% beach volleyball players did not meet the RMR caloric needs compared to their associated dietary intake. LEA was present in 94.4% of the participants. For proteins, 61.1% were under recommendations and 5.6% were over the recommendations. All beach volleyball players were under the recommendations for carbohydrates (CHO), and 33.3% were over the recommendations for fats while all others met the recommendations for fats. Repeated-measures analysis of variance indicated a main effect for GS and RF muscle glycogen pre-and post-practice across 5 days; however no specific interactions were found. No significant differences were found with BB measurements. Chi-square analysis revealed no significant differences for level of muscle glycogen vs. CHO intake. **Conclusion:** Beach volleyball athletes are at risk for LEA due to both the high energy expenditure demands of their sport and low nutritional intake. Health care professionals working with beach volleyball athletes should consider monitoring nutrition and implementing nutritional education sessions in order to prevent long term LEA and its negative health consequences. The MuscleSound device can be a good tool for determining if an athlete strays from their norm over time, but more research is needed in order to use this device as a tool for determining chronically low CHO intake.

121 Board #5 May 31 9:30 AM - 11:30 AM

A Novel Method Of Assessing Dietary Behavior Using a Wrist-Worn Accelerometer

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(No relationships reported)

PURPOSE: To describe a novel way of estimating dietary behavior using a wrist-worn accelerometer. **METHODS:** The eating behaviors of one subject were captured via video recording while motions were concurrently recorded using a wrist-worn ActiGraph GT3X, set at 100Hz sample rate on the dominant wrist. The video recording and ActiGraph were synchronized at the start of data collection through action of a transient event visible in both data sources. Behaviors and motions, which included both eating and non-eating behaviors we captured for 30 min. A taxonomy was developed to code the video recording (e.g., fork to mouth, spoon away from mouth) and three raters identified the exact times of actions, to the nearest millisecond. Categorical assignments of each rater were used to identify "true" start and stop times of each movement; while similar, each was used separately to train a classifier. These categorical markings were then used to select data from the accelerometer. A feature set of each sample in the categorical sets, surrounding each category of action, were used to train a supervised machine learning naïve bayes classifier. The feature set consisted of mean, standard deviation, and binned spectral analysis of raw, first derivative (ddt), and angular derived measures; this totaled 110 measures across the original x,y,z and other resultant measures. Given the relatively small data set (i.e., 180,000 samples for 30 min), the training dataset was also used for testing this proof of concept. **RESULTS:** Adjusting for the prior probability of each categorical selection (i.e., ten categories of eating behaviors), the agreement for specific food actions between the video and the classifier predicted action was found to be 63%. Simplifying to consider cases of eating and non-eating only, agreement improved to 67%. Agreement was 66% when prediction results were condensed to "not eating," "drinking," and "eating." **CONCLUSION:** These findings present a plausible new method of estimating dietary behavior. Further refinement is necessary to generalize to larger and more diverse populations, though the potential of providing real-time, objective, dietary behavior analyses is a promising area for research and practice.

122 Board #6 May 31 9:30 AM - 11:30 AM
Effect Of Exercise-induced Weight Loss On 24 Hour Energy Metabolism
 Nicholas T. Broskey, Corby K. Martin, Jeffrey H. Burton, John W. Apolzan, Melissa Harris, Timothy S. Church, Eric Ravussin, Leanne M. Redman. *Pennington Biomedical Research Center, Baton Rouge, LA.*
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 (No relationships reported)

Exercise usually results in less weight loss than expected. It is therefore postulated that changes in energy expenditure (EE) and/or compensatory increases in energy intake (EI) occur to counteract energy deficits induced by exercise.

PURPOSE: Compare changes in all components of daily energy expenditure (24hrEE) after 24 weeks of exercise training between varying doses of exercise recommended for weight loss.

METHODS: Forty-one (28 F, 13 M) obese (35.2±3.7 kg/m²) middle aged (47.8±12.5 y), sedentary individuals from the Examination of Mechanisms of Exercise-induced Weight Compensation (E-MECHANIC) study were randomized to either a healthy living control group (HL, n=13) or a supervised, controlled aerobic exercise intervention that achieved 8 kcal/kg of body weight/week (KKW, n=14) or 20 KKW (n=14). 24hrEE (metabolic chamber), total daily energy expenditure (TDEE, by doubly labeled water), energy intake (by Intake-Balance method), and VO_{2peak} (by graded exercise test) were measured before and after the intervention.

RESULTS: Compared to the HL group, VO_{2peak} increased in the 8 KKW (p=.004) and 20 KKW (p<.0001) groups. With 20 KKW, TDEE (and 24hrEE) increased (p=.04) and weight loss (-2.5±0.9 kg, p=.04) was significant but approximately half of what was expected based on the increase in energy expenditure from exercise. Fat mass (-2.1±0.8 kg, p=.02) but not fat-free mass (-0.4±0.3 kg, p=.79) was also significantly reduced. A 151 kcal/d energy deficit was detected at week 24. The increase in TDEE is attributed to the increased physical activity (p=.03) and not to changes in EE during sleep, arousal or the thermic effect of food. Besides physical activity, the largest change in EE was a reduction in spontaneous physical activity by ~15% (p=.04). With 8 KKW, there was no significant weight or body composition change and no significant increase in TDEE. An energy deficit of 23 kcal/d was detected at week 24. None of the components of EE were changed in the 8 KKW group.

CONCLUSIONS: Structured aerobic exercise that expends up to 1800 kcal/wk increased TDEE but produces less weight loss than expected possibly due to compensatory increases in EI and behavioral adaptations that could lead to reduced spontaneous physical activity.

123 Board #7 May 31 9:30 AM - 11:30 AM
Validity of Self-Reported Energy Intake Compared to Resting Metabolic Rate in Athletes
 Virginia R. Lemon¹, Jody Herman¹, Emily N. Werner, 19102¹, Jacqui Van Grouw¹, Rachel C. Kelley², Francesco Alessio¹, Michael L. Bruneau¹, Stella L. Volpe, 19102, FACSM¹. ¹Drexel University, Philadelphia, PA. ²University of Florida, Gainesville, FL. (Sponsor: Stella Lucia Volpe, FACSM)
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 (No relationships reported)

Energy intake (EI) is frequently under-reported by study participants and can be biased for reasons such as memory, incorrect estimation of portion sizes, deliberate manipulation, etc. It is important that EI is reported as accurately as possible when used for dietary assessment for research studies. **PURPOSE:** To compare self-reported EI from a Block Food Frequency Questionnaire (FFQ) to resting metabolic rate (RMR) in Collegiate Athletes, Reserve Officer's Training Corps (ROTC) Cadets and Midshipmen, and Masters Athletes. **METHODS:** This cross-sectional study included 21 Collegiate Athletes (8 females, 13 males) and 15 ROTC Cadets and Midshipmen (7 females, 8 males), 18 to 25 years of age. It also included 18 Masters Athletes (6 females, 12 males), 26 years of age and older. Indirect calorimetry was used to determine RMR. Participants completed a self-administered Block FFQ to assess dietary patterns over the previous year. A ratio ≤1.35 for EI to RMR was considered under-reporting of dietary intake on the FFQ. **RESULTS:** The mean ratio of EI to RMR for all participants was 1.24 (±0.38) and the frequency of under-reporting was 67% (n=36). Percentage of under-reporting was significant (p<0.01). Seventy-three percent of males (n=24) and 57% of females (n=12) under-reported EI. Sixty-two percent of all Collegiate Athletes, 73% of ROTC Cadets and Midshipmen, and 67% of Masters Athletes under-reported EI. Sex significantly affected reporting status (p<0.01), with males more likely to under-report than females. **CONCLUSIONS:** Significant under-reporting of energy intake was found in these athletes. Further analyses is required to determine why males in these three athlete populations were more likely to under-report than females. These represent data from an unfunded research project

124 Board #8 May 31 9:30 AM - 11:30 AM
Metabolomic Responses to Acute Aerobic and Anaerobic Exercise Bouts
 Joseph K. Pellegrino¹, Christopher E. Ordway¹, Sean P. Conway², Alan J. Walker¹, Marissa J. Bello¹, Anthony Poysstick¹, Eddie B. Capone¹, Nick Mackowski¹, David J. Sanders¹, Bridget A. McFadden¹, Morgan Hofacker¹, Peter J. Gillies¹, Shawn M. Arent, FACSM¹. ¹Rutgers University, Rutgers Center for Health & Human Performance, New Brunswick, NJ. ²DURO Health, New York, NY. (Sponsor: Shawn M Arent, FACSM)
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 (No relationships reported)

Purpose: To explore the acute serum metabolomic responses following single bouts of aerobic and anaerobic exercise in differentially-trained subjects. **Methods:**

Subjects (N = 40) were equally distributed into one of 4 groups (n = 10) based on a combination of sex [male (M) or female (F)] and training history [endurance (E) or resistance (R) trained] (M = 24 + 4 y, 160.5 + 17.2 kg, 12.8 + 5.7 %BF; F = 22 + 2 y 135.5 + 15.8 kg, 23.3 + 4.8 %BF). On separate days, 45 min aerobic (A) or weight-training (W) exercises were performed. Serum was collected pre, 0 & 60 min post exercise (T0, T1 & T2), and analyzed via UHPLC/MS for identification of 754 biochemicals. Principle components analysis (PCA) was used to define metabolite profiles. RMANOVA's for sex, training status, exercise type, and time were run with significance set at P < .05. **Results:** Both A and W increased glycolysis (A = 3.5 + .7 fold; W = 3.9 + 1.0 fold; P<.05), with a significantly greater activation for RW, P<.05. TCA activity (AVG = 1.5 + 0.3 & 1.9 + 0.3 fold; P<.05) also increased. Downstream TCA intermediates (succinate, fumarate, & malate) were increased at T1, particularly for succinate in E (P<.05), and returned to baseline by T2. During exercise, A increased fat metabolism as evidenced by elevation of multiple FFAs and acylcarnitines (i.e., palmitate increased 2.0 + 0.4 v 1.0 + 0.1 fold in A v W) and elevated ketone bodies at T1 in RA & EA. Across exercise conditions, E showed relatively lower FFA and BCAA catabolism than R at T2 (E v R changes from baseline: stearate = 1.4 + 0.3 v 1.4 + 0.2 fold; 3-hydroxyisobutyrate = 1.8 + 0.2 v 2.2 + 0.1, P<.05) and generally faster returns towards baseline for all metabolites. Sex-dependent differences in global metabolite profiles were more pronounced in E than R groups, including elevated FFA's and muted TCA intermediate levels and BCAA catabolism in FE during both A and W. **Conclusion:** The biological response to exercise is dictated by the metabolic demand of the exercise and the physiology of the exerciser, allowing exercise type and individual variation to alter the exercise metabolome. Data support greater TCA capacity in E and greater glycolytic power in R leading to differential fuel selection during exercise, particularly with matched mode. Females displayed lower TCA activity, yet higher FFA oxidation with sex differences most apparent in the E groups.

A-25 Free Communication/Slide - Respiratory Physiology
 Wednesday, May 31, 2017, 9:30 AM - 11:15 AM
 Room: 110

125 **Chair:** Michael Stickland. *University of Alberta, Edmonton, AB, Canada.*
 (No relationships reported)

126 May 31 9:30 AM - 9:45 AM
Inspiratory Flow Resistive Loaded Breathing and Inspiratory Muscle Induced Systemic Oxidative Stress
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 (No relationships reported)

Markers of oxidative stress such as F₂-isoprostanes (a marker of lipid peroxidation) are elevated in the blood of patients with chronic obstructive pulmonary disease (COPD) compared to healthy individuals. Oxidative stress may reduce quality of life and contribute to morbidity and mortality in patients with COPD but unfortunately its origin is unclear and, therefore, it cannot be treated effectively. The inspiratory muscles may contribute significantly to systemic oxidative stress in COPD because the work of breathing increases to overcome airway resistance. **PURPOSE:** To investigate whether the inspiratory muscles contribute to systemic oxidative stress during inspiratory flow resistive loaded breathing. **METHODS:** Four young healthy adults (3 males and 1 female) who were free from respiratory disease undertook inspiratory flow resistive

loaded breathing for 30 minutes. Subjects maintained breathing frequency at 15 breaths·min⁻¹, duty cycle at 0.5 and transdiaphragmatic pressure at 70% of maximum which was provided by a variable sized aperture with a length of 2 mm. Inspiratory muscle work was estimated by the diaphragm pressure-time product (PTP_{di}), which was calculated by multiplying breathing frequency by transdiaphragmatic pressure integrated over the period of inspiratory flow. Plasma samples were collected at rest (0 min), 5 and 30 minutes during, and 30 minutes after (+30 min) inspiratory flow resistive loaded breathing and analyzed for F₂-isoprostanes using isotope dilution mass spectrometry. Time comparisons were made using a one-way ANOVA with repeated measures. **RESULTS:** PTP_{di} increased (P<0.005) from 663 ± 102 (mean ± SD) at 0 min to 1931 ± 501 and 1618 ± 258 cmH₂O·s·min⁻¹ at 5 and 30 min, respectively. Plasma F₂-isoprostanes increased (P<0.05) from 154 ± 22 at 0 min to 197 ± 35, 229 ± 83 and 206 ± 58 pg·mL⁻¹ at 5, 30 and +30 min, respectively. **CONCLUSIONS:** Lipid peroxidation increased during, and remained elevated following, inspiratory flow resistive loaded breathing. Our novel data are the first to indicate that the inspiratory muscles may directly contribute to systemic oxidative stress during periods of increased inspiratory muscle work, such as those encountered in COPD. Supported by University of Southern Queensland Centre for Health Sciences Research sponsored research grant scheme.

127 May 31 9:45 AM - 10:00 AM

Competitive Runners Can Adapt To Nasal Breathing With Similar Peak Running Velocity And Lower Ventilation

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(No relationships reported)

PURPOSE: This study investigated the effect of breathing restricting to the nasopharynx (NB) versus the oropharynx (OB) in 10 mixed gender (5 males, 5 females) recreationally competitive runners (VO₂max = 40.10 ± 2.65 ml/kg/min). **METHODS:** Each subject performed a maximal graded exercise test (GXT) and a subsequent six minute high intensity steady state run (SSR) during random order NB and OB days. All runners had previously adapted themselves to nasal only breathing at all levels of running intensity. **RESULTS:** In the GXT trials the subjects exhibited no significant mean difference in time to exhaustion (TE) (NB = 428 ± 24 vs. OB = 421 ± 18 secs), absolute maximal oxygen consumption (VO₂max) (NB = 2.55 ± 0.25 vs. OB = 2.75 ± 0.25 L/min) or peak lactate (NB = 7.0 ± 0.76 vs. OB = 7.2 ± 0.76 mmols/dl). In the nasally restricted breathing condition they demonstrated a significantly lower mean ventilatory equivalent for oxygen (VE/VO₂) (NB = 35.20 ± 1.34 vs. OB = 41.30 ± 1.59) and carbon dioxide (VE/VCO₂) (NB = 29.4 ± 1.33 vs. OB = 32.8 ± 1.13) and peak ventilation (VE) (NB = 92.8 ± 10.8 vs. OB = 112.6 ± 16.8) with a significantly higher breathing frequency (RR) (NB = 39.2 ± 2.1 vs. OB = 49.4 ± 2.5) at VO₂max. During the SSR trials the subjects exhibited no significant difference lactate (NB = 9.05 ± 0.88 vs. OB = 7.92 ± 0.98 mmols/dl) and again demonstrated a significantly lower mean VE/VO₂ (NB = 32.43 ± 0.77 vs. OB = 36.70 ± 1.03), VE/VCO₂ (NB = 28.47 ± 0.68 vs. OB = 32.92 ± 0.92) and VE (NB = 84.4 ± 8.5 vs. OB = 102.1 ± 8.2) with a significantly higher RR (NB = 36.4 ± 1.8 vs. OB = 43.2 ± 2.3). **CONCLUSION:** This study confirms the ability of competitive recreational runners to adapt to breathing restricted to the nasopharynx during running at both a maximal effort and a subsequent high intensity steady state effort, with a lower VE and RR and without a loss in TE or VO₂max.

128 May 31 10:00 AM - 10:15 AM

Does Competitive Swimming During Puberty Affect Lung Development?

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(No relationships reported)

Whether or not competitive swimming (CS) accentuates lung development beyond genetically endowed growth has been widely debated. **PURPOSE:** Given that peak growth velocities for the lungs occur during puberty, this longitudinal study aimed to determine if one season of CS affected lung development in pubertal females. **METHODS:** Female swimmers (SWIM; n=11, 3.3±1.7 y of CS experience, 19±8 km swimming/week) and healthy active controls (CON; n=10) underwent pulmonary function testing before (PRE) and after (POST) one season of CS (7.3±0.5 months). The groups were matched for age (SWIM 12.4±0.8 vs CON 13.2±1.3; p=0.10), height (PRE 161±8 vs 158±7, POST 163±7 vs 161±7 cm; p=0.38) and weight (PRE 52±11 vs 46±5, POST 56±10 vs 49±6 kg; p=0.10). Sexual maturity rating was self-reported to be pubertal (Tanner stages 2-4) for all of the SWIM and 90% of CON. Changes in lung volumes, spirometry, diffusion capacity (DLCO), and maximal inspiratory (MIP) and expiratory (MEP) mouth pressures were compared using 2-way mixed model ANOVA. **RESULTS:** Despite having a similar body size as controls, swimmers had a larger

total lung capacity (TLC; PRE 4.73±0.73 vs 3.93±0.46, POST 5.08±0.68 vs 4.19±0.64 l; p<0.01). Forced vital capacity (PRE 3.92±0.71 vs 3.13±0.50, POST 4.15±0.61 vs 3.28±0.54 l; p<0.01) and peak expiratory flow (PRE 6.48±0.92 vs 5.70±0.86, POST 6.97±0.84 vs 6.00±0.77 l/s; p=0.03) were higher in SWIM. Although DLCO was greater in SWIM (PRE 23.4±2.6 vs 20.7±1.9, POST 24.1±1.9 vs 21.0±3.2 ml/min/mmHg; p=0.01), there was no difference when expressed relative to alveolar volume (PRE 5.1±0.6 vs 5.4±0.4, POST 4.9±0.6 vs 5.2±0.4 ml/min/mmHg/l; p=0.20). Both MIP (PRE 87±26 vs 71±24, POST 103±22 vs 79±26 cm H₂O, p=0.06) and MEP (PRE 112±17 vs 98±18, POST 114±13 vs 84±19 cm H₂O; p<0.001) were greater in SWIM. Changes from PRE to POST were similar between groups (interactions p>0.05). No association between CS training volume (km/week) and change in lung size (delta TLC) (r=-0.02, p=0.95) was found. **CONCLUSION:** This data shows that pubertal female swimmers already had larger lung capacities, higher flows, and greater indices of respiratory muscle strength compared to matched controls. One season of CS did not further accentuate this enhanced function, suggesting that CS during puberty did not affect lung development. Support: NSERC

129 May 31 10:15 AM - 10:30 AM

Operational Lung Volumes While Seated, Supine, and During Exercise in Obese and Nonobese Children

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(No relationships reported)

PURPOSE: The effects of adult obesity on lung function at rest, such as reductions in functional residual capacity and expiratory reserve volume, are well recognized. However, the effects of obesity on operational lung volumes at rest, while lying supine, and during exercise in obese children are unknown but could create meaningful respiratory limitations. **METHODS:** 11 nonobese (Ht: 143.3 ± 5.2 cm; Wt: 35.8 ± 3.8 kg; BMI percentile: 50 ± 21; Body fat: 27 ± 6%) and 12 obese (Ht: 149.7 ± 6.7 cm; Wt: 65.8 ± 14.4 kg; BMI percentile: 97.5 ± 1.4; Body fat: 46 ± 3%) children underwent dual energy x-ray absorptiometry, pulmonary function testing, and measurement of operational lung volumes when seated upright, while supine, during constant load cycling at 40W, and during maximal exercise testing. **RESULTS:** Ratio of forced expiratory volume in the first second and forced vital capacity (FEV₁/FVC) was lower in obese compared with nonobese children (83.6 ± 4.1 vs. 88.6 ± 4.1%; P = 0.004). Functional residual capacity (FRC) was lower in obese compared with nonobese children when seated upright (38.5 ± 4.8 vs. 49.3 ± 4.0% TLC; P < 0.001) and while supine (35.0 ± 6.4 vs. 45.4 ± 6.5% TLC; P < 0.001). Three children (2 obese) experienced expiratory flow limitation (EFL) while supine. Both end expiratory lung volume (EELV) and end inspiratory lung volumes (EILV) were lower during exercise at 40W (P < 0.01) and EILV was lower at peak exercise (P = 0.048) in obese compared with nonobese children. EELV did not change from rest to exercise at 40W or peak exercise in nonobese children. In obese children, EELV was higher at peak exercise (44.4 ± 4.7% TLC) compared with rest and exercise at 40W (40.5 ± 4.1 and 38.7 ± 3.1% TLC, respectively; P < 0.05). None of the nonobese children experienced EFL during exercise. In obese children, one experienced EFL during exercise at 40W (44% tidal volume; V_T) and seven experienced EFL at peak exercise (37 ± 22% V_T). Higher levels of fat mass were associated with lower levels of FRC when seated (r = -0.88; P < 0.001) and while supine (r = -0.65; P = 0.003), and EELV during exercise at 40W (r = -0.68; P = 0.001). **CONCLUSIONS:** Obese children demonstrate low lung volume breathing when seated, while supine, and during exercise, which may contribute to an obstructive breathing pattern at rest as well as EFL and dynamic hyperinflation during peak exercise.

130 May 31 10:30 AM - 10:45 AM

The Effect Of Thoracic Gas Compression On Forced Expiratory Flows Is Increased At High-altitude

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It is well-known that the maximal expiratory flow-volume (MEFV) curve may be underestimated due to the confounding effects of thoracic gas compression (TGC) at sea-level. This artefact, if not addressed, reduces the sensitivity/specificity of pulmonary function testing to detect expiratory flow-limitation and changes in bronchomotor tone. The magnitude of TGC artefact increases the more compressible is the gas inhaled. With this in mind, we reasoned that magnitude of TGC artefact would be greater at high-altitude (> 2,400 m) where the density of air is lower, and its

compressibility increased. **PURPOSE:** To determine whether high-altitude engenders a greater magnitude of TGC artefact on the MEFV curve. **METHODS:** Twenty-four adults (10 women; 44 ± 15 yrs) with normal baseline pulmonary function (>90% pred.) completed an 11-day sojourn at Mt. Kilimanjaro. Participants were assessed at Moshi (Day -1, 843 m) and at Barafu Camp (Days 8-9, 4,837 m). Typical MEFV curves with no TGC correction were obtained in accordance with ATS/ERS guidelines. MEFV curves were then corrected for TGC by performing 7-9 vital capacity manoeuvres at varying degrees of expiratory effort. Both MEFV curves were further corrected to account for differences in gas-density between altitudes. **RESULTS:** At both altitudes, peak expiratory flow rate (PEFR), and forced expiratory flows at 75, 50 and 25% of vital capacity (FEF_{75%}, FEF_{50%}, and FEF_{25%}, respectively) were higher after correction for TGC ($P < 0.05$). The magnitude of change in the MEFV envelope incurred by TGC-correction was relatively greater at Barafu Camp compared with data at Moshi for FEF_{50%} ($\Delta 16 \pm 19\%$ v $\Delta 3 \pm 5\%$, $P < 0.05$) and FEF_{25%} ($\Delta 34 \pm 40\%$ v $\Delta 15 \pm 16\%$, $P < 0.05$). Once corrected for TGC and gas-density, we observed that PEFR, FEF_{75%}, FEF_{50%}, and FEF_{25%} were lower at Barafu Camp compared with data at Moshi ($P < 0.05$). **CONCLUSIONS:** Our data further emphasize what is already well-known at sea-level: that is, the MEFV envelope is significantly underestimated if no attempt is made to correct for TGC. More importantly, however, we show that the underestimation of the MEFV curve due to TGC is worsened upon ascending to higher altitudes, particularly for those expiratory flows occurring over the effort-independent portion of the MEFV envelope.

131 May 31 10:45 AM - 11:00 AM

Effect of Acute Expiratory Loading on Abdominal Muscle Function and Exercise Tolerance in Healthy Humans

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Heavy-intensity whole body exercise sustained to the limit of tolerance elicits fatigue of the diaphragm and expiratory abdominal muscles. Such respiratory muscle fatigue is likely involved in exercise limitation in healthy humans. Acute submaximal inspiratory muscle loading causes a transient increase in diaphragm excitability and inspiratory muscle strength, and may enhance subsequent exercise performance. Whether loading of the expiratory muscles has a similar ergogenic effect is unknown. **PURPOSE:** To determine the effect of acute expiratory muscle loading on expiratory abdominal muscle function and exercise tolerance in healthy humans. **METHODS:** Using a single-blind, placebo-controlled design, nine male subjects [$\dot{V}O_{2peak} = 50.1 \pm 3.8$ (SD) ml·kg⁻¹·min⁻¹] cycled at ≥90% of $\dot{V}O_{2peak}$ to the limit of tolerance after 1) 2 × 30 expiratory efforts against a pressure-threshold load of 40% maximal expiratory pressure (MEP) (EML-EX), and 2) 2 × 30 expiratory efforts against a pressure-threshold load of 10% MEP (SHAM-EX). Abdominal muscle function was assessed before and after expiratory muscle loading and 5 min after exercise by measuring 1) the gastric pressure response to maximal voluntary expiratory efforts ($P_{ga_{max}}$), and 2) gastric twitch pressure ($P_{ga_{tw}}$) in response to magnetic stimulation of the thoracic nerve roots. **RESULTS:** From before to after expiratory muscle loading in EML-EX, there was no change in non-potentiated $P_{ga_{tw}}$ (30.3 ± 10.6 vs. 32.9 ± 10.3 cmH₂O, $P = 0.232$), potentiating $P_{ga_{tw}}$ (36.3 ± 8.0 vs. 38.9 ± 8.1 cmH₂O, $P = 0.079$), or $P_{ga_{max}}$ (190 ± 44 vs. 202 ± 45 cmH₂O, $P = 0.611$). Similarly, there was no change in expiratory abdominal muscle function from pre- to post-expiratory muscle loading in SHAM-EX. Exercise time to the limit of tolerance was not different in EML-EX vs. SHAM-EX (480 ± 132 vs. 489 ± 120 s, $P = 0.792$). The severity of exercise-induced abdominal muscle fatigue was not different in EML-EX vs. SHAM-EX (potentiating $P_{ga_{tw}} - 25 \pm 12$ vs. $-22 \pm 9\%$, $P = 0.376$). Perceptual ratings of dyspnoea and leg discomfort (Borg CR10) were not different at min 1, min 3, and at end-exercise during EML-EX and during SHAM-EX ($P > 0.05$). **CONCLUSION:** Acute expiratory muscle loading does not improve expiratory abdominal muscle function or subsequent exercise tolerance in healthy humans. **Supported by The Physiological Society.**

132 May 31 11:00 AM - 11:15 AM

Diagnosing Exercise Induced Bronchoconstriction: A Comparison Of Eucapnic Voluntary Hyperpnoea And Exercise In Low Humidity

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(No relationships reported)

Eucapnic Voluntary Hyperpnoea (EVH) is a sensitive indirect airway challenge to assist in the diagnosis of Exercise Induced Bronchoconstriction (EIB). However, it has been previously reported that a positive EVH challenge may not necessarily predictive a positive exercise challenge (EX). EX have previously shown varying sensitivity due to differences in control over the inspired air water content, with studies being conducted in ambient lab conditions or using medical grade dry air.

PURPOSE: To compare the EVH challenge with an EX in a controlled dry air environment, to see if a standardised EX can be used in the diagnosis or EIB. **METHODS:** Thirty-one healthy participants (10 female; 21 males, age 36 ± 10 yrs, exercising 7.7 ± 3.0 hrs per week) gave informed consent. Eight had a history of asthma but were not taking preventative medication. Participants completed an EVH and an EX on a cycle ergometer in a randomised order. The EVH required participants to breathe a gas mixture (5% CO₂, 21% O₂ and 74% N₂, <2%RH) at a rate equivalent to 85% predicted MVV. The EX was conducted in an environmental chamber (16°C, 25%RH). Following a 4-min set warm up participants completed 6-mins of cycling at a work rate associated with 85% HRmax. Tests were deemed positive if there was a fall in FEV₁ of ≥ 10% following the challenge. Results were analysed using paired *t*-tests and Pearson's correlation and are presented as mean ± SD. **RESULTS:** Seven participants were positive to EVH. Of these, only two had a positive response to EX. No differences in baseline FEV₁ between EVH and EX were found (EVH: 4.06 ± 0.79, EX: 4.06 ± 0.77L, $p = 0.746$). There was a strong correlation between the % fall in FEV₁ post EVH and EX ($r = 0.520$, $p = 0.003$). However, the % fall in FEV₁ post EVH was significantly greater than post EX (EVH: -7.5 ± 5.4, EX: -2.0 ± 3.8 %, $p < 0.001$). The total amount of air expired was significantly higher in 6 mins EVH compared to 6 mins EX (EVH: 686.5 ± 141.7, EX: 617.9 ± 83.1 L, $p = 0.002$). **CONCLUSION:** A positive EVH challenge may not be predictive of a positive Exercise Challenge in a dry environment. EVH may have a greater sensitivity due to the lower water content of inspired air and a greater VE. This suggests that a mild positive EVH challenge (a fall in FEV₁ of 10-15%), may not be predictive of EIB.

A-26 Free Communication/Slide - Thermoregulation in Clinical Populations

Wednesday, May 31, 2017, 9:30 AM - 10:45 AM
Room: 103

133 **Chair:** Jody Greaney, Pennsylvania State University, University Park, PA.

(No relationships reported)

134 May 31 9:30 AM - 9:45 AM

Core Temperature Responses To Exercise Using A Simulated Burn Injury Model: Impact Of Body Size

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(No relationships reported)

BACKGROUND: The US Army's Standards of Medical Fitness indicate that a burn injury spanning ≥40% of total body surface area (BSA) "does not meet the standard." While whole-body sweat production and thus evaporation are diminished in burn survivors with extensive skin grafts, the impact of a 40% BSA burn injury on core temperature regulation during exercise is likely dependent on body size, as larger individuals will have a greater absolute skin area that can still participate in heat loss despite the same percentage BSA burn injury. **PURPOSE:** Using a simulated burn injury model, we tested the hypothesis that the detrimental effect of a 40% BSA "burn injury" would be exacerbated in individuals of smaller versus larger body size during exercise due to a lower absolute (i.e., in m²) skin area available for heat loss. **METHODS:** On separate occasions, healthy non-burned individuals of small (SM: n=8, 62.4 ± 5.8 kg, 1.69 ± 0.11 m²) or large (LG: n=8, 99.1 ± 8.4 kg, 2.25 ± 0.09 m²) body size cycled to elicit ~500 W of metabolic heat production for 1 h in a 39°C and 20% relative humidity environment with and without (0%) a simulated burn injury of 40% BSA. Burn injuries were simulated by affixing a highly absorbent, vapor-impermeable material to the torso (20% BSA), arms (10% BSA), and legs (10% BSA) to prevent sweat evaporation. Core temperature was measured in the gastrointestinal tract (T_{gi}). **RESULTS:** Greater increases in T_{gi} were observed in SM at 0% (SM: 1.09 ± 0.33°C; LG: 0.64 ± 0.22°C; $P=0.03$) and 40% (SM: 1.65 ± 0.32°C; LG: 1.14 ± 0.23°C; $P=0.01$). However, the exacerbated rise in T_{gi} from 0% to 40% was not different between groups (SM: 0.57 ± 0.28°C; LG: 0.49 ± 0.24°C; $P=0.60$). **CONCLUSIONS:** Preliminary data suggest that the exacerbated rise in core temperature with a simulated burn is not dependent on body size. Nevertheless, SM subjects with a simulated burn exercising at the same rate of metabolic heat production experienced the highest absolute T_{gi} and would therefore be at the greatest risk for a heat-related injury. Funding support: Department of Defense - US Army, W81XWH-15-1-0647.

135 May 31 9:45 AM - 10:00 AM

Does the Exercise-Induced Heat Load Influence Whole-Body Heat Loss in Type 1 Diabetes?Sheila Dervis¹, Martin P. Poirier¹, Pierre Boulay², Ronald J. Sigal³, Janine Malcolm¹, Naoto Fujii¹, Glen P. Kenny¹.¹University of Ottawa, Ottawa, ON, Canada. ²University of Sherbrooke, Sherbrooke, QC, Canada. ³University of Calgary, Calgary, AB, Canada.

(No relationships reported)

To date, only two studies have examined the effects of Type 1 diabetes (T1D) on the body's ability to dissipate heat during exercise in the heat. The first study showed no effect of diabetes on local or whole-body heat loss during moderate intensity exercise. However, a recent study revealed that differences may be heat load dependent as evidenced by the fact that attenuations in sweating only were observed for select skin sites at moderate-to-high exercise intensities. It remains to be determined however if these regional attenuations in sweating may lead to reductions in whole-body heat loss thereby compromising body core temperature regulation. **PURPOSE:** To examine if T1D impairs whole-body heat loss as function of increasing exercise-induced heat loads. **METHODS:** Young (27 ± 6 years) adults with (n=6, hemoglobin A1c: 8.0 ± 1.7%, duration of diabetes: 15 ± 7 years) and without T1D (CON, n=6) were matched for age, physical characteristics and aerobic fitness (VO_{2peak}). Participants performed three 30-min bouts of cycling at fixed incremental rates of metabolic heat production of 200 (Ex1), 250 (Ex2) and 300 W·m⁻² (Ex3) in the heat (35°C), equivalent to 35, 52 and 65% of their VO_{2peak}. Each exercise bout was followed by a 30-min recovery. Whole-body evaporative and dry heat loss and metabolic heat production were measured by direct and indirect calorimetry respectively. The change in body heat storage was calculated from the temporal summation of the rate of heat production and heat loss. **RESULTS:** Evaporative heat loss tended to be lower in the T1D group at the end of the second (T1D: 401 ± 71 W; CON: 424 ± 60 W, p=0.15) and third (T1D: 462 ± 75 W; CON: 479 ± 62 W, p=0.12) bouts of exercise only when compared to their healthy counterparts. No differences in dry heat gain were measured between groups for all exercise bouts (all p>0.05). Accordingly, the individuals with T1D stored more heat relative to healthy counterparts during the second (T1D: 247 ± 48 kJ; CON: 167 ± 48 kJ, p=0.03) and third (T1D: 314 ± 70 kJ; CON: 250 ± 83 kJ, p=0.02) exercise bouts. **CONCLUSION:** Our preliminary findings demonstrate that T1D may impair whole-body heat loss during exercise in the heat. Further, we show that the influence of T1D on heat dissipation is dependent upon the exercise-induced heat load. Support provided by the Canadian Institutes of Health Research.

136 May 31 10:00 AM - 10:15 AM

Are Type 2 Diabetes-Related Impairments in Heat Dissipation Heat Load Dependent?Martin P. Poirier¹, Sheila Dervis¹, Pierre Boulay², Ronald J. Sigal³, Janine Malcolm¹, Glen P. Kenny¹. ¹University of Ottawa, Ottawa, ON, Canada. ²Université de Sherbrooke, Sherbrooke, QC, Canada. ³University of Calgary, Calgary, AB, Canada. Email: mpoir026@uottawa.ca

(No relationships reported)

Older adults with type 2 diabetes (T2D) have an attenuated physiological ability to dissipate heat during moderate intensity exercise in the heat. However, it is unclear if T2D-related impairments in heat dissipation only occur above a certain exercise-induced heat load and therefore level of heat stress. **PURPOSE:** To examine whether T2D-related impairments in whole-body heat loss, as assessed by direct calorimetry, occur above a certain heat load threshold. **METHODS:** Twelve older (60 ± 7 years) habitually active males with (n=6, hemoglobin A1c: 6.8 ± 0.6 %, duration of diabetes: 9 ± 5 years) and without (n=6) T2D (CON) matched for age, body surface area, and fitness (VO_{2peak}) completed three successive 30-min bouts of semi-recumbent cycling performed at fixed incremental rates of metabolic heat production of 300 (Ex1), 400 (Ex2) and 500 (Ex3) W in the heat (40°C). This was equivalent to 37, 50 and 62% of their pre-determined VO_{2peak}. A 15-min recovery period followed each exercise bout. Whole-body heat loss (evaporative and dry heat exchange) was measured using direct calorimetry. The simultaneous measurement of metabolic heat production via indirect calorimetry was used to calculate the change in body heat storage. **RESULTS:** Whole-body heat loss was reduced in the T2D group relative to CON at the end of Ex1 (T2D: 235 ± 23 W; CON: 261 ± 34 W, p=0.004), Ex2 (T2D: 294 ± 24 W; CON: 335 ± 44 W, p=0.030), and Ex3 (T2D: 330 ± 59 W; CON: 390 ± 39 W, p=0.02). Given that dry heat gain was similar between groups at the end of all exercise bouts (all p>0.05), differences in whole-body heat loss were only due to differences in evaporative heat loss. The relative difference in the maximal level of whole-body heat loss achieved between groups became greater with increasing exercise-induced heat loads (Differences: Ex1=10.5%, Ex2=14.0% and Ex3=20.5%). As such, the individuals with T2D stored more heat during all exercise bouts (Ex1: 197 ± 39 kJ; Ex2: 236 ± 67 kJ; Ex3: 334 ± 78 kJ, p<0.05) compared to the control group (Ex1: 150 ± 61 kJ; Ex2: 160 ± 74 kJ; Ex3: 248 ± 80 kJ). **CONCLUSION:** Our preliminary findings show that

type 2 diabetes impairs the body's ability to dissipate heat during exercise in the heat and that these differences are first evident at a moderate heat load of 300 W (equivalent to 37% of VO_{2peak}).

Supported by the Canadian Institutes of Health Research

137 May 31 10:15 AM - 10:30 AM

Thermoregulation During Exercise and Passive Recovery in Athletes with a Spinal Cord InjuryPeta Forsyth¹, Joanna Vaile-Miller², Kate Pumpa¹, Kevin G. Thompson, FACSM¹, Christopher McLellan³, Ollie Jay, FACSM⁴. ¹University of Canberra, Canberra, Australia. ²Australian Institute of Sport, Canberra, Australia. ³Bond University, Gold Coast, Australia. ⁴University of Sydney, Sydney, Australia. (Sponsor: Ollie Jay, FACSM)

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(No relationships reported)

PURPOSE: To establish the extent of thermoregulatory impairment in paraplegic and tetraplegic athletes compared to able-bodied controls during exercise and passive recovery in the heat using an experimental method that accounts for differences in biophysical factors. **METHODS:** Thirteen trained males were separated into three groups based on spinal cord injury (SCI) level: tetraplegia (TP; C5-C8, 26.8±5.4 y, 71.2±7.1 kg), paraplegia (PA; T4-T12, 25.6±4.6 y, 74.0±19.7 kg), and able-bodied (AB; 26.2±2.2 y, 78.8±3.9 kg). Participants exercised on an arm ergometer for 30 min at a heat production of 4.0 W/kg (AB vs. TP) or 6.0 W/kg (AB vs. PA) with 3 min rest every 10 min, followed by 45 min of passive recovery in 35°C, 50% RH. Esophageal (T_{es}) and gastrointestinal (T_{gi}) temperature and local sweat rate (LSR) on the forehead and upper back were measured throughout. **RESULTS:** After 30 min exercise, ΔT_{es} was greater in TP (1.13±0.25°C) compared to AB (0.34±0.10°C). Similarly, a greater ΔT_{es} was evident for TP (1.60±0.28°C) compared to AB (0.28±0.15°C). Core temperature peaked at 45 min post-exercise for TP, with ΔT_{es} and ΔT_{gi} reaching 1.94±0.18°C and 1.83±0.13°C, respectively. No sweating was evident in TP however in AB, end-exercise ΔLSR was 0.38±0.26 mg·min⁻¹·cm⁻² on the head and 0.36±0.15 mg·min⁻¹·cm⁻² on the upper back. Differences between PA and AB were evident after 30 min exercise for ΔT_{es} (0.56±0.32°C vs 0.38±0.08°C) and ΔT_{gi} (0.75±0.38°C vs 0.50±0.09°C), which is when core temperature peaked for both groups. At 45 min post-exercise, PA remained greater than AB for ΔT_{es} (0.45±0.16°C vs 0.38±0.15°C) and ΔT_{gi} (0.46±0.22°C vs 0.28±0.18°C). Furthermore, ΔLSR was greater in PA than in AB after 30 min exercise, both at the head (1.03±0.75 mg·min⁻¹·cm⁻² vs 0.87±0.20 mg·min⁻¹·cm⁻²) and the back (1.03±0.30 mg·min⁻¹·cm⁻² vs 0.49±0.18 mg·min⁻¹·cm⁻²). **CONCLUSION:** The increase in post-exercise body temperature in TP demonstrates the inability to dissipate heat in hot conditions, primarily due to the lack of sweating. A greater, but less pronounced increase in body temperature during exercise was also apparent in PA compared to AB, suggesting there is a graded effect of SCI level on thermoregulatory impairment.

Funding: Collaborative Research Network for Advancing Exercise and Sport Science (CRN-AESS) Seed Funding Scheme

138 May 31 10:30 AM - 10:45 AM

Multiple Sclerosis Impairs Sweating but not Skin Blood Flow during a Passive Whole-Body Heat StressDustin R. Allen¹, Mu Huang¹, Iqra M. Parupia¹, Ariana R. Dubelko¹, Elliot M. Frohman², Scott L. Davis¹. ¹Southern Methodist University, Dallas, TX. ²University of Texas Southwestern Medical Center, Dallas, TX.

(No relationships reported)

Multiple sclerosis (MS) is an autoimmune disease that affects the central nervous system (CNS), disrupting autonomic function. **PURPOSE:** The aim of this study was to test the hypothesis that individuals with MS have blunted control of thermoregulatory reflex increases in sweat rate (SR), and cutaneous vasodilation compared to controls during a passive whole-body heat stress (WBH). **METHODS:** 18 individuals with relapsing-remitting MS and 18 healthy controls (CON) participated in the study. Core temperature (T_{core}), skin temperature, heart rate, arterial blood pressure, skin blood flow (laser-Doppler flowmetry: LDF), and SR were continuously measured during normothermic baseline (34 °C water perfusing a tube-lined suit) and WBH (increased core temperature 0.8 °C via 48 °C water perfusing the suit). Following WBH, local heaters were warmed to 42 °C, inducing maximal cutaneous vasodilation at the site of LDF collection. Cutaneous vascular conductance (CVC) was calculated as the ratio of LDF to mean arterial pressure and expressed as a percentage of maximum. **RESULTS:** Individuals with MS had an attenuated SR response to WBH (ASR from baseline: MS: 0.42±0.2 vs CON: 0.60±0.3 mg/cm²/min, p=0.005), while Δ% CVC_{max} was similar between the groups (CON: 41.7±16%; MS: 37.6±12 %, p=0.39). Additional analysis revealed SR responses were blunted as a function of T_{core} in MS (interaction: group*T_{core}, p=0.03), of which differences were evident at ΔT_{core} 0.7 °C and 0.8 °C (p<0.05). Similar analysis for Δ% CVC_{max} revealed no significant

interaction **CONCLUSION:** Taken together, the attenuated sweat responses in MS may be a result of altered neural control of sweat rate, while the control of the cutaneous vasculature is preserved in response to a WBH.

A-27 Clinical Case Slide - Cardiovascular I

Wednesday, May 31, 2017, 9:30 AM - 10:50 AM
Room: 401

139 **Chair:** Aaron L. Baggish, FACSM. *Massachusetts General Hospital, Boston, MA.*
(No relationships reported)

140 **Discussant:** Paul D. Thompson, FACSM. *Hartford Hospital, Hartford, CT.*
(No relationships reported)

141 **Discussant:** Jeffrey M. Mjaanes, FACSM. *Northwestern University, Evanston, IL.*
(No relationships reported)

142 May 31 9:30 AM - 9:50 AM

He's All Heart

Elana Bannerman¹, John H. Stevenson¹, Pierre Rouzier, FACSM², Greg Little². ¹*University of Massachusetts, Worcester, MA.* ²*University of Massachusetts, Amherst, MA.*
(No relationships reported)

HISTORY: An 18 year old male freshman diver at a division 1 university presented to the student health clinic for his pre-participation exam. On discussing his medical history, he reported that at age 8 he syncope while climbing a rope at gymnastics practice. He was taken to the ED for evaluation, and, after a normal glucose and CT scan of the head, the episode was attributed to dehydration. Over the coming weeks the patient syncope twice more at practice. He was then admitted to the hospital for further evaluation.

PHYSICAL EXAMINATION (at PPE): BP 112/76. HR 60. NAD. CV: NRRR, no murmurs, gallops, rubs. PMI is mid-clavicular with a normal impulse. Lungs: CTAB. The patient has a 5cm diagonal well-healed scar at the upper lateral corner of the L chest.

DIFFERENTIAL DIAGNOSIS: Dehydration, orthostasis, neurocardiogenic/vasovagal syncope, hypoglycemia, seizure, aortic stenosis, hypertrophic cardiomyopathy, cardiac ischemia, supraventricular tachycardia, ventricular tachycardia (Long QT, CPVT, Brugada), bradyarrhythmia.

TEST AND RESULTS (during hospital admission): CT head WNL. ECG WNL. EEG WNL. Exercise stress test revealed concomitant increase in PVCs with increase in HR. Genetic testing (+) for RYR2 gene.

FINAL WORKING DIAGNOSIS: Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT)

TREATMENT AND OUTCOMES: Initially placed on nadolol 60mg daily. Significant athletic restrictions imposed. 3 years later restrictions loosened and he began competitive diving and started weightlifting and performing light cardio. 3 months prior to starting college, he sustained an episode of cardiac arrest while walking on the treadmill. Medications changed to nadolol 60mg daily and flecainide 100mg BID. Implantable loop monitor placed. Patient continued to dive and restrictions tightened to decrease the intensity of training. 3 months later the patient sustained a 3 minute episode of PVT while doing burpees at practice. He then underwent a PM/ICD placement and a left cardiac sympathetic denervation. Started diving again 2 months later. Chose not to reveal medical history during college recruitment process due to concern that he would not be recruited. Currently cleared to perform modified practices and compete in 1m and 3m springboard. Restricted from platform diving.

143 May 31 9:50 AM - 10:10 AM

Aortic Root Dilation in Professional SCUBA Diver

Francisco Morales¹, Araceli Boraita², Maria-Eugenia Heras², Manuel Marina-Breyse², Alvaro N. Gurovich, FACSM¹. ¹*Indiana State University, Terre Haute, IN.* ²*Spanish Sports Health Protection Agency, Madrid, Spain.* (Sponsor: Margot Putukian, FACSM)
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(No relationships reported)

HISTORY: A 34 years old asymptomatic male underwent a complete cardiovascular screening as part of his occupational health screening in the Special Police Force,

Diving Section. Physically active (e.g. running, martial arts, strength training, swimming, and diving). He reports no history of chest pain, syncope, dizziness, palpitations, or dyspnea. His past medical history is unremarkable. No family history of sudden death. He has no current or prior history of smoking or drug use.

PHYSICAL EXAMINATION: Anthropometrics: height 179 cm; weight 83 kg; BSA 2.02 m². Vitals: HR 60 bpm; BP 120/70 mmHg. The cardiac exam revealed a protodiastolic murmur that was heard in the inferior left sternal border, intensity 2/6 with no irradiation. Rest of the examination was normal.

DIFFERENTIAL DIAGNOSIS: Physiologic Murmur, Healthy.

TEST AND RESULTS: Electrocardiogram: Normal sinus rhythm, 60 bpm, axis 0°, PR 0.16 s, QTc 0.38 s, early repolarization, IRBBB, U waves V2-V6. Echocardiogram: Aortic root is severely dilated (aortic annulus 30.5 mm, z-score 1.6; sinuses of Valsalva 50.7 mm, z-score 5.5; sinotubular junction 43.5 mm, z score 5.2; proximal ascending aorta 42.0 mm, z-score 4.2). Aortic valve is tricuspid with mild aortic regurgitation. Distal ascending aorta, aortic arch and descending aorta are normal in size. Left ventricular dimensions show mild LV dilation. LV wall thickness is normal with normal contractility, EF 66%. Cardiac MRI: Aortic root aneurysm (48 mm diameter) and effacement of the sinotubular junction. Tricuspid aortic valve without significant stenosis or regurgitation. Rest of the thoracic aorta is normal.

FINAL WORKING DIAGNOSIS: Moderate to severe aortic root aneurysm with tricuspid aortic valve and annuloaortic ectasia.

TREATMENT AND OUTCOMES: Valve sparing aortic root replacement (macroscopic hyaline degeneration of the aneurysm). Acetylsalicylic acid 100 mg/day for 3 months. Progressive aerobic exercise training (low to moderate intensity) for 3 months. Strength training (40-50% of body weight) after first 3 months post-surgery. Referred to genetic testing. Control (3 months): Asymptomatic; ECHO: aortic annulus 27.4 mm, sinuses of Valsalva 35.4 mm, sinotubular junction 33.1 mm, proximal ascending aorta 33.1 mm. Is expected the return to diving activities after 1 year without complications.

144 May 31 10:10 AM - 10:30 AM

Transitory Cardiomyopathy In An Elite Swimmer: A Case Study

Demitri Constantinou. *Faculty of Health Sciences, University of the Witwatersrand, Wits, South Africa.* (Sponsor: Yoganathan (Yoga) Coopoo, FACSM)
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(No relationships reported)

HISTORY: A 20-year-old swimmer presented with symptoms of chest pain, dyspnea and two episodes of syncope whilst training for Olympic trials. Symptoms started 4 months before and increasing. He had difficulty training. He reported palpitations at random and not related to syncope or chest pain. His heart rate would exceed 200bpm at times. He was referred to a cardiologist who applied a Holter monitor and inserted an implantable cardiac defibrillator. There was no previous history of any similar problem. History was suggestive of non-specific viremia several weeks prior. The swimmer had no medical or surgical history of note. He was not on any medication and had been using whey protein supplements and creatine, but denied using prohibited performance enhancing substances.

PHYSICAL EXAMINATION: Examination on several occasions did not reveal any abnormalities. Normal pulses and perfusion. Heart rate average 68 bpm, regular, good volume. Blood pressure equal in left and right arms, average 128/68 mmHg. The rest of cardiovascular examination normal.

DIFFERENTIAL DIAGNOSIS:

1. Viral myocarditis arrhythmia
2. Hypertrophic cardiomyopathy
3. Previously unidentified congenital cardiac pathology
4. Non-cardiac cause

TEST AND RESULTS:

Chest radiology normal. Electrocardiography investigations at time symptom onset, several times later on ambulatory readings did not reveal any pathology / arrhythmias. Cardiac enzyme markers initially showed marginal elevated Troponin T. Echocardiography showed dysfunction of left ventricle with wall hypomotility. Ejection fraction 45% using the Simpson method. Cardiac MRI scan reported no signs of severe left or right ventricle dilation or hypertrophy, but concentric hypomotility of whole left ventricle wall. Ejection fraction was 35% Valves were normal as was the rest of the assessment.

FINAL/WORKING DIAGNOSIS:

Transitory cardiomyopathy following possible viremia

TREATMENT AND OUTCOMES:

1. With detraining form not swimming, the athlete slowly recovered.
2. Follow up echocardiography after 6 months showed improvement with no regional wall motion abnormalities with uniform left ventricle contractility. Ejection fraction was 56%.
3. Chest pain symptoms persisted for at least 6 months, but other symptoms subsided.
4. He gradually returned to symptom-guided training

146 May 31 10:30 AM - 10:50 AM

Chest Pain- Volleyball

Samuel T. Dona, Jr.¹, Jeffrey M. Mjaanes, FACSM². ¹Rush University Medical Center, Chicago, IL. ²Northwestern University, Evanston, IL. (Sponsor: Jeffrey M Mjaanes, FACSM)
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(No relationships reported)

HISTORY: A 20-year-old female collegiate volleyball player presented with a 3-month history of chest pain. Pain was non-exertional, localized to the mid-chest and described as constant with rating of 8/10. She initially sought consult 3 months prior in the emergency room with EKG and labs unremarkable. The patient was diagnosed with costochondritis and managed with a steroid dose pack that provided temporary relief. Her pain then progressively increased to inability to tolerate volleyball activity. Of note, she reported mild left hip and lower back pain that started one week prior to consult.

PHYSICAL EXAMINATION: Cardiac exam revealed regular rate and rhythm with no murmurs. Tenderness to palpation was significant over the sternomanubrial junction. Left hip exam revealed positive piriformis test and sacroiliac compression test. Range of motion was full throughout the bilateral upper and lower extremities. Strength, reflexes, sensation, and pulses normal throughout.

DIFFERENTIAL DIAGNOSIS:

1. Costochondritis
2. Osteomyelitis of sternum
3. Seronegative spondyloarthropathy

TEST AND RESULTS:

Anterior-posterior and lateral chest x-rays:

—Normal cardiac silhouette. No bony abnormalities.

Anterior-posterior and lateral pelvis x-rays:

— Normal joint space. No bony deformities.

Nuclear medicine total bone scan:

— Increased uptake at sternomanubrial interval concerning for inflammatory process.

Further evaluation with CT scan suggested.

CT scan of the sternum with IV contrast:

— Increased uptake at the manubriosternal joint demonstrating subchondral sclerosis.

CBC, RF, ESR, CRP, HLA-B27, ANA, Lupus panel and Lyme titers ordered.

— Lab results normal with the exception of slightly elevated ESR.

FINAL/WORKING DIAGNOSIS:

Seronegative spondyloarthropathy

TREATMENT AND OUTCOMES:

1. Patient referred to Rheumatology given concern for inflammatory arthritis.
2. Initiated NSAIDs and physical therapy for suspected piriformis syndrome.
3. MRI of bilateral SI joints performed and suggestive of sacroiliitis.
4. In preparation for TNF agent treatment, patient found to be Hep B core antibody positive and referred to Hepatology.
5. Started entecavir for Hepatitis B treatment and adalimumab.
6. After 2 months, the patient returned to full volleyball participation with complete resolution of her symptoms.

A-28 Clinical Case Slide - Head

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM

Room: 402

147 **Chair:** Christina L. Master. *The Children's Hospital of Philadelphia, Haverford, PA.*

(No relationships reported)

148 **Discussant:** Robert C. Cantu, FACSM. *Emerson Hospital, Concord, MA.*

(No relationships reported)

149 **Discussant:** John Leddy. *University at Buffalo Sports Medicine Institute, Buffalo, NY.*

(No relationships reported)

150 May 31 9:30 AM - 9:50 AM

Dizziness - Runner

Amanda M. Honsvall¹, William O. Roberts, FACSM², Kelly Roberts Lane, FACSM³. ¹University of Minnesota Medical School, Minneapolis, MN. ²University of Minnesota, Minneapolis, MN. ³Fix It Physical Therapy, Mahtomedi, MN.
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(No relationships reported)

HISTORY

A 36 year old previously healthy male presented to the medical tent via wheelchair with acute onset of dizziness and nausea after finishing a marathon. He had met his goal of finishing just under 3 hours. He alternated water and sports drinks for fluid replacement. He described the dizziness as a spinning sensation that began shortly after crossing the finish line associated with emesis. This persisted while lying still with his eyes closed. Symptoms were exacerbated by tilting his head or attempting to look up. No lightheadedness, chest pain, shortness of breath, hearing changes, numbness or altered mental status. No history of vertigo episodes, recent illness or head trauma. In the medical tent, he vomited 3 times. He was laid supine with his legs elevated. Over 45 minutes, he had 5 cups of oral electrolyte replacement, 3 cups of water and a banana without improvement. He was eventually able to walk one lap around the medical tent while keeping his gaze focused downwards.

PHYSICAL EXAMINATION

T 0 min:

BP 120/58, HR 94, RR 19, O₂ 94%

T 45 min:

Supine BP 116/64, HR 63

Standing BP 105/60, HR 72

Rectal temp 97.9F

He was mildly ill-appearing with clear mental status, alert and oriented x 4. Cranial nerves II-XII were intact and he demonstrated 5/5 strength in b/l upper and lower extremities. Extraocular movements and smooth pursuit were normal. No signs of spontaneous nystagmus. Nystagmus was observed with change in posture from sitting to supine to side lie. Head impulse testing was positive for compensatory saccade response. Dix-Hallpike maneuver to the right was positive for nystagmus and reproduction of symptoms.

DIFFERENTIAL DIAGNOSIS

1. Exercise associated postural hypotension
2. Exertional Heat Stroke
3. Exercise Associated Hyponatremia
4. Vestibular system dysfunction
5. Central nervous system lesion

TESTS AND RESULTS

N/A

FINAL/WORKING DIAGNOSIS

Benign paroxysmal positional vertigo (BPPV)

TREATMENT AND OUTCOMES

1. The Epley maneuver was performed, inducing one episode of emesis followed by gradual improvement of symptoms over the following 10 minutes.
2. Instructed to avoid rapid or frequent head movements for the next few days.
3. Gradual return to running after complete resolution of symptoms.
4. Follow up with primary care for any worsening of symptoms.

151 May 31 9:50 AM - 10:10 AM

Head Injury - Soccer

Christina L. Master¹, Eileen P. Storey¹, Lei Wang², Hasan Ayaz², Olivia Podolak¹, Matthew F. Grady¹. ¹The Children's Hospital of Philadelphia, Philadelphia, PA. ²Drexel University School of Biomedical Engineering, Philadelphia, PA.

(No relationships reported)

HISTORY: A 16-year-old female soccer goalie sustained a head injury during a heading drill. The player reported a few awkward headers, including one that hit her in the back of the head. The player developed a headache and nausea, but had a normal evaluation by an athletic trainer on the sidelines. The trainer still removed the athlete from play due to the mechanism of injury and the player's report of low-grade symptoms.

PHYSICAL EXAMINATION: The player reported only a mild headache at rest the following day when she presented to clinic. On clinical examination, the player had no symptoms or abnormalities with smooth pursuits, saccades, vestibulo-ocular reflex, visual motion sensitivity, convergence and accommodation tests.

DIFFERENTIAL DIAGNOSIS:

1. Concussion
2. Sub-concussive head injury
3. No concussion

TEST AND RESULTS:

- The player performed the physical examination both 1-day and 1-week post-injury while wearing a functional near-infrared spectroscopy (fNIRS) headband that recorded anterior prefrontal cortex oxygenation changes. Compared to her baseline, the player showed significantly different levels of oxygenation changes at 1-day post-injury that approached pre-injury levels but had not fully returned to baseline at 1-week post-injury.

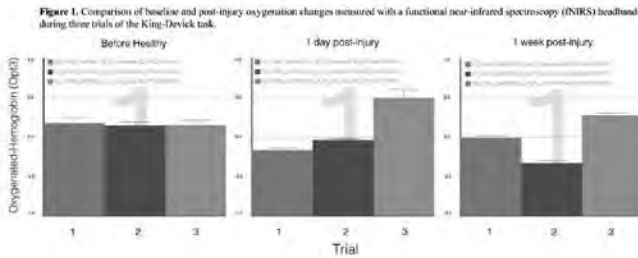
- At clinical evaluation a week after injury, the player reported no symptoms at rest or during the physical examination. The clinician detected no abnormal findings on physical examination.

FINAL WORKING DIAGNOSIS:

Concussion with subclinical deficits

TREATMENT AND OUTCOMES:

1. At 1-day post-injury, the player was permitted to begin a return-to-learn plan as well as a return-to-play protocol.
2. The player was cleared to return to soccer at 1-week post-injury with resolution of symptoms and normal physical examination.



152 May 31 10:10 AM - 10:30 AM

Headache After MVA in Physically Active, Healthcare Professional

Enayet Neak¹, Vanessa Lalley-Demong². ¹St. Joseph's Family Medicine Residency, Syracuse, NY. ²St. Joseph's Family Medicine Faculty, Syracuse, NY.

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(No relationships reported)

HPI: 35 y/o F NP with hx of migraines, presented to the ED 1 day s/p MVA, c/o right-sided headache, nausea, photophobia. The patient went off the road at 30 mph, hitting a snowbank. She had a mild headache after the accident, saying her head whiplashed but denied hitting her head, or LOC. She took an ibuprofen but woke up the following morning with the worst headache of her life, prompting ED visit. Pertinent negatives: No retrograde amnesia, phonophobia, blurred vision, eye pain, hearing loss, tinnitus, neck pain, extremity weakness, paresthesia, dizziness.

In the ED, patient was told her eye dilated funny, but otherwise normal exam. CT head was negative. GCS 15. Symptoms improved with prochlorperazine, diphenhydramine. She followed up in the office 2 days later, with continued symptoms. Office SCAT2 scored 52. She was diagnosed with post-concussion syndrome, and treated supportively. Over the next several months, patient developed diplopia, vertigo, neck pain, fatigue.

EXAM: Vital signs were stable and afebrile, well-developed, AxAxO3, anxious. NCAT. Pupils were equal, round, and L pupil was sluggishly reactive to light. EOMI Visual acuity: OU20/20, OD/OS20/25. AROM/PROM of head and neck were normal. No ptosis, proptosis. CN 2-12 intact. Romberg test negative. Motor strength 5/5 UE & LE. Sensation intact.

Subsequent office visits revealed R neck pain to palpation, asymmetry along R levator and R trapezius muscles, with reduced range of motion.

DDX: Post-concussive syndrome, BPPV, chronic migraine with aura, CN injury, malignancy/tumor

TESTS/RESULTS: CT head (ED) negative. X-ray cervical spine AP/lateral negative. Non-contrast brain MRI negative. She received OMT for neck pain with mild improvement. While working with OT, patient was noted to have horizontal saccades on lateral gaze along L eye, with lateral deviation of L eye. She was referred to neuro-ophthalmology. She was diagnosed with CN3 palsy.

DX: Partial oculomotor (CN3) nerve palsy secondary to whiplash from MVA

TX & OUTCOMES: Tx: Optometry rehab with vestibular exercises, prism therapy, OMT, TP injections, PT/OT; Sumatriptan, amitriptyline, melatonin. 17 mo s/p MVA, pt continued to have intermittent headaches, light/noise sensitivity, trouble focusing. Symptoms have improved and pt resumed training for local 5K, which she completed. She is not at baseline.

153 May 31 10:30 AM - 10:50 AM

Partial Abducens Palsy Following Concussion

Brian Vernau. Children's Hospital of Philadelphia, Philadelphia, PA.

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(No relationships reported)

HISTORY: 11 year old male presents to the sports medicine office for evaluation of concussion two weeks after he fell off his bike, hitting his head on concrete. He had no loss of consciousness. He was evaluated in the ED for laceration repair. Initial symptoms included headache, vomiting, and sleeping more than usual. Approximately one week into his injury he developed diplopia at which time his parents noticed his eyes were "crossing" more. Headaches and vomiting resolved 10 days post-injury. He endorses a history of color-blindness. He denies history of concussion, mood disorders, strabismus, amblyopia, or eye surgery. There is a strong family history of strabismus and eye surgery.

PHYSICAL EXAM: Neurological exam notable for left CNVI palsy on EOM testing. Normal resting gaze. Testing of smooth pursuits, saccades, and gaze stability did not provoke symptoms. Diplopia and left eye lateral gaze deficit persisted throughout testing, but this was variable. He was able to cross midline intermittently. Near point of convergence was 4cm and accommodation was 7cm bilaterally. Finger to nose testing was fast but inaccurate. Balance testing revealed difficulty with tandem walk backwards with eyes open and closed.

DIFFERENTIAL DIAGNOSIS:

Traumatic abducens palsy

Lateral rectus entrapment

Intracranial mass

Ocular migraine

Malingering

TESTS AND RESULTS:

CT and MRI brain both normal

Ophthalmology: left abducens palsy, bilateral resolving papilledema, recommended patching to alleviate symptoms

Neurology: Traumatic abducens palsy. Resolved papilledema. No other neurological findings.

FINAL WORKING DIAGNOSIS:

Concussion with left abducens palsy

TREATMENT AND OUTCOMES:

4 weeks after his injury he still complained of diplopia, but more intermittently and no longer requiring eye patches. He remained headache free with full academics. He had normal extraocular movements with slow pursuits, but deficit would return with fast eye movements.

He was lost to follow up, but per mother's report, diplopia resolved approximately 7 weeks from injury.

154 May 31 10:50 AM - 11:10 AM

"Post-concussion" Syndrome In A 16-year-old Female Basketball Player

Ryan Woods, Eric Crowley, Edward Laskowski, FACS. Mayo Clinic, Rochester, MN. (Sponsor: Edward R. Laskowski M.D., FACS)

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(No relationships reported)

HISTORY: 16-year-old female presents for evaluation of a possible post-concussion syndrome after being struck in the head by a dodgeball in gym class. Patient was asymptomatic at the time of injury. Two weeks following the injury she awoke feeling "different". Symptoms predominately consisted of headache, head pressure, nausea and photophobia. Her symptoms progressed to the point where she was unable to attend school. She was seen in the sports medicine clinic for presumed post concussive symptoms. Upon presentation she denied upper extremity weakness, radicular pain or sensory symptoms. Her post-concussion symptom score was 56 at the time of her sports medicine visit, with significant headache, light and noise sensitivity, and a continued sensation of feeling "not right." She had a history of concussion sustained two years prior to presentation in which symptoms resolved after two days.

PHYSICAL EXAMINATION: Healthy-appearing individual, sensitive to light. No cognitive deficit. Flat affect. Normal gait. Cranial nerve exam was normal. Full joint range of motion. Normal neurologic exam. Spurling's test was negative for radicular pain. SAC score: 29/30.

DIFFERENTIAL DIAGNOSIS: Brain tumor, Post-concussion syndrome, Migraine headaches, Depression, Anxiety

TEST AND RESULTS: MRI without contrast: No definite evidence of traumatic brain injury. Large cystic-appearing mass in the right lateral ventricle. MRI with contrast: Re-demonstration of mass. Appearance concerning for a neoplasm such as choroid plexus carcinoma metastasis. No evidence of metastatic disease on MRI of cervical, thoracic and lumbar spine. **FINAL WORKING DIAGNOSIS:** Right lateral ventricle brain tumor

TREATMENT AND OUTCOMES: Referrals were made to pediatric neurooncology and pediatric neurosurgery. The patient underwent a right tempoparietal craniotomy with full tumor resection. Surgery was without complications. Biopsy results confirmed a choroid plexus xanthogranuloma. Seven days following surgery she experienced postoperative seizures, and was placed on Kepra. She did not experience recurrent seizures and was able to be titrated down on her Kepra. A six month postoperative MRI scan is pending, with neurology and neurosurgery appointments to follow. She was slowly reintegrated back into school and is currently asymptomatic.

155 May 31 11:10 AM - 11:30 AM

Head- Lacrosse

Amy Valasek. *Nationwide Childrens Hospital, Westerville, OH.*
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(No relationships reported)

HISTORY: A 14-year-old male sustained a closed head injury while playing recreational lacrosse with a friend. During a face off, he tripped over his feet and hit frontal aspect of head on turf. There was no loss of consciousness, hematoma, or bleeding. He was disoriented and taken home due to headache and confusion. He slept for 45 minutes, then, awoke with emesis three times. The family took him to a local pediatric emergency room, a head CT was performed and diagnosed with a concussion. He followed up in concussion clinic 8 days later. He reported symptoms of fatigue, motor slowing, and no headaches. After intake and history, he began computer Cogstate Concussion Test. Within 5 minutes of start, his father called for help due to a first time seizure.

PHYSICAL EXAMINATION: Not alert, sitting in chair with left arm flexed and left leg extended actively having a generalized tonic clonic seizure. He was lifted to the table and head tilt jaw thrust performed due to dusky appearance with improvement, 100% non-rebreather face mask was placed, and seizure self-resolved in 4 minutes. He was slow to arouse and answered questions slowly and appropriately. On examination vital signs were normal for age and no focal deficits elicited with equal strength, sensation, and reflexes bilateral upper & lower extremities. He was transported from concussion clinic to the pediatric emergency room by EMS for further evaluation.

DIFFERENTIAL DIAGNOSIS:

1. Cerebrovascular degenerative disease inflammatory/autoimmune
2. Intracranial lesion
3. Subdural hematoma

TEST AND RESULTS:

Head CT day of injury: No acute intracranial abnormality. Extensive confluent hypodensity in the periventricular cerebral white matter with atrophy.

MRI of brain with contrast 8 days after injury: Extensive, symmetric areas of T2 prolongation within the deep white matter of both cerebral hemispheres, with small cystic changes adjacent to the frontal horns of the lateral ventricles.

EEG: Intermittent slowing on the left is suggestive of underlying cerebral dysfunction.

FINAL/WORKING DIAGNOSIS:

Vanishing White Matter Disease

TREATMENT AND OUTCOMES:

1. Whole Genome Sequencing completed and positive for Vanishing White Matter Disease.
2. Held from all further contact sport participation.
3. Physical therapy and occupational therapy to address progressive weakness.

A-29 Clinical Case Slide - Shoulder I

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 504

156 **Chair:** Kyle J. Cassas, FACSMM. *Greenville Health System, Greenville, SC.*
(No relationships reported)

157 **Discussant:** Jessie R. Fudge. *Group Health Cooperative, Seattle, WA.*
(No relationships reported)

158 **Discussant:** Dustin Nabhan. *United States Olympic Committee, Colorado Springs, CO.*
(No relationships reported)

159 May 31 9:30 AM - 9:50 AM

Biceps Pain- Rock Climber

Stephanie Kramer¹, Darius Greenbacher², Pierre Rouzier, FACSMM³. ¹*Baystate Medical Center, Springfield, MA.* ²*Baystate Medical Practices, Northampton, MA.* ³*University of Massachusetts, Amherst, MA.* (Sponsor: Pierre Rouzier, FACSMM)
Email: stephanie.kramerDO@baystatehealth.org
(No relationships reported)

HISTORY: 44 year old right hand dominant rock climber presented with right sided anterior-medial biceps pain without acute injury, although history significant for 500 push ups and 100 pull ups daily, as well as 3-4 hours of rock climbing 3-4 times/week. He does have a history of a 15 foot fall while climbing (in harness and about 7-8 feet from last anchor point) after losing grip with his right hand, but does not associate this with the onset of his pain. He complains of pain with any type of elbow flexion, more with abduction to 90 degrees such as when climbing.

PHYSICAL EXAMINATION: Elbow exam: Inspection: No obvious defects of the biceps/anterior musculature. No overlying ecchymosis. Palpation: Mild tenderness over mid to distal biceps and myotendinous junction, no bony tenderness. ROM: full Strength: 5/5 Special: No Popeye sign. Pain with resisted flexion of the elbow (greater with thumb up) and resisted forearm supination.

Shoulder exam: Inspection: No asymmetry, atrophy or ecchymosis. Palpation: no pain with palpation. ROM: full Strength: 5/5 and symmetric Special: Jobe's test neg. Some mild discomfort with Speed's and Yergason's test at the mid biceps muscle belly but no proximal shoulder/arm pain. No pain with impingement tests. Biceps pain with O'Briens. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS for biceps pain: 1. Biceps tendon strain vs partial tear- distal vs proximal 2. Overuse injury at biceps myotendinous junction 3. Brachialis strain 4. Acute myositis 5. Sarcoma of the muscle

TEST AND RESULTS: MRI (not arthrogram) showed minimal tendinosis of supraspinatus but no rotator cuff tear. Large type II SLAP tear extending from just posterior to biceps anchor to the upper aspect of posterior labrum. Biceps long head tendon intact and normal position. Normal musculature at marker site placed by pt (approx 16cm from shoulder joint). No evidence of biceps retraction.

FINAL WORKING DIAGNOSIS: Type II SLAP tear

TREATMENT AND OUTCOMES: Minimal relief with rest/PT. Corticosteroid injection provided some relief and pt able to resume activities, however not yet at full volume 1 month after treatment

160 May 31 9:50 AM - 10:10 AM

Shoulder Pain and Weakness in 11 y/o Male after Bike Accident

Everett Hayes. *Evergreen Sports Medicine, Augusta, ME.*
(Sponsor: Peter Sedgwick, FACSMM)
(No relationships reported)

History: 11 y/o RHD male with no PMH presented for evaluation of left shoulder injury. He fell off his bike 3 weeks prior while visiting his aunt, landing on his left shoulder onto a sidewalk. There were no other injuries other than an elbow abrasion. He did not complain of any pain, but his mother became concerned when she noticed he wasn't moving his left arm much. When asked, the patient did admit to some pain over the lateral aspect of the shoulder. He could not lift his arm over his head despite lack of significant pain with the motion. He denied neck pain, radicular pain, numbness, tingling or prior shoulder injury. The symptoms had not improved since the time of injury.

Physical Examination:

General: well appearing, no apparent distress
L shoulder:

Inspection: antalgic carriage of shoulder, no deformity, atrophy, swelling
Palpation: tender over humeral head, glenohumeral joint, posterior shoulder
ROM: significantly limited in AROM despite lack of significant pain
Strength: Weak diffusely (3-4/5) out of proportion to minimal level of pain
Neurovascular: distal pulses intact, negative Spurlings, decreased sensation over anterior biceps, otherwise intact

Skin: no breakdown, erythema, ecchymosis

Differential Diagnosis:

Brachial plexus injury
Nerve root avulsion
Suprascapular nerve palsy
Shoulder dislocation
Fracture: humeral head, humeral neck, glenoid, clavicle, cervical
AC separation
Contusion
Non-accidental trauma
Altered pain inhibition

Test and Results: 3-view X-ray of L shoulder: proximal humeral neck fracture, minimally displaced and mildly angulated. There was no apparent involvement of the growth plates.

Diagnosis: Left humeral neck fracture with possible associated neurologic injury
Treatment and Outcomes:

- Placed in a sling for 2 weeks and limited to gentle ROM
- 5 weeks post injury: Repeat x-rays demonstrated appropriate healing. He still demonstrated reduced strength and ROM despite almost no pain so MRI was ordered.
- 8 weeks: MRI obtained and unrevealing for secondary injury that would explain the weakness. He had begun to show improvement with strength and ROM. Started home therapy exercises.
- 11 weeks: No pain, ROM and strength were continuing to improve. Repeat x-ray demonstrated good bone healing. Strengthening exercises increased with plan for resumption of all activities in 2 more weeks.

161 May 31 10:10 AM - 10:30 AM
Right Shoulder Pain

Arie (Eric) Dadush¹, Vincent Morelli¹, James Johnson².
¹Meharry medical college, Nashville, TN. ²Elite Sports Medicine, Nashville, TN.
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 (No relationships reported)

History: A 48 year-old right-handed AAF with no significant PMH presented with right shoulder weakness and pain for 2 weeks. There was no inciting event or recent changes in activity. Her symptoms began 2 weeks after a viral URI. She works as a network manager and started developing acute pain for a few days, which was followed with stiffness, weakness and numbness on the lateral side of her arm. The pain then become constant and the numbness and tingling were intermittent and radiating into her hand. Her symptoms had been worsening over the prior week specifically with overhead activity. She had been using NSAID's, ice/heat and massage with no relief

Physical examination: Winging of the right scapula was noticed as well as tenderness over the deltoid. Passive ROM was normal with decreased active ROM; forward flexion and abduction 0-120 degrees, abduction external rotation 0-60 degrees. Supraspinatus, infraspinatus and triceps strength 3/5 with normal deltoid and trapezius strength. Hawkin's, Neer's, Empty can, and Impingement tests are all positive. O'Brien's, Yergason's and Crossover tests negative. **Differential Diagnosis:** Parsonage-Turner syndrome, Cervical disk disease, Shoulder impingement syndrome, Neoplastic brachial plexopathy, Supraspinatus tendinopathy **Tests and results:** Xray were obtained; no fracture, arthritis or soft tissue abnormalities were seen. Patient was sent for cervical and plexus MRI as well as EMG and nerve conduction studies. MRI results were without infiltrating process or extrinsic compression on the brachial plexus. Cervical spine MRI revealed a small right central disc extrusion without impingement. Nerve conduction studies demonstrated significant differences between the right and left Median and Ulnar nerves. The right Median and Ulnar nerves F-wave latency showed no response compared to 20.3 msc on the left side, which is consistent with a proximal injury as at the level of the plexus. **Final working diagnosis:** Parsonage-Turner syndrome

Outcome: Patient was given Toradol and Depomedrol IM as well as Medrol dose pack and Amitriptyline. She was also referred to PT.

Return to activity and follow up: 7 weeks after the initiation of the treatment patient reported almost complete resolution of her symptoms. She was instructed to follow up as needed if not complete resolution within 8 weeks.

162 May 31 10:30 AM - 10:50 AM
Chronic Axillary Pain and Weakness in a Recreational Weight Lifter

Christopher Chong, 19064, Kevin Duprey. Crozer Keystone, Springfield, PA. (Sponsor: Thomas Kaminski, FACSM)
 (No relationships reported)

HISTORY: A 19 year old college student and recreational weight lifter presents with chronic right axillary pain and mass. His pain started 8 months earlier while doing a human flag pole pose (holding onto a pole and lifting his body parallel to the ground). He felt an acute onset of sharp pain over right axillary region. He self treated with ice and foam roller without any improvement. He saw his primary care doctor who prescribed physical therapy. He attended 10 sessions with no improvement. Pain is currently 5/10, aching, worse after lifting weights and with palpation of the mass.

PHYSICAL EXAMINATION: Exam reveals no ecchymosis on inspection. There is a 2x2 non-mobile soft tissue mass over posterior inferior axillary region that is tender to palpation. Shoulder abduction and flexion on right is limited to 160 degrees with full internal/external rotation. 4+/5 strength with shoulder adduction.

DIFFERENTIAL DIAGNOSIS: Infraspinatus tear, teres major tear, latissimus dorsi tear, lipoma, liposarcoma, neurofibroma, hematoma, asymmetric fat deposition, rhabdomyosarcoma

TEST AND RESULTS: US of right latissimus dorsi: Imaging shows a heterogenous hypo and hyperechoic circular array within the right latissimus dorsi muscle measuring 2cm x3cm.

FINAL WORKING DIAGNOSIS: chronic latissimus dorsi tear.

TREATMENT AND OUTCOMES: Due to chronicity of symptoms and failure of physical therapy, patient elected for dextrose tenotomy. At one month follow up, he reported improvement in his pain from 5/10 to a 2/10, and was advised to slowly increase his activity. Three months after initial treatment, returned for follow up and reported 80% improvement in symptoms and strength. He elected for repeat dextrose tenotomy, and after the procedure was referred to physical therapy. After one month of physical therapy, he was discharged with full strength and complete resolution of pain. He was able to successfully audition for America Ninja Warrior.

163 May 31 10:50 AM - 11:10 AM
Shoulder Injury in a College Football Player

Ward McCracken¹, Justin Byers², Dave Smith¹. ¹University of Minnesota, Minneapolis, MN. ²Bethel University, St Paul, MN.
 (Sponsor: Suzanne Hecht, MD, FACSM)
 (No relationships reported)

HISTORY:

A 21 y/o male, college football running back and basketball player felt his left shoulder pop and shift during a contact play in a football game. He removed himself immediately from play, and on the sideline, he was diagnosed with an anterior glenohumeral dislocation. He had no prior shoulder instability. His shoulder was successfully reduced using a Hennepin-Kocher maneuver on the sideline. Examination immediately following the reduction showed no deficits and he was allowed to return to play wearing a Sully brace. Later in the same game, he was carrying the ball and stiff armed an opponent with the left hand and dislocated his shoulder a second time. Reduction on the sideline was initially unsuccessful the second time and he was taken to the athletic training room and his shoulder was there successfully reduced using a traction/counter-traction technique.

PHYSICAL EXAMINATION:

Left shoulder exam after the second reduction was significantly limited due to continued apprehension but generally showed diffuse weakness without focal deficit, limited AROM in all planes, no bony TTP, and neurovascular exam was intact.

DIFFERENTIAL DIAGNOSIS:

1. Glenohumeral Dislocation
2. Bony Bankart Injury
3. Hill-Sachs Lesion
4. Labral Tear

TESTS AND RESULTS:

XR

- 4V's (AP, Grashey, Axillary, and Scapular Y) negative
 MRI without contrast

- 3x2x1cm Hill-Sachs lesion, soft tissue Bankart injury, no evidence of any rotator cuff muscle tear, residua of moderate medial anterior capsular stripping inferiorly and of medial stripping of the inferior capsular attachment along the undersurface of the glenoid

FINAL DIAGNOSES:

1. Anterior Glenohumeral Dislocation x2
2. Soft Tissue Bankart
3. Hill-Sachs Lesion
4. Capsular Stripping

TREATMENT AND OUTCOMES: He was seen in the college's athletic training room three days following the injury. The medical team presented treatment options to him and surgical consult was obtained. After consideration, he opted for a trial of non-operative treatment. Presently, he continues to make excellent progress with range of motion and strength and has experienced no further instability.

164 May 31 11:10 AM - 11:30 AM
Subacute Presentation of an Elbow Injury-Work Related Delayed by Insurance

Ali Ashraf¹, John Chappa², Melinda Schalow³, Mimi Zumwalt¹.
¹Texas Tech University Health Sciences Center, Lubbock, TX.
²John Chappa, Lubbock, TX. ³Melinda Schalow, Lubbock, TX.
 (Sponsor: Jacalyn J. Robert-McComb, FACSM)
 (No relationships reported)

HISTORY: A 30 year-old, right hand dominant male firefighter sustained a right arm/elbow injury by attempting to catch a heavy garage door from falling during installation at work. He felt a pop with immediate pain. He experienced swelling/bruising in the ensuing couple of days, also difficulty using the affected extremity. Patient was initially seen at an urgent care clinic, then later by his primary care physician. Due to worker's compensation insurance requirements, an MRI was eventually done nearly 3 weeks out from initial injury, before he was referred for orthopedic consultation.

PHYSICAL EXAMINATION: Right upper extremity exam revealed tenderness/ecchymosis in the arm/elbow, weakness with resisted supination and positive hook test. He was still able to flex, extend the elbow plus pronate and supinate his right forearm. He reported no paresthesias or radicular symptoms, with sensation intact to light touch distally. Palpation also showed mild "popeye" deformity proximally at mid anterior arm.

DIFFERENTIAL DIAGNOSIS:

Partial distal biceps tendon rupture
Complete distal biceps tendon rupture
Bony distal biceps avulsion

TEST AND RESULTS: Right elbow anterior-posterior and lateral radiographs: -No fractures or dislocations Right extremity MRI: -Shows complete tear of the distal biceps tendon with retraction

FINAL WORKING DIAGNOSIS: Complete distal biceps tendon rupture - subacute
TREATMENT AND OUTCOMES:

Immediate open reattachment of distal biceps tendon (2 incision technique) to prevent any further retraction.

Arm kept in posterior/U splint with elbow flexed at 90 degrees-NWB R UE.

Follow up visit 10-14 days post-op then right elbow placed in dynamic brace.

Physical therapy protocol two weeks after surgery starting with gravity assisted elbow extension.

Regained full elbow ROM in 3 months (out of brace) with grip strength 90%.

Resolving proximal lateral forearm paresthesias.

Functional test planned at 6 months before returning to previous work/job.



A-39 Basic Science World Congress/Poster - Motor Control and Movement Disorders

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM

Room: Hall F

180 Board #1 May 31 9:30 AM - 11:00 AM

Rock Climbing as a Novel Intervention to Improve Function in Parkinson's Disease: A Case Series

Joshua G. Woolstenhulme, Natalia Agüero, Elizabeth Ruckert, Susan J. Leach. *The George Washington University, Washington, DC.*

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(No relationships reported)

PURPOSE: To preliminarily characterize the feasibility and safety of indoor rock climbing (IRC) as a therapeutic intervention for persons with Parkinson's Disease (PD) and to explore any potential IRC may have for improving physical function.

METHODS: Subjects participated in 8 weeks of thrice weekly IRC. Each climbing session was comprised of 3 climbing sets. Sets gradually progressed from 5 to 8 min as did the degree of technical difficulty (5.5 to 5.7, assessed by the Yosemite Decimal System) over the 8-week intervention. Self-reported difficulty of movement and movement self-confidence were assessed using the Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL). Dynamic balance was assessed using the Mini Balance Evaluation Systems Test (miniBESTest). Functional leg strength/power was measured using the five times sit-to-stand test (5xSTS).

Aerobic capacity was assessed using the 6-min walk test (6MWT). Grip strength (GS) was assessed using a hand dynamometer. All data were collected at baseline (T0) and after the intervention period (T1). Data for each subject were obtained at the same time of day on T0 and T1.

RESULTS: Three men on stable medication regimes (in order of recruitment: ages 73, 70, 72 yrs; BMI: 24, 24, 25 kg/m²; disease duration: 7, 13, 4 yrs; subjects 1 and 2 had idiopathic PD, subject 3 had familial PD) participated. Most subjects reported improvements in difficulty of movement (change scores [T1-T0] for each subject: -5, +3, -7) and all reported improvements in movement self-confidence (-4, -9, -15) on the OPTIMAL. Minimal dynamic balance improvements (+1, +1, +2) were noted on the total score of the miniBESTest for all subjects. Minimal improvements in functional leg strength/power for 2 subjects (-0.54, +1.27, -0.71 sec) were observed as measured by the 5xSTS. No improvements were observed for 6MWT or GS. No adverse events occurred.

CONCLUSIONS: IRC appears to be a feasible therapeutic activity with minimal safety risks for persons with PD. IRC may play a unique role in decreasing the perceived difficulty of movement and in increasing movement self-confidence for persons with PD. IRC may potentially improve dynamic balance and functional leg strength. This case series provides preliminary evidence for larger studies to examine potential benefits of IRC for persons with PD.

181 Board #2 May 31 9:30 AM - 11:00 AM

Impact of Rock Climbing on Complex Tasks in Persons with Parkinson's Disease: A Case Series

Susan J. Leach, Elizabeth Ruckert, Natalia Agüero, Joshua G. Woolstenhulme. *George Washington University, Washington, DC.*

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(No relationships reported)

PURPOSE: Indoor rock climbing (IRC) incorporates a physical component of climbing a wall with a cognitive component of selecting an appropriate climbing route. A climber is required to divide attention between the physical and cognitive demands of the task, a necessary skill in many daily activities. The purpose was to examine the impact of a novel and challenging IRC intervention on complex tasks such as those requiring divided attention in individuals with Parkinson's Disease (PD).

METHODS: A pretest, posttest pilot intervention study had participants perform IRC 3 x per week for 8 weeks while increasing climbing duration and technical difficulty. Outcome measures included the Trail Making Part B test, the dual task Timed Up & Go (TUG) manual and cognitive tests, the timed Supine to Stand test, and the Four Square Step Test.

RESULTS: Three novice rock climbers with PD took part in this study. Participant 1 (P1) was a 73-year-old male with a 7-year history of idiopathic PD with early stage clinical presentation. Participant 2 (P2) was a 70-year-old male with a 13-year history of idiopathic PD with middle stage clinical presentation. Participant 3 (P3) was a 72-year-old male with a 4-year history of familial PD with early stage clinical presentation and cognitive involvement. The following results represent the change from pretest to posttest in seconds. Climbers P1 and P3 had faster and improved Trail Making Part B times P1: -3.89; P2: +22; P3: -8.57. Climbers P2 and P3 had faster and improved TUG manual times: P1: +0.041; P2: -0.141; P3: -0.976. Climber P3 had faster and improved TUG cognitive times: P1: +0.209; P2: +0.633; P3: -3.791 seconds. All 3 climbers had faster and improved timed Supine to Stand times: P1: -0.442; P2: -0.209; P3: -3.791. Climber P3 had faster and improved 4 Square Step Test times: P1: +0.3; P2: +1.258; P3: -1.458.

CONCLUSIONS: Three novice rock climbers with PD demonstrated improvements in complex tasks following 8 weeks of IRC: P1 and P2 in 2/5 measures; P3 in 5/5 measures. The extent of improvement appeared greatest in P3 who presented with cognitive impairment at baseline. It is possible that IRC prepares learners for task complexities similar to those encountered in the community. This pilot study provides preliminary evidence for larger studies to investigate potential benefits of IRC for persons with PD.

182 Board #3 May 31 9:30 AM - 11:00 AM

Val66met Polymorphism's Influence On Depression Symptoms And Responses To Exercise In Individuals With Parkinson's Disease

Sara A. Harper, 44883¹, Angela L. Ridgell². ¹Tiffin University, Tiffin, OH. ²Kent State University, Kent, OH. (Sponsor: Dr. Ellen Glickman, FACSM)

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(No relationships reported)

Individuals with Parkinson's disease (PD) show high inter-individual variability in response to exercise interventions and in the severity of depression symptoms. It may be influenced by a genetic variation called brain derived neurotrophic factor (BDNF) Val66Met polymorphism. **PURPOSE:** To determine if the prevalence of the Val66Met polymorphism influenced incidences of depression symptoms and if

Val66Met polymorphism influenced changes in depression symptoms after dynamic cycling. **METHODS:** Fourteen participants (N=10, 6M/4F Val-allele group, N=4, 2M/2F Met-allele group, 64±9 years old), diagnosed with idiopathic PD were assessed with the Beck Depression Inventory (BDI-II) and provided saliva samples for BDNF Val66Met genotyping. The exercise intervention was three 40 minute dynamic cycling sessions separated by 48 hours. **RESULTS:** There were no differences in the severity or prevalence of depression symptoms at pre-intervention for Val-allele group (N=10, 11.20±12.43) or Met-allele group (N=4, 6.25±5.97) on a 0-63 scale ($P=0.468$). Four of the fourteen participants experienced moderate to severe depression symptoms: one participant - mild depression symptoms (15/63), two participants - moderate depression symptoms (22/63 and 23/63), and one participant - severe depression symptoms (38/63). Participants with moderate or greater depression symptoms had an average BDI-II score that significantly improved ($P=0.017$) from pre-intervention (24.50±9.68) to post-intervention (5.75±6.24). **CONCLUSION:** Val66Met polymorphism did not influence the presence or severity of depression symptoms and did not influence improvements in depression symptoms after dynamic cycling in individuals with mild depression symptoms. However, there was a significant improvement in participants who had moderate to severe depression symptoms regardless of the polymorphism presence. Future research will recruit individuals with PD who have moderate/severe symptoms to determine if these trends hold true in a larger sample. Supported by Kent State University's School of Health Sciences, Midwest American College of Sports Medicine, and Ohio Parkinson Foundation Northeast Region Grant.

183 Board #4 May 31 9:30 AM - 11:00 AM
Dynamic Cycling Improves Motor Symptoms And Mobility In Individuals With PD

Angela L. Ridgel, Dana L. Ault. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, FACSM)
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Parkinson's disease (PD) affects more than one million people in the US and this number is expected to double by 2040. PD is a progressive neurodegenerative disease that leads to difficulties in performing activities of daily living, such as balance and walking. Dynamic high cadence cycling is a unique rehabilitation modality that has been shown to improve motor function in individuals with idiopathic PD after three sessions. **PURPOSE:** To assess if six bouts of dynamic cycling, on a custom motorized recumbent cycle, improves motor function and mobility in individuals with PD. **METHODS:** Individuals were randomized to either a dynamic cycling or a stretching group. Dynamic cycling consisted of a 5 minute warm-up at 50 revolutions per minute (rpm), 30 minutes of dynamic high cadence cycling between 75-85 rpm, and a 5 minute cool down. Motor function, balance and gait were assessed after every cycling bout using the UPDRS Motor III scale, Kinesia One, and Timed up and Go (TUG). **RESULTS:** Six bouts of dynamic cycling significantly improved UPDRS III scores ($p=.001$), hand movement amplitude ($p=.002$) and TUG time ($p=.005$) from baseline testing to end of treatment. There was a 17% improvement in UPDRS scores and a 22% improvement in TUG time from baseline testing to end of treatment. **CONCLUSIONS:** Six bouts of dynamic cycling improves motor symptoms, overall motor function and mobility in individuals with PD. These findings suggest that dynamic cycling could be a valuable rehabilitation modality in this population.

184 Board #5 May 31 9:30 AM - 11:00 AM
Cerebellar Transcranial Direct Current Stimulation For Motor Function In Parkinson's Disease

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INTRODUCTION: Cerebellar transcranial direct current stimulation (c-tDCS) is a non-invasive brain stimulation technique that has been shown to acutely increase motor performance in healthy populations. Since altered cerebellum activity contributes to Parkinson's disease (PD) pathology, anodal c-tDCS may improve motor function in PD. **PURPOSE:** The purpose of this study was to determine the long-term influence of c-tDCS on motor learning and transfer of motor learning in PD. **METHODS:** The study was a sham-controlled, double-blind, between-subjects design. Twelve PD patients were allocated to either a c-tDCS group or a SHAM group. Practice consisted of 9 daily sessions involving performance of a complex, visuomotor precision grip task (PGT) with their most affected hand during either c-tDCS (25 minute duration, 2 mA current strength) or SHAM. The PGT involved matching a target sine wave (target force range: 5-35% of maximum) for 10 trials in each session. PGT performance was quantified as the average force error relative to the target force. Transfer tasks were performed in 2 testing sessions performed before and after the 9 practice days and included the Unified Parkinsons Disease Rating Scale Part III (UPDRS) and the Jebsen Taylor Hand Function Test (JTT).

RESULTS: For the PGT, there was no difference in the percentage decrease in force error between groups from the 1st to the 9th practice sessions ($P = 0.64$; c-tDCS 29 ± 13%, SHAM 28 ± 14%). For the JTT, the main effect for Group was not significant ($P = 0.37$; c-tDCS 37 ± 8 sec, SHAM 33 ± 5 sec). Furthermore, the main effect for Test was not significant ($P = 0.42$; Test 1 35 ± 6 sec, Test 2 35 ± 7 sec). Finally, the Group x Test interaction was not significant ($P = 0.58$). For the UPDRS, the main effect for Group was not significant ($P = 0.53$; c-tDCS 18 ± 4 pts vs SHAM 18 ± 9 pts). Furthermore, the main effect for Test was not significant ($P = 0.38$; Test 1 19 ± 7 pts, Test 2 17 ± 7 pts). Finally, the Group x Test interaction was not significant ($P = 0.07$). **CONCLUSION:** These findings indicate that long-term c-tDCS does not seem to elicit improvements in motor learning or transfer of motor learning in PD. Therefore, c-tDCS may not be as effective as tDCS applied to the motor cortex in PD. The first author is a CAPES PhD student grantee (BEX 13509/13-6) This research was supported by a CTR-IN Pilot grant to Brach Poston.

185 Board #6 May 31 9:30 AM - 11:00 AM
The Effects of Water Aerobics Exercise on Cerebral Perfusion in Multiple Sclerosis

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PURPOSE: To determine the effects of a 7-day water aerobics exercise intervention on the cerebral hyperemic response to a cognitive task in individuals with MS. **METHODS:** Thirty-one individuals diagnosed with MS were assigned to either an exercise group (N = 17) or a non-exercise group (N = 14). The non-exercise group maintained normal activity for the 7 days, while the exercise group participated in 1 hour of water aerobic exercise on each of the 7 days. Oxygenated hemoglobin (O₂Hb), deoxygenated hemoglobin (HHb), and total hemoglobin (tHb) were measured using near-infrared spectroscopy at rest and during a cognitive task prior to and after the 7 day period. For both groups, paired samples t-tests were used to compare differences in O₂Hb, HHb, and tHb from rest to cognition before and after the 7 days. **RESULTS:** There was no significant difference between O₂Hb from rest to cognition at pre-testing ($t(16) = -1.91, p = 0.07$), however O₂Hb significantly increased from rest during cognition at post-testing ($t(16) = -2.30, p = 0.04$). For the control group, O₂Hb significantly increased from rest during cognition at pre-testing ($t(13) = -2.51, p = 0.03$), but there was no significant difference between O₂Hb from rest to cognition at post-testing ($t(13) = -1.6, p = 0.13$). **CONCLUSIONS:** Water aerobics exercise could be a useful therapy for improving the cerebral hyperemic response to cognition in individuals with MS, which may help offset the cerebral hypermetabolic effects of the disease.

186 Board #7 May 31 9:30 AM - 11:00 AM
Effect Of Aquatic-treadmill Training On Cerebrovascular Function In Community-dwelling Stroke Survivors: A Pilot Study

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Exercise-induced increases in brain blood flow are a key mechanistic pathway for improved brain function through regular exercise. Water-based exercise augments this response and therefore may represent an optimal exercise strategy to target this mediator of improved brain health, particularly for those with impaired cerebrovascular vascular function such as stroke survivors. While aquatic treadmill exercise has been reported to improve gait re-education in stroke rehabilitation, no research has assessed whether cerebrovascular function in stroke survivors is improved following water-based training. **PURPOSE:** To examine the effect of a 4-wk aquatic treadmill (ATM) training intervention on cerebrovascular responsiveness in community-dwelling stroke survivors. **METHODS:** Six community-dwelling stroke survivors (58 ± 11 yrs), with chronic stroke (>6 months), completed a 4-wk ATM training intervention of 30 min water-based walking, 3 times/wk. Before and following the intervention, resting cerebral blood flow velocity (Transcranial Doppler) of the stroke affected and unaffected cerebral hemispheres was assessed along with cerebrovascular responsiveness, as indexed from the percent change in middle cerebral artery blood velocity (MCAv) to a 4-min hypercapnic stimulus (5% CO₂ in air). ANOVA was used to compare pre and post intervention measures. **RESULTS:** Pre-training resting MCAv was similar between the affected and unaffected side (mean ± SD: 46 ± 12 vs 46 ± 19 cm/s, respectively; $p=0.96$), and the

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4-wk intervention did not change this relation ($p=0.42$) nor significantly change the resting MCAv value (post training: 47 ± 11 vs 52 ± 15 cm/s; $p=0.29$). MCAv- CO_2 responsiveness increased by 40% in the affected hemisphere (2.8 ± 1.9 to 4.2 ± 1.8 %MCAv / mm Hg $P_{\text{ET}}\text{CO}_2$) and 65% in the unaffected hemisphere (3.0 ± 1.1 to 4.9 ± 0.9 %MCAv / mm Hg $P_{\text{ET}}\text{CO}_2$) following the 4-wk intervention, although this main effect did not reach statistical significance ($p=0.08$) nor was there statistical support for a differential increase between hemispheres (interaction effect: $p=0.41$).

CONCLUSIONS: This pilot study supports ATM training as a feasible option in stroke rehabilitation, and shows promising potential of enhanced cerebrovascular function for stroke survivors in this chronic phase of the rehabilitation pathway.

187 Board #8 May 31 9:30 AM - 11:00 AM
Effect Of Multidirectional And Unidirectional Exercises On Brain Blood Flow Activation In Chronic Stroke Patients

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PURPOSE: Recent studies reported that repetitive unidirectional exercise therapy (UET) like treadmill-walking stimulates subcortical brain areas and the cerebellum. UET may stimulate plasticity of the central nervous system by increasing blood flow in this area and hence increasing neuronal activity. The aim of this study was to examine the effects of two different types of exercise on brain blood flow activation in chronic stroke patients: multi-directional training using a half-dome ball and an aero-step (MET) versus UET on a treadmill. **METHODS:** Twenty chronic stroke patients were randomly assigned to two 12-week exercise programs, MET ($n=10$, 50.9 ± 15.0 yrs) or UET ($n=10$, 58.3 ± 12.1 yrs). Activation of blood flow in the brain was measured during leg movement using functional magnetic resonance imaging (fMRI) at baseline and after 12 weeks of exercise. The MET consisted of using a half-dome ball and an aero-step at 85% of maximal heart rate for 1h/day, 3days/week. SPM5 (<http://www.fil.ion.ucl.ac.uk/spm/>) was used for preprocessing and statistical analysis of the fMRI data ($p < 0.001$). Paired T-tests were used to analyze differences between pre- and post-exercise results ($p < .001$). **RESULTS:** Both MET and UET groups showed a significant increase in activation of blood flow after exercise training. However, there was no significant difference between MET and UET in the total area of activation of blood flow in the brain. While it was not statistically significant, the fMRI analysis reveals different patterns of activation: in the MET group, the most highly activated areas were motor movement and posture control ($t=10.54$, $t=8.6$, $t=8.12$, $p < .001$), while in the UET group, the highly activated areas were somatosensory functions ($t=13.10$, $t=10.08$, $t=3.95$, $p < .001$). **CONCLUSION:** Our finding suggest that although both MET and UET exercise program enhanced blood flow to the brain in chronic stroke patients, MET exercise promotes more activation in submotor areas responsible for unilateral involuntary motor movement and posture control.

188 Board #9 May 31 9:30 AM - 11:00 AM
Influence of Aerobic Exercise Intensity on Acute Changes in Motor Activation Post-Stroke

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Based on evidence among healthy adults, it has been proposed that aerobic exercise (AEX) could acutely activate the brain in ways that facilitate motor learning post-stroke. However, the acute effects of AEX on cortical motor activation have not been well described, and no previous studies have assessed the influence of aerobic intensity on this response among persons with stroke.

PURPOSE: To investigate the effect of AEX intensity on acute cortical motor activation among persons with chronic hemiparetic stroke.

METHODS: Using a crossover design, 10 subjects (5 male; mean \pm SD age, 60.1 ± 8.1 years; 6.1 ± 4.3 years post stroke; comfortable walking speed, 0.69 m/s [$52 \pm 25\%$ normal]; VO_2peak , 16.6 ± 3.4 mL/kg/min [$67 \pm 14\%$ normal]) performed one 20 minute session of moderate-intensity treadmill AEX (peak speed, 0.69 ± 0.30 m/s; mean VO_2 , $55 \pm 14\%$ VO_2peak ; blood lactate at end of session, 1.5 ± 0.5 mmol/L) and one 20 minute session of high-intensity treadmill AEX (1.29 ± 0.41 m/s; $62 \pm 15\%$ VO_2peak ; 5.7 ± 3.2 mmol/L) in random order, at least one week apart. High-intensity AEX used an interval training strategy involving 30 second bursts at maximum safe treadmill speed alternated with 30-60 second rest periods. Cortical motor activation

threshold of the paretic quadriceps femoris was measured immediately before and after each AEX session using transcranial magnetic stimulation. A fixed effects model to incorporate the crossover design was used to examine between-protocol differences in change.

RESULTS: During moderate-intensity AEX, motor threshold increased from 78.2 ± 2.2 to $81.4 \pm 2.2\%$ maximum stimulator output (MSO), indicating decreased paretic motor activation. During high-intensity AEX, motor threshold decreased from 80.6 ± 2.2 to $77.3 \pm 2.2\%$ MSO, indicating increased paretic motor activation. The between protocol difference was statistically significant ($p=0.037$).

CONCLUSIONS: In chronic stroke, high-intensity AEX (above the lactate threshold) appears to acutely increase paretic motor activation significantly more than moderate-intensity AEX (below the lactate threshold), which may have the opposite effect. Further studies are needed to confirm this finding in a larger sample and to determine whether this acute motor activation from high-intensity AEX can be used to improve motor outcomes following stroke.

189 Board #10 May 31 9:30 AM - 11:00 AM
CN-NINM Intervention For The Neurorehabilitation Of Disordered Speech And Emotion

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 (No relationships reported)

BACKGROUND: CN-NINM intervention combines the use of targeted exercise and non-invasive neurostimulation—delivered transcutaneously to the tongue—to enhance natural recovery mechanisms. In a case of chronic stroke, CN-NINM intervention successfully recovered speech and reversed symptoms of depression. **PURPOSE:** To evaluate the efficiency of CN-NINM intervention, using translingual neurostimulation (TLNS), in stroke patient populations. **METHOD:** The patient completed a thirteen-month intervention that consists of three components: (1) TLNS, (2) physical exercises for balance, posture and gait, and (3) speech training. For the first 6 months of the intervention this individual practiced all three components for one hour, twice daily. After 6 months of intervention, there was a 30-day withdrawal period, followed by an additional 6 months resuming the exercises, training, and device use. Improvements in speech and emotion were measured using the Dysarthria Impact Profile (DIP), the Quick Inventory of Depressive Symptoms (QIDS), and the Stroke Impact Scale (SIS). **RESULTS:** All measures demonstrated substantial improvement from baseline to end of intervention. Speech recovered by 49 percent. Depression score decreased by 10 points—a clinically significant improvement—from moderate depression to complete remission of depression. SIS scores for communication and emotion also improved by 13 and 20 percent, respectively. **CONCLUSION:** CN-NINM intervention can be used to recover and improve disordered emotion and speech in individuals with chronic stroke. These findings present a new non-invasive brain stimulation technique with applications in rehabilitative neurosciences. Additional research is necessary to understand the potential mechanisms of this phenomenon and optimize efficiency of the intervention.

190 Board #11 May 31 9:30 AM - 11:00 AM
Lower Extremity Function in Different Cognition Older Adults

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PURPOSE: Lower extremity function is closely related to cognitive and balance impairments. Evaluate the difference of lower extremity function with different levels of cognitive impairment to find out the cognitive effects of balance functioning in community-dwelling older adults.

METHODS: Fifty-five adults aged over 60 (age: 74.36 ± 7.11 yrs, BMI: 23.43 ± 3.29 kg/m²) were divided into normal cognitive (NC, $n=17$), mild cognitive impairment (MCI, $n=16$), and dementia groups (D, $n=22$), using the SLUMS scale and physician's diagnosis. Lower extremity muscle strength (30-second chair stand test), lower extremity flexibility (chair sit-and-reach), agility/dynamic balance (8-foot up-and-go), stability score and single-leg static balance capacity were evaluated.

RESULTS: In static balance, NC group had better performance in stability score (1.77 ± 0.58 vs. 4.22 ± 2.03 , $p < 0.001$) than D group, especially in anterior-posterior side (1.57 ± 0.77 vs. 1.41 ± 1.02 , $p < 0.001$). In ankle proprioception, NC and MCI groups improved the joint position sense more slightly ($1.46 \pm 0.45/1.48 \pm 0.50$ vs. 2.07 ± 0.45 , $p=0.004$) than D group. Moreover, NC and MCI groups had significantly better performance in lower extremity flexibility ($7.5 \pm 8.56\text{cm}/8.72 \pm 6.69\text{cm}$ vs. $-2.57 \pm 10.89\text{cm}$, $p=0.001$), agility/dynamic balance ($6.08 \pm 1.52\text{sec}/6.65 \pm 1.74\text{sec}$ vs. $9.42 \pm 2.6\text{sec}$, $p=0.007$) than D group.

CONCLUSIONS: The abilities of lower extremity functioning and agility/dynamic balance may be affected by the level of cognitive impairment. We suggest that should

give priority for providing strategies of exercise intervention for balance to improve lower extremity function, especially when agility/dynamic, anterior-posterior control and ankle proprioception are limited because of early cognitive impairment.

Key words: dementia, mild cognitive impairment, muscle strength, balance, ankle proprioception

191 Board #12 May 31 9:30 AM - 11:00 AM
Psychophysiological Responses To Dual-task Postural Control In Older Adults After 3-month Of Cognitive-motor Intervention

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In the aging process, there is a higher competition for attentional resources during challenging/dual-task postural conditions, which consequently increases risk of falls. Fall prevention programs should therefore seek proper interventions to improve dual-task performance of the elderly. **PURPOSE:** To assess psychophysiological responses to dual-task postural control in older adults and the effectiveness of 3-month cognitive-motor intervention. **METHODS:** Thirty healthy older adults (70±6y, 76% women) were randomly divided into either 3-month cognitive-motor or control group. Postural control was monitored using a force plate (AMTI HE600600-2k, MA, USA) during quiet stance and in tandem position, both in normal and in DT conditions (subtracting three). Psychophysiological responses (heart rate and variability, breathing frequency, skin temperature and galvanic skin responses) were assessed with NeXus-10 MKII (Mind Media B.V., The Netherlands). Finally, the subjective ratings of physical and cognitive workload were assessed by Borg scale. The results were addressed by interactions of RM ANOVA at p<0.05. **RESULTS:** Significant interactions in terms of better outcomes for cognitive-motor group were found for heart rate (p=0.044) and breathing frequency (p=0.048) whereas results for postural sway failed to reach statistical significance (non-significant trend p=0.097). Furthermore, subjective ratings were increased in both groups with increased postural difficulty (p<0.05). Finally, the cognitive-motor group revealed higher accuracy of secondary (cognitive) task while balancing at the end of the intervention (p=0.032). **CONCLUSION:** Aging process is associated with structural and functional alterations of autonomic nervous system functions that are responsible for an impaired ability to adapt to environmental challenging tasks. The present cognitive-motor intervention was identified as a potentially promising method to counteract these age-related negative adaptations. Supported by Norway Grants, Project No. 4300-472/2014

A-40 Free Communication/Poster - Activity Interventions and Programming in Adults I

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

192 Board #13 May 31 11:00 AM - 12:30 PM
Evaluation Of A Hospital-based Weight Loss Program Involving Exercise, Nutritional, And Behavior Change Modification.

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Weight loss can reduce health risks associated with obesity. Team-approach interventions that involve exercise, diet, and behavioral modification have been shown to result in successful weight loss. **PURPOSE:** The purpose of this project was to evaluate the effectiveness of a hospital-based team-approach physician-referred program that enrolls community members without use of incentives. **METHODS:** Participants included obese (BMI≥30) members of the community (COM, N=48) compared to employees of the local hospital (EMP, N=88). COM were referred to the program by a Physician while EMP were provided with incentives to participate. All participants were evaluated both pre- and post- a 16-week intervention period which included regular supervised exercise sessions and monthly consults with a Registered Dietitian (RD) and a Behavioral Health Specialist (BHS). Background information collected included, sex, initial weight (kg), BMI (kg/m²), percent fat (%) using Bioelectrical Impedance, and readiness for change (RTC) evaluation (modified Brownell LEARN RTC Questionnaire). Attendance at all sessions (RD, BHS, exercise)

were recorded. If final weight was obtained, then the program was considered completed. Independent samples t-tests (p<0.05) were used to determine differences in physical characteristics between groups as well as in total weight loss. Association between consultation attendance (RD and BHS) and completion was determined by Chi-square test for independence with a Bonferroni adjustment. **RESULTS:** No significant differences were detected between participant initial characteristics. There was no significant difference in weight loss between groups (EMP=-12.29±12.56lbs vs COM=-15.58±8.08lbs, p=0.20). However, overall program completion was lower in the COM compared to EMP (58% vs. 85%, respectively). In the COM program a Chi-square test revealed a significant association only between attending BHS consultations and program completion (X²(1,n=48), X²=6.291, p=0.01, phi=0.41). **CONCLUSION:** A team-approach weight loss program may be an effective intervention if the participants successfully complete the program. However, additional research is warranted to determine if adhering to BHS consultation visits could improve completion rates when other incentives are not offered.

193 Board #14 May 31 11:00 AM - 12:30 PM
Use It And Lose It: Fitbit Use, Daily Steps, And Weight Change Among Overweight Adults

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(No relationships reported)

Despite the increasing proliferation of advanced wearable physical activity tracking devices (e.g., Fitbit Zip), their value as tools for physical activity promotion and weight loss remains unclear.

PURPOSE: As part of a pilot intervention trial that examined the efficacy of a novel social support approach for enhancing weight loss, participants were provided with a Fitbit Zip to monitor their physical activity. The current study examined the relationships between Fitbit use and change in weight and daily steps over 4 months. **METHODS:** Overweight adults (N=36) were randomized to either a standard or social support-enhanced, 16-week behavioral weight loss intervention. In addition to a Fitbit Zip, both groups received weekly, in-person group counseling sessions and digital body weight scales. Participants in the social-support enhanced group received two extra Fitbits and scales to share with up to two persons in their social circle. There were no significant differences between conditions, so analyses collapsed groups and examined the full sample. Paired t-tests were used to evaluate changes in weight and daily steps from baseline to post-treatment. Spearman rank correlation coefficients were calculated to test the associations between the total number of days the Fitbit was used (out of 112 days) and changes in daily steps and weight. Fitbit use was objectively established by weekly monitoring of synced data from the Fitbit website. **RESULTS:** At baseline, participants were obese (M BMI= 36.1 + 7.3 kg/m²) and low active (M=5546 + 2390 steps/d). Weight losses averaged -3.5±4.3 kg (p<.0001) and daily steps increased an average of 1101±2395 (p=.009) over baseline. Participants used the Fitbit an average of 5.9±2.5 days/wk. A significant correlation between total number of days the Fitbit was used and weight loss such that there was greater use of Fitbit was associated with greater weight loss (r_s = -.60, p<.0001). A significant, positive correlation was found between the change in daily steps and the number of days the Fitbit was used (r_s = .43, p=.008). **CONCLUSION:** These preliminary findings suggest that advanced wearable physical activity trackers hold promise as tools for assisting with physical activity promotion and weight loss in adults within the context of a multi-component behavioral weight loss program.

194 Board #15 May 31 11:00 AM - 12:30 PM
Lifestyle Enhancement Program: Evaluation of a Community-based Physical Activity Smoking Cessation Program

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PURPOSE: The purpose of this study was to evaluate the efficacy of the Lifestyle Enhancement Program, a two arm, parallel group, randomized clinical trial comparing community-based physical activity (PA) program to a wellness control program as adjunctive smoking cessation treatment.

METHODS: All participants (n=392) received cessation counseling and the nicotine patch and were randomized to PA (n=199; YMCA membership and personalized exercise programming from a health coach) or an equal contact wellness curriculum (n=193). Primary (CO-verified continuous smoking abstinence) and secondary (PA

levels) outcomes were assessed at baseline, 7-week, 6- and 12-months. Indices of treatment perception, adherence, abstinence rates, and PA levels were compared between groups using chi-square analyses and ANOVA.

RESULTS: Smoking abstinence in the PA and wellness groups were 18.6% and 23.8%, respectively at 7 weeks, 15.1% and 16.1% at 6 months, and 14.1% and 16.6% at 12 months. Between group differences did not significantly differ from each other (all *p*-values > 0.18). In the PA group, increases from baseline to 7 weeks were observed for total minutes of PA/week (97.8 min to 145.2 min; *p*<.01) and total minutes of strength training/week (12.8 to 29.7; *p* < 0.005). For the PA group, total PA and strength training were not different at 6 and 12 months compared to baseline, and no changes at any follow-up were observed in the wellness group. Intervention session attendance over the year averaged 63% for the PA intervention and 72% for the wellness (*p* < 0.001). Participants in both the PA and wellness conditions found the intervention to be “very helpful” in quitting smoking [85% and 83% respectively (*p* = 0.20)]. Time commitment to the program was considered to be “not at all a burden” [88% in both conditions (*p* = 0.84)]. Participants indicated they would “strongly agree” to recommend the program to a friend [95% and 92% respectively (*p* = 0.06)]. **CONCLUSIONS:** A combination of individual smoking cessation counseling, nicotine replacement therapy, and a community-based PA or wellness program was acceptable to smokers but did not appear to improve long-term abstinence rates above what has been seen with nicotine replacement therapy in previous studies. Grant funded: PHS Grant R01 HL068569

195 Board #16 May 31 11:00 AM - 12:30 PM
Gesture Analysis for Yoga Alignment in Young Adults
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Introduction: Biomedical research aimed toward a deeper understanding of yoga’s benefits and physiological mechanisms has become an active area of study. To decrease disparity between populations who can readily access yoga classes and therapies, benefits of yoga could be implemented in an exergame format at clinical or home environments. This platform could be installed with low cost hardware using the Cloud for analytics and data collection. **Purpose:** Objective was to analyze yoga posture alignment using a 3D room sensor to produce a physical activity exergame for specific groups, such as young adults. This research utilizes gesture analysis software to provide skill improvement feedback to students in a yoga course setting. **Methods:** We measured yoga posture alignment over the course of a 10-week period using Kinect SDK 2.0. A convenience sample of 12 undergraduate students with minimal yoga experience were recruited under an IRB approved protocol. **Results:** Five yoga postures were captured from seven yoga teachers, as a gold standard for comparison and used for training supervised machine learning algorithms. Default settings in Kinect Visual Gesture Builder produced solutions with high True Positives (99.5%) and low False Positives (0.03%) for most yoga postures sampled. Depth stream and skeleton coordinates for the 12 participants were acquired and analyzed against this trained solution. Analysis showed sensitivity for True Positives was greatest for “Side Bend” (0.496) and “Upward Salute” (0.141) and most postures had specificities for True Negatives near 1.0. Based on these results the higher the gesture score, the closer the postures were to the “gold standard”. **Discussion:** Gesture analysis for yoga alignment training may be a useful tool for the development of home and clinical yoga therapy for hard to reach populations. The exergame developed here provides a tool that scores the performance of yoga postures and improvement. Prior research has shown that even short-term yoga based lifestyle interventions were efficacious in weight loss, inflammation and stress and positively influenced cardiovascular risk factors. **Conclusion:** Our plans are to target special populations, study the potential effects of body mass and age on posture alignment, and assess breathing, heart rate and limb stretch.

196 Board #17 May 31 11:00 AM - 12:30 PM
Effects of a Dog Walking Intervention on a University Campus: A Pilot Study
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 (No relationships reported)

A great deal of research has focused on implementing walking interventions with the intent of increasing employee well-being and decreasing organizational healthcare costs. The inclusion of dogs within a walking intervention can not only facilitate walking adherence, but also increase health benefits. **PURPOSE:** To assess the benefits experienced by university staff members after walking local shelter dogs during their lunch breaks. **METHODS:** Staff members at a local university were

recruited through a campus listserv. Seven full-time staff members (100% female, 100% white, 27-66 years of age) completed the study. Shelter dogs were transported to campus weekly for four weeks in the Spring of 2016. One week was canceled due to rain. Participants were paired and instructed to walk their assigned dog for 30 minutes using the sample walking routes provided. Accelerometer data (hip-worn ActiGraph GT3X) were collected during each walk to document intensity levels and post-intervention interviews were conducted upon completion of the study to assess participant’s perceived benefits from the intervention. **RESULTS:** Eighty-six percent of participants completed all walking sessions. Participants averaged 24.9 ± 7.4 minutes of moderate-to-vigorous physical activity (range 12-37 min) during the walk. Interview data revealed that participants sat anywhere from 3-7.5 hours out of their 8-hour workday. Participants self-reported being somewhat physically active outside of the workplace setting, but all wanted to find ways to be more physically active throughout the workday. Thematically, qualitative analysis suggested that participants signed up for the study because of their love of dogs, looked forward to their Friday walks, had fun during the walks, returned to work happy, and wanted the program to continue. **CONCLUSION:** Incorporation of dogs into a university-based walking program can encourage program adherence and promote moderate intensity walking among women staff members.

197 Board #18 May 31 11:00 AM - 12:30 PM
Effects Of Elastic Resistance Band Exercise On Older Women With Nonspecific Chronic Low Back Pain
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 (No relationships reported)

Nonspecific chronic low back pain (NCLBP) is a common ailment in older adults. It is possible that simple and inexpensive exercise programs could reduce pain and improve physical function, fitness and body composition in older women with NCLBP. **PURPOSE:** To analyze the effects of a short-term elastic band resistance program (EBRP) on pain, spine function, fitness and body composition in older adults with NCLBP. **METHODS:** 20 sedentary older women (70.9±5.9 yr) with NCLBP for at least of 6 months were randomly divided into two groups: control group (CG) (n=9) that continued normal activities without exercise; and EBRP group (EBRPG) (n=11) that performed an 8-wk EBRP on 2 d/wk with 6 multi-articular standing exercises for upper and lower extremities for 4 sets of 10 repetitions (8-9 perceived effort) with 60 s of recovery between sets. Participants did not consume any nutritional supplements and none had any pathology that was currently being treated. Measures assessed pre- and post-training were: visual analogue scale of pain (VAS); Oswestry disability index (ODI); categorized sciatica pain (CSP); back performance tests: pick and lift repetitions tests (PT and LRT, respectively); Schober flexion’s test (SFT); timed up and go test (TUGT); six-minute walk test (6MWT); isometric strength tests: vertical row (VRT), squat (SQT) and trunk curl (TCT); body fat percentage (BF) and fat-free mass (FFM) (via bioelectric impedance). **RESULTS:** CG did not change from pre- to post-testing while EBRPG significantly (*p*<0.05) improved all variables analyzed. Percentage differences are provided for CG and EBRPG, respectively: VAS +9.4 vs. -70.3; ODI +6.0 vs. -49.1; CSP +4.2 vs. -100; PT +66.7 vs. -85.7; LRT -4.2 vs. +26.4; SFT -2.6 vs. +4.6; TUGT -2.74 vs. -25.4; 6MWT -1.5 vs. +16.6; VRT -7.2 vs. +14.1; SQT -5.2 vs. +23.5; TCT -14.8 vs. +33.2; BF +1.6 vs. -2.4; FFM -1.1 vs. +2.44. Intergroup post-training significant differences were found on VAS, ODI, CSP, PT, LRT, and TUGT. **CONCLUSION:** An intense EBRP applied in a short time period appears to help reduce pain and improve spine function, physical fitness and body composition in older women with NCLBP. Further research is needed regarding the long-term impact of this program on NCLBP.

198 Board #19 May 31 11:00 AM - 12:30 PM
Effects of Combined Aerobic and Resistance Training: A Randomized Controlled Trial
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Reported Relationships: S.S. Sawada: Contracted Research - Including Principle Investigator; Curves Japan Co., Ltd.

Limited data are available on the effect of combined aerobic and resistance training (combined training) in Asian populations.

PURPOSE: To determine the effect of combined training on fatness and fitness outcomes, including body fat mass, waist circumference, muscle strength, and flexibility; and also clinical outcomes, including blood pressure, brachial-ankle pulse wave velocity and fasting blood glucose in Japanese women.

METHODS: Forty-one women were randomized to a training group, n = 23 (age 47.3 ± 6.5 years) or control group, n = 18 (age 46.7 ± 6.5 years). The intervention included participation in a 24-minute circuit training session (combining aerobic and resistance training, each of which lasted 30 seconds) and 6-minute stretching 3 times per week for 16 weeks. The aerobic exercise was stepping on a step board while executing resistance training, using 12 different hydraulic devices developed for females to increase their muscle strength. During this training, the participants measured their heart rates once every 8 minutes based on the instructor's guidance to maintain them at 60 to 80% of their maximal heart rates throughout training by adjusting training intensity levels. All outcomes were measured at baseline and after the intervention.

RESULTS: Although there was no statistically significant change in the control group, there were significant reductions in waist circumference (91.0 ± 6.3 to 89.8 ± 6.5 cm) (p = 0.045), systolic blood pressure (127.5 ± 18.9 to 123.3 ± 19.5 mmHg) (p = 0.038), fasting blood glucose (101.0 ± 19.4 to 95.3 ± 13.2 mg/dL) (p = 0.015), and brachial-ankle pulse wave velocity (1315 ± 181 to 1271 ± 173 cm/s) (p = 0.009) in the combined training group. Also, significant increases in the knee extension strength (858 ± 184 to 1140 ± 216 watts) (p < 0.001) and flexibility (33.7 ± 6.4 to 35.9 ± 6.4 cm) (p < 0.001) only in the training group.

CONCLUSIONS: The results of this randomized controlled trial showed that a 16-week combined training significantly improved the fatness and fitness outcomes and the clinical outcomes in Japanese women.

199 Board #20 May 31 11:00 AM - 12:30 PM
Combination Of Sling Exercise Training And Nutritive Administration Of Carbohydrates And Protein By Food As A Strategy To Increase Strength In Older Men And Women

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 (No relationships reported)

PURPOSE: After the age of 60, muscle strength is reduced by 1-1.5% per year increasing to 3% per year. However, strength training can counteract age related loss of strength. Sling training, a specific type of strength training, has positive effects on balance and functional mobility. However, knowledge about its effects on force and strength is limited. Malnutrition may be part of aging; especially the uptake of proteins can be below nutrition recommendations which may result in reduced muscle mass. Therefore we investigated in this study combined effects of protein and carbohydrate intake by food immediately after sling training on the training response in older people.

METHODS: 31 subjects (25 female and 6 males, age: 65.9 ± 4.9) conducted a sling training (three times 30 minutes per week for 12 weeks). Immediately after training the intervention group received a meal consisting of 110 g sour milk cheese with two slices of whole meal toast and 250 ml of buttermilk. The nutritional values of these meal consisting of 38.95 g protein, 23.2 g carbohydrates and 2.9 grams of fat (= 1190 kJ / 278.5 kcal). Prior and after the intervention, maximum strength of trunk and leg muscles was tested.

RESULTS: Sling training resulted in a significant increase of strength in the control group as well as the intervention group. Average strength increased between 20 to 30% for leg and chest strength up to 40% to 130% for trunk strength (ventral, dorsal and lateral). For all kinds of trunk strength nutritive protein carbohydrate uptake resulted in an additive training effect which was significant for the left lateral trunk strength. Interestingly all volunteers like to have a common meal after training.

CONCLUSIONS: Our results indicate that a combination of sling training and nutritive protein and carbohydrate uptake by food may be a suitable strategy to counteract age related loss of strength and muscle mass and improve the quality of life in the elderly.

200 Board #21 May 31 11:00 AM - 12:30 PM
Effect of a Group Exercise Program in Symptoms of Depression and Physical Activity: Pilot Study

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Depression has the highest incidence among mental illnesses. Physical activity (PA) and exercise has been associated with lower symptoms of depression (SD). However evidence of the effectiveness of a group exercise program combining aerobic and resistance exercise in this population is scarce. **PURPOSE:** To evaluate the effect of a 6-weeks group exercise program combining aerobic and resistance exercise in SD and moderate to vigorous physical activity (MVPA). **METHODS:** Seven college students

(5 females and 2 males, 21 (21-23) years of age) with a score ≥ to 17 in the Beck's Depression Inventory-II (BDI-II) volunteered for the study. Participants underwent a 3 day per week combined aerobic and circuit resistance 6 week group exercise program. Before and after the exercise program participants completed the BDI-II and wore an accelerometer for 7 days. Tests to assess health related physical fitness (HRF) were also performed (% body fat, VO₂ max, leg and chest 1RM/lb body weight, isometric relative strength, push-ups and curl-ups) and results converted into a score. Wilcoxon Signed Rank were conducted to determine differences between pre- and post-tests, and Spearman's correlations to determine associations between SD, PA and HRF.

RESULTS: Differences were found between pre- and post BDI scores (pre=26 (23 - 27) vs. post=7 (5 - 9), p = 0.02), MVPA (pre= 275.5 (255.63 - 296.27) min/week vs. post= 250.55 (150.27 - 243.43) min/day, p = 0.04), and HRF scores (pre= 4 (4 - 6) vs. post= 7 (6 - 9), p = 0.02). Differences were also found between pre- and post HRF results: % body fat (pre= 34.4 (25.2 - 48.5) vs. post=28.8 (24.4 - 48.4)%, p = 0.02), VO₂ max (pre=23.5 (21.1 - 27.6) ml/kg*min⁻¹ vs. post= 27.2 (21.2 - 29.9) ml/kg*min⁻¹, p = .03), 1RM bench press (pre=.43 (.41 - .83) lb/bw vs. post=.50 (.48 - .97) lb/bw, p = 0.02), 1RM leg press (pre=1.51 (1.36 - 2.44) lb/bw vs. post= 1.99 (1.84 - 2.68) lb/bw, p = 0.02), and push-ups (pre=5 (3 - 13) vs. post=11 (4-20), p = 0.02). No significant correlations were found between SD, PA and HRF. **CONCLUSION:** A 6-week group exercise program can help achieve a reduction of SD and can improve the HRF components in young adults with SD. Exercise training plays an important role in the reduction of SD in physically active young adults.

201 Board #22 May 31 11:00 AM - 12:30 PM

A 12-week Modified Tabata Exercise Program On Functional Fitness For The Elderly: A Pilot Study

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PURPOSE: This preliminary study sought to examine the impact of a 12-week modified TABATA circulative exercise program on functional fitness in an elderly population. **METHODS:** Subjects were community-dwelling older adults over the age of 60. They were recruited using flyers or telephone calls from a local community facility in New Taipei City. Subjects were consented and evaluated by a set of functional fitness tests at baseline and post intervention. The modified TABATA exercises incorporating squatting, forward lunge, heel raise, and table plank were conducted in a circular fashion with a 110 bpm music in the background. The exercise-to-rest ratio were 30:30, 30:20, and 40:20 seconds during the 1st -6th, 7th -10th, and 11th -12th week respectively using the high-knee stepping and side stepping in the rest sessions alternatively. This modified TABATA was implemented weekly for 12 weeks for an average duration of 50 minutes each time. The non-parametric Wilcoxon signed rank test was conducted to detect the pre-and-post differences in all functional fitness tests. Significant level was at α = .05. **RESULTS:** A total of 14 subjects were recruited. Ten (2 male and 8 female) of the participants aged 69.2 ± 5.7 years old completed both pre and post tests with an average attendance rate of 87.8%. After the once-a-week modified TABATA exercise program for 12 weeks, significant differences were found in % body fat (p=0.03), hand grips (left) (p=0.015), 30-seconds chair rise (p=0.007), chair sit-and-reach (left: p=0.033; right: p=0.028) and 2-minute stepping (p=0.012). **CONCLUSIONS:** With some little modification, TABATA exercise can be safe and feasible for older population. Specifically, it might be even more beneficial in prevention of the general deterioration in lower limb flexibility and muscular strength, and also the cardiorespiratory fitness normally occurred with age.

202 Board #23 May 31 11:00 AM - 12:30 PM

Keep Up The Good Work: Does Enrolling In An Exercise Program Influence Other Behaviors?

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Many agencies promote a healthy "lifestyle" but this comprehensive vision of wellness contrasts with interventions targeting specific health behaviors. However, initiation of a new health behavior could promote, consciously or unconsciously, the modification of a second health behavior.

PURPOSE: To investigate if participation in an exercise program promotes spontaneous dietary modification. **METHODS:** Ninety-eight healthy, sedentary adults (53% female, aged 31.4±6.1 years; baseline BMI 25.0±3.9) were randomized to either 12 weeks of aerobic exercise training (n=44) - 4 days/week for 45 min at an intensity of 80-85% of maximal heart rate followed by 4 week deconditioning - or wait list control (n=54). A Food Frequency Questionnaire was administered at baseline and weeks 12 and 16, to derive caloric intake (Kcal), Alternate Mediterranean Diet Index (aMed), and Macronutrients

(Protein, Fat, Carbohydrate) intake. Repeated measures tested treatment, session, and their interaction as predictors with diet measure (Kcal, aMed, Protein, Fat, or Carbohydrate) at Wk12 and Wk16 as the response variables. All models were adjusted for the baseline value of the response variable and were repeated adjusting for gender. **RESULTS:** Both the exercise (Ex) and the waitlist (WL) groups significantly decreased, from baseline to week 16, mean caloric intake (Ex: $\Delta=-232.43\text{cal}$, $p<.01$; WL: $\Delta=-219.89\text{kCal}$, $p<.01$), mean protein intake (Ex: $\Delta=-11.26\text{g}$, $p<.01$; WL: $\Delta-9.42\text{g}$, $p<.01$), mean fat intake (Ex: $\Delta=-7.42\text{g}$, $p=.04$; WL: $\Delta=-8.29\text{g}$, $p<.01$), and mean carb intake (Ex: $\Delta=-24.00\text{g}$, $p<.01$; WL: $\Delta=-24.28\text{g}$, $p<.01$). No significant change in aMed over time was found for either group (Ex: $\Delta=-.31$, $p=.24$; WL: $\Delta=-.35$, $p=.05$). There were no significant difference between the groups in any of the 5 diet measures ($p>.65$).

CONCLUSIONS: Despite this intervention's singular focus on aerobic training, both groups showed a marked reduction in KCal and Macronutrients. Sedentary participants willing to enroll in an exercise study may already be in the action stage of behavior change and may independently elect to change dietary behavior to improve overall wellness. Future studies should investigate what psychological triggers lead to a behavioral "spillover" and if the degree of engagement in the primary behavior could predict the magnitude of the "spillover".

203 Board #24
Abstract Withdrawn

204 Board #25 May 31 11:00 AM - 12:30 PM
Effects Of Participating In Sports Events Through Exercise Class On The Establishment Of Exercise Habits
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Participating in sports events through exercise class may be able to help goal setting, which may contribute to establishing exercise habits. **PURPOSE:** To examine the effects of participating in sports events through exercise class on the establishment of new exercise habits.

METHODS: The requirement of participants were 20- to 64-yr-old women who have not been having exercise habits and confidence to play sports for a long period of time without orthopedic and cardiovascular disease. Fifteen women participated in an exercise (EX) class (6 months, 90 min/session, twice a week) and 16 women who were recommended to participate in a weight-loss (WL) class (the first 3 months were only dietary guidance and the last 3 months were only exercise. Guidance and exercise were 90 min/session, and once a week). Two months after the EX class started, we set a goal to participate in a sports event (5 km running race or 6 km fun walking). The EX class started from low-intensity exercise (stretching and muscle strength training to load own body weight), and gradually transitioned to moderate- or vigorous-intensity exercise (walking, Nordic-pole walking, jogging or running) depending on the level of physical fitness. Ten participants finished the running race and the remaining 5 participants finished the fun walking. The WL class did not set any exercise goals. The participants' exercise habits were investigated and 3 METs or more physical activity was measured using an accelerometer after 1 year from the end of the classes.

RESULTS: The stability rate of the exercise habits was significantly higher in the EX class than in the WL class (EX, 12 participants, 80.0%; WL, 8 participants, 50.0%; χ^2 test, $p = .038$). However, 4 of the 8 participants in the WL class already had had the exercise habits before the class. In addition, 10 participants from the EX class who finished the running race last year have applied for the next year's race. However, physical activity did not differ significantly between the two classes after 1 year (EX, 4.3 ± 1.9 METs-h/day; WL, 3.8 ± 1.9 METs-h/day; t-test, $p = .466$).

CONCLUSIONS: It is concluded that when establishing exercise habits goals should be sets and making use of sports events through exercise class contribute to set definite goals easily and establish new exercise habits.

205 Board #26 May 31 11:00 AM - 12:30 PM
Quantitative And Qualitative Analysis Of An Individualized Consultation To Change Sedentary Behavior In The Workplace.

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Independent of an individual's physical activity levels, prolonged periods of sedentary behavior are detrimental to health. Office-based workers engage in prolonged periods of sitting and are a target group for intervention. Individualized consultations have

potential to change sedentary behavior and offer a low cost alternative to interventions such as sit-to-stand desks. **PURPOSE:** To report quantitative and qualitative outcomes from a randomized controlled trial exploring the use of an individualized consultation intervention to change sedentary behavior in the workplace. **METHODS:** 48 participants (42F, 6M, mean age 42.9 ± 12.0 yrs, BMI 25.2 ± 3.8 kg/m²) were recruited from a university by workplace email and poster distribution. Participants were > 18yrs with full time desk based occupations. Participants were randomized to a control group (n=23) or an intervention (n=25) group who received a 30-45 minute individual consultation incorporating behavior change strategies to support reducing sedentary behavior. Before and after the intervention participants wore an activPAL monitor for 7 days. A sub-sample of 16 intervention participants took part in semi-structured interviews exploring intervention perceptions. **RESULTS:** No changes were reported in overall, weekday or weekend mean sitting, standing or stepping time; step count; sit-to-stand transitions or % of waking day spent sitting, standing or stepping ($p>.05$). Semi-structured interviews provided insight into participant intervention perceptions. Many participants mentioned increased knowledge and awareness of sedentary behavior and the associated physical and psychological benefits. However, several barriers to behavior change were reported including: social norms within a workplace; perceived negative opinion of colleagues; excessive workloads and deadlines and loss of concentration and productivity. **CONCLUSIONS:** The individualized consultation intervention was not effective in changing sedentary behavior. Multi-level barriers impede sedentary behavior change in the workplace. Further work is required to fully understand these complex influences on this behavior in a workplace setting to allow the development and implementation of effective interventions.

206 Board #27 May 31 11:00 AM - 12:30 PM
The Rehabilitation Effect Of Plank For Patients With Chronic Low Back Pain
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Objective: contrast research plank on the rehabilitation effect of patients with chronic low back pain. **Methods:** choose in college affiliated hospital outpatient clinic hospital diagnosed with non-specific and income of 60 patients with chronic low back pain, single blind, randomized, controlled experiment method to are divided into conventional treatment group (zheng massage, cupping, infrared), additional McCann stomach stretch group (routine treatment added McCann base treatment of stomach stretch training) and the additional plank support training group. Three groups of subjects baseline data and evaluation index of no statistical difference before treatment, before treatment, 4 weeks, 8 weeks after treatment has been accepted Oswestry disability index (ODI) questionnaire scores and core strength tests. Data obtained by the SPSS T test and variance analysis. **Results:** 1. ODI is: before the trial, ODI scores of three groups of subjects had no significant difference, after the trial, ODI scores of three groups of participants is less than before the trial, group A $P < 0.05$, B and C group $P < 0.01$. After the trial, the ODI score of group C compared with group A score decreased, $P < 0.01$; Compared with group B score decreased, $P < 0.05$. 2. Core strength comparison: before the trial, all direction core muscle strength compared in three groups were no significant differences, after the intervention, the core strength of the C groups were all directions are also increase before experiment, $P < 0.01$; After the group B were at the core of the strength increase from before the trial, $P < 0.05$. Group C after the intervention, the direction of the core strength of group A were increased, $P < 0.01$; Is in the direction of B group were increased, among them, in the former flexion, left lateral flexion, left and right rotation strength increased significantly, $P < 0.01$. **Conclusion:** 1. Conventional treatment group, the additional plate support group, additional McCann base stomach stretch group, all three methods to different degrees of ease the pain of patients with chronic low back pain, and the latter two effect is better; 2. Plank and McCann stomach stretch training can both improve and increase the role of the core strength of patients with chronic low back pain, and tablet supported training the McCann, prone to stretch more comprehensive.

207 Board #28 May 31 11:00 AM - 12:30 PM
High Intensity Interval Training Improves Blood Lipid Profiles And Fatigue Resistance
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(No relationships reported)

High intensity interval training (HIIT) has merged as a novel metabolic modulator, mitigating metabolic syndrome (i.e., high blood glucose and LDL) and improving cardiovascular fitness. However, little research has been conducted, and importantly, mode, duration, and frequency of exercise remain unclear. **PURPOSE:** To investigate if HIIT improves health fitness-related biomarkers including: fasting blood glucose (FBG), resting heart rate (RHR), blood lipids, resting blood pressure (BP), and post exercise blood lactate production. **METHODS:** 13 healthy male subjects (age: 18-28 years old) were recruited in this study. Subjects were informed about the project

and allowed to familiarize with laboratory bicycle riding for two days, during which pre-test dependent variables (FBG, RHR, BP, blood lipids, maximal anaerobic power by Wingate Test, and post Wingate blood lactate) were measured. On the third day, the subject performed modified Wingate Tests with 2.5% of their body weight as the resistance (3 sets of 30 seconds with 2 minutes of active resting between sets, 3 times a week for 2 weeks). 24 hours after the last session of HIIT, the same dependent variables were assessed for post-test data collection. Results were expressed as mean ± SEM and analyzed with paired, one tail student t-test. **RESULTS:** The HIIT exercise reduced post-exercise BLA (pre-test: 11 ± 2.68; post-test: 9 ± 3.19, p<0.05), LDL cholesterol (17 ± 4.5% drop, compared to pre-test levels, p<0.05) and total cholesterol levels (9 ± 3% drop compared to pre-test levels, p<0.05), with no significant differences found in FBG, RHR or BP, and HDL cholesterol. **CONCLUSIONS:** HIIT was effective in lowering LDL and TC levels, and BLA during maximal anaerobic power exercise. Our results suggest that as reflected in long-term endurance exercise, short-term HIIT may also be a sufficient means of ameliorating cardiovascular risk factors, specifically bad cholesterol. Our results also suggest that HIIT would be effective to improve fatigue resistance evidenced by reduced lactate levels during maximal anaerobic power, which typically resulted from long-term endurance exercise. Taken together, our study supports emerging evidence that HIIT may be a potent mode of exercise contributing to preventing cardiovascular diseases.

208 Board #29 May 31 11:00 AM - 12:30 PM
ACSM Recommended Exercise of 30 minutes Per Day Improves Aerobic Capacity Similar to 60 minutes Per Day in Individuals with NAFLD

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The effects of two different exercise doses on improving aerobic capacity (VO_{2peak}) in obese individuals with nonalcoholic fatty liver disease (NAFLD) is unknown. **PURPOSE:** The aim of this study was to evaluate the effect of the American College of Sports Medicine physical activity guidelines for adults (30min/d) on aerobic capacity compared to a high dose (60 min/d) in obese persons with NAFLD. **METHODS:** Eighteen obese people (mean ± SD, Age 46.8±5.2 years, BMI=37.3±4.9 kg/m²) with NAFLD were randomized to 16 weeks of verified exercise training (45-55% VO_{2peak} , 5 days/week) to either a low dose (LD, 30 min; n=9) or high dose (HD, 60min/day, n=9). Aerobic capacity (VO_{2peak}) was measured on a motor-driven treadmill. Participants walked to volitional exhaustion using the Balke treadmill protocol. Dual Energy X-ray Absorptiometry (DXA) was used to measure body weight (BW) and percent body fat. Magnetic resonance spectroscopy was used to evaluate (intrahepatic triglyceride) IHTG content. All measures were performed at baseline and 16 weeks. **RESULTS:** Aerobic capacity significantly (p<0.05) improved in both the LD (9.8 ± 2.8%) and HD (8.6 ± 3.0%) from baseline to 16 weeks with no significant (p>0.05) difference between groups. There were no between group differences for IHTG, BW, or percent body fat so data was combined. Exercise training resulted in a 10.5±4.7% decrease in IHTG content (p<0.05), but did not change total body weight (103.5±4.0 kg and 102.7±3.0 kg) or percent body fat (39.0 ±2.0% and 38.5±2.1%) from baseline to 16 weeks. **CONCLUSION:** Performing verified physical activity as recommended by the ACSM improves aerobic capacity, IHTG, and body composition similarly to a higher exercise dose of 60min/day in obese persons with NAFLD.

209 Board #30 May 31 11:00 AM - 12:30 PM
Types of Social Support and Weight Change among Overweight Adults

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Engaging social support has been found to be an effective strategy to promote weight loss. Yet, little is known about the specific types of social support that may be the most influential. **PURPOSE:** The aim of this study was to examine the association between weight change and the types of social support adults participating in a behavioral weight loss intervention identified as the most helpful for their weight loss efforts. **METHODS:** Overweight adults (N=36) were randomized to one of two, 16-week behavioral weight loss interventions. Both treatments consisted of weekly, in-person group counseling sessions, Fitbit Zips for monitoring physical activity, and scales for monitoring body weight. One group also received two extra Fitbit Zips and scales to share with up to two persons in their social circle. There were no significant differences between conditions, so analyses collapsed groups and examined those who started the intervention (N=35). Participants completed an online survey at the end of each intervention week, which asked them to select the most helpful type of social support they received (informational; tangible; network; emotional; esteem). The support type

identified the most frequently as the most helpful type over time was determined for each participant and used in Fisher's exact tests to measure the frequencies with which each type of support was reported between those who lost > 5% of their initial body weight and those who did not. **RESULTS:** Participants were obese at baseline (M BMI = 36.1 + 7.3 kg/m²), and 43% lost > 5% of their initial weight by 16 weeks. Only emotional, esteem, and tangible support emerged as the most frequently reported most helpful types of support among all participants across the intervention period. A greater proportion of those who lost > 5% of their baseline weight identified esteem support as the most helpful type of support versus those who lost < 5% of their initial weight (47% vs 10%, p = .02). No significant differences between weight change groups were found for other support types (ps > .05). **CONCLUSION:** These findings suggest that esteem support may be especially influential for fostering weight loss. However, future studies should employ designs that allow for the direct comparison and more robust evaluation of the effectiveness of different types of support on weight loss in adults.

210 Board #31 May 31 11:00 AM - 12:30 PM
The Effect Of A Hiit And Resistance Exercise Program On Body Composition In Obese Females

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PURPOSE: High intensity interval training (HIIT) has shown reductions in fat mass in normal weight populations¹ equal to or superior than continuous training. However, limited literature exists on the benefits and feasibility of HIIT training with obese participants. Furthermore, it is not known the additional benefits of incorporating resistance training with HIIT training on body composition for obese participants. The purpose of this study was to examine the effect of a 10-week HIIT and resistance training intervention on body composition in obese females. **METHODS:** 20 women (M Age = 37.1 ± 7.4) participated in a 10-week exercise intervention consisting of a high intensity interval treadmill protocol and resistance training three times a week for a total of 30 sessions. Body composition was assessed with the iDexa. **RESULTS:** Participants significantly (p=.007) increased lean mass from pre (107.5±16.4) to post (110.2±18.2) and significantly decreased fat mass from pre (101.93±33.5) to post (96.7±32.7). Greatest fat loss occurred in android (p=.007) and visceral (p=.006) area. **CONCLUSIONS:** Based on the results of this study, HIIT training is a feasible intervention to reduce fat in obese individuals. Combining HIIT training with a resistance training program resulted in favorable body composition changes in obese females.

211 Board #32 May 31 11:00 AM - 12:30 PM

Beat The Street - Harnessing Gamification For Population Level Changes In Physical Activity
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Purpose
 Intelligent Health delivers 'Beat the Street' with the aim to get a whole community more physically active. Beat the Street turns the town into a real-life game where players register their walking and cycling journeys by tapping a smartcard on RFID readers called 'Beat Boxes' placed on lampposts around the town. Players monitor their progress via a website where they can see their own and their team's progress, and the overall target
Methods
 During registration, participants complete a questionnaire which includes a single item physical activity question¹. follow up surveys take place at the end of the game and up to 8 months later. Pre-intervention/post-intervention comparisons are completed based on survey responses and in-depth analysis is completed based on data from each player's activity by tapping their card on beat boxes.
Summary of Results:
 In 2015, Intelligent Health delivered 11 Beat the Street projects, engaging 170,000 participants and collected baseline survey data from 45,136 adults. In 2016 prior to September, Intelligent Health delivered 15 Beat the Street projects, and reached the milestone of 500,000 people engaged and collected baseline survey data from 53,234 players. In 2015, across all Beat the Street projects the proportion of people reporting 0 or 1 days of physical activity decreased from 14% before Beat the Street to 8% after. The proportion meeting WHO guidelines increased from 43% to 48%, and the proportion of people walking for 15+ minutes on 5-7 days per week increased from 54% to 63%. In 2016, across all Beat the Street projects the proportion of people reporting 0 or 1 days of physical activity decreased from 8% before Beat the Street to

1% after. The proportion meeting WHO guidelines increased from 46% to 57%, and the proportion of people walking for 15+ minutes on 5-7 days per week increased from 47% to 61%.

Conclusion

Intelligent Health's analysis from the 26 completed Beat the Street projects to-date suggests that the concept of turning a whole community into a game leads to immediate changes in population levels of physical activity.

212 Board #33 May 31 11:00 AM - 12:30 PM

A Randomized Trial of Chinese Traditional Health-Promoting Exercises for Ankylosing Spondylitis

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PURPOSE: The purpose of this study was to evaluate the influence of a 12-week traditional Chinese Qigong exercise (TCQG) on physiological and physical functions in patients with Ankylosing Spondylitis (AS).

METHODS: Sixty patients diagnosed with AS according to the modified criteria of New York were randomly assigned into either experimental (n = 30) or control groups (n = 30) using a computer-based random generator. AS patients in the experimental group experienced 60-minute Daoyinshu Qigong session twice per week for 12 weeks, whereas AS patients in the control group stayed with their original lifestyle during the 12-week intervention period. The TCQG exercise consisted of 15 basic movements associated with deep breathing, chest expansion, trunk rotation and bending, hip extension and flexion, flying bird movements, opening and closing the hands, and waving hands in the clouds. Health-related outcome measures included Modified Schober Flexion Test (MSF), Finger-to-floor test (FF), and Chest Expansion Test (CE), administered by two certificated physicians. The intragroup data within both groups were compared with the paired t test. The intergroup comparison of changes between baseline and week 12 was investigated with the unpaired t test.

RESULTS: AS patients in the experimental group showed an improvement from baseline to week 12 in all three outcome measures (p = .000), whereas the control group only showed an improvement in Finger-to-floor test (p = .012). For the intergroup comparison, significant differences were only observed in MSF (p = .001) and CE (p = .041), but FF (p = .483). More specifically, the experimental group showed greater improvement in the two tests than the control group.

CONCLUSIONS: Traditional Chinese Qigong exercise is effective in improving spinal mobility, chest expansion, and flexibility. Clinicians could incorporate the TCQG routine into rehabilitation program for patients suffering from AS.

213 Board #34 May 31 11:00 AM - 12:30 PM

Moderate Versus High Intensity Interval Exercise Training Reduce the Clinical Components of Metabolic Syndrome in Physically Inactive Adults: A Randomized Clinical Trial

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PURPOSE: Metabolic syndrome (MetSyn) increases the risk for morbidity and mortality from cardiovascular disease and exercise training is a fundamental factor in the treatment and prevention the clinical components of MetSyn. We conducted this study to investigate how an exercise program affects the risk components of MetSyn and exercise capacity in physically inactive adults. **METHODS:** Twenty inactive adults were randomly allocated to receive either moderate intensity training (MCT group) or high intensity interval training (HIT group). The MCT group performed aerobic training at an intensity of 55-75% of the walking on a treadmill at 60-80% heart rate max (HRmax) until expenditure of 300 kcal until the end of training. The HIT group performed running on a treadmill during 4 minutes at 85-95% peak HRmax and had a recovery of 4 minutes at 65% peak HRmax until expenditure of 300 kcal until the end of training. A MetSyn z-score was calculated for each subject from triglycerides, HDL-c, fasting glucose, waist circumference, and arterial blood pressure (MAP). Blood lipids and glucose, waist circumference, MAP and exercise capacity were measured at baseline and 12-weeks thereafter.

RESULTS: Z-score MetSyn changes were 1.546 (1.575) in the MCT group, -1.249 (1.629) in the HIT group (difference between groups -2.795 [95% CI, 1.276 to 4.311 (P=0.001)]. Average cardiometabolic risk factors changed -0.133 in the MCT group (p=0.040) and 0.018 (p=0.294) in the HIT group. There was a significant decrease in glucose fasting from 0 to 12 weeks in MCT group (P=0.039) compared to 12 weeks for the HIT group (P=0.001). Waist circumference was significantly reduced at 12 weeks compared to 0 weeks in HIT (P=0.010). Percentage body fat did not change in the MCT group 0.0 (0.8) and decreased in HIT group -1.1 (difference between groups 1.2 [95% CI, 0.1 to 2.4 P=0.04]). Muscle mass significantly increased throughout the 12 weeks of training in high intensity with significant differences between groups 0.8 kg [95% CI, 0.3 to 1.3 P=0.027]. MAP was significantly reduced from 0 weeks at 12 weeks in HIT group (P=0.019).

CONCLUSIONS: In inactive adults, this study showed that a 12-week HIT program can improve the clinical risk factor profile for MetSyn.

214 Board #35

Abstract Withdrawn

215 Board #36

May 31 11:00 AM - 12:30 PM

Self-care Posters Serve As A Low-cost Option For PA Promotion Of Hospital Nurses

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Overweight and obesity prevalence is higher in nursing than other healthcare and non-healthcare occupations in part due to minimal participation in physical activity (PA) not required for work. Nurses cite long shifts as a barrier to PA participation. Additionally, PA promotion efforts rarely target staff in the hospital setting.

PURPOSE: To examine the impact of PA monitoring and a poster campaign on the PA behaviors of hospital nurses. **METHODS:** A total of 26 nurses (control: n=13; experimental: n=13) participated in this study. Instructional exercise posters and lifestyle modification posters specific to the nursing profession were hung in the breakroom of two experimental hospital units. Posters were replaced every two weeks for a total of eight weeks. All subjects completed a PA behavior survey pre (week 1) and post (week 10) intervention. Subject PA was objectively monitored with an Actigraph wGT3X-BT accelerometer for 24 hours on three workdays during weeks 1, 5, and 10. All subjects were provided a pedometer in week 2 and received an activity time and intensity breakdown after each accelerometer wear period. PA changes were analyzed with a repeated measures ANOVA. **RESULTS:** Subjects spent more time sedentary (15.3±0.02 vs. 7.0±0.01%), took fewer steps (522.8±47.1 vs. 659.9±38.8 steps/hr), and engaged in less moderate intensity activity (9.8±0.6 vs. 8.0±0.6%) at home than at work independent of condition and study phase, p<0.05. Both groups increased activity-specific caloric expenditure (36.2±3.7 vs. 42.1±3.8 kcal/hr) and step count at home (472.9 vs. 610.9 steps/hr) from week 1 to week 5 (p<0.05). By week 10, activity levels were no longer statistically different than week 1 for either group (p>0.05). In contrast, subjects who incorporated PA into work breaks continued to increase caloric expenditure (+24.9±15.4%) and MVPA (+30.9±18.2%) from week 5 to week 10, p<0.05. At post-test, six experimental subjects were regularly performing exercises depicted in wall posters at work and/or at home compared to two control subjects who participated in PA breaks throughout the study duration.

CONCLUSION: Instructional and motivational posters promoting self-care are more likely to induce lasting changes on the daily PA behavior of hospital nurses than information provided through PA monitoring devices.

216 Board #37

May 31 11:00 AM - 12:30 PM

Zumba Fitness To Improve Body Composition & Physical Fitness In Inactive Employed Females

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PURPOSE: to investigate the effect of two exercise interventions based on Zumba Fitness and Bodyweight training on body composition and physical fitness in inactive employed females. **METHODS:** A total of 56 inactive employed female participated in this study (38.7±1.00-yr). The sample was randomly divided into two groups: Zumba Fitness (Z, n=28, 1hour/per session) and Zumba Fitness + 20 minutes of Bodyweight training (ZB, n=28, 1.33 hours/per week), including both 3 days per week. Body composition (BMI, Fat mass, muscle mass and 6-skinfold) and Physical Fitness through Alpha Fitness Battery for adults: Motor fitness (one leg stand test), Musculoskeletal fitness (shoulder and neck mobility test, jump and reach test, hand-

grip test and sit up test), and cardiorespiratory fitness (2-km test) was analyzed at baseline and 16-weeks post-interventions. A Factorial Anova was used to analyze the effects and interactions of the type of intervention and the measure moments on body composition and physical fitness variables. **RESULTS:** The type of intervention showed a significant effect only in the case of rest heart rate after 2-km test, which was lower in ZB group compared with Z group ($MD=9.53.45$ bpm, $p=0.011$). However, both interventions showed a significant effects ($p<0.05$) on the majority of the studied variables compared baseline with post-intervention. BMI, fat mass, muscle mass, 6-skinfold, one leg stand test, hand grip test, and 2-km test, enhanced for both group after interventions, however, Z group reached the higher improvements. Shoulder and neck mobility test, sit up test and the Heart Rate post- 2km test, only improved after ZB intervention. **CONCLUSIONS:** Zumba Fitness intervention could improve the body composition and physical fitness in inactive employed females. Twenty minutes plus of bodyweight training seem not to generate changes in the variables studied.

217 Board #38 May 31 11:00 AM - 12:30 PM

Effects of Momentum-based Dumbbell Training on Quality of Life in Subjects with Mild Cognitive Impairments

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Mild cognitive impairment (MCI) is a transitional state between healthy aging and dementia. Individuals with MCI have been reported to reduce their cognitive and physical function and consequently worsen their quality of life and sleep quality. Given that no effective pharmacological treatment exists for MCI patents to alter the progress of cognitive decline exists, there is much interest in lifestyle approaches, such as exercise. Momentum-based dumbbell training is a self-initiated dumbbell-spinning exercise aimed at challenging, concurrently, physical and cognitive abilities. The health effects of this exercise on quality of life and sleep quality were unclear.

PURPOSE: The purpose of this study was to determine the effect of 12-week momentum-based dumbbell training on quality of life and sleep quality among older adults with MCI.

METHODS: We conducted a 12-week randomized controlled trial of 45 community-dwelling older adults with MCI. Participants were randomly assigned to either a dumbbell training group (DTG; $n=22$) or control group (CG; $n=23$). Participants in the DTG participated in a 3-time weekly exercise session for 12 weeks. The primary outcomes were changes in physical component summary (PCS) and mental component summary (MCS) of Short Form 36 health (SF-36) survey with secondary outcomes being eight subscales of SF-36 survey and the Pittsburgh Sleep Quality of Index (PSQI).

RESULTS: At post intervention, participants in the DTG, compared to those in the CG, had significantly improved SF-36 physical functioning (9.55 points; $F=4.14$, $P=0.048$) and vitality (16.51 points; $F=4.27$, $P=0.04$), PSQI total score (1.43 points; $F=4.08$, $P=0.05$) and sleep efficiency score (0.12 points; $F=7.13$, $P=0.01$). Compared to baseline, there was a significant within-group changes (improvement) in DTG group, including SF-36 MCS ($t=2.16$, $P=0.04$), the subscale of SF-36 ($t_{\text{bodily pain}}=3.56$, $P<0.01$; $t_{\text{vitality}}=4.84$, $P<0.01$; $t_{\text{mental health}}=3.96$, $P<0.01$) and PSQI total score ($t=-2.36$, $P=0.03$).

CONCLUSION: There is preliminary evidence showing the potential benefit of momentum-based dumbbell training to improve quality of life and sleep quality in older adults with mild cognitive impairment.

Supported by National Natural Science Foundation of China (11372194).

218 Board #39 May 31 11:00 AM - 12:30 PM

Momentum-based Dumbbell Training Improved Cognitive Function in Older Adults with Mild Cognitive Impairment

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Mild cognitive impairment (MCI) is a transitional state between healthy aging and dementia, which has higher risk for developing Alzheimer's disease. Older adults with MCI also experience decline of motor control, affecting their health and independence. Studies have demonstrated that combined cognitive and exercise training may well provide greater cognitive and physical benefits. Momentum-based dumbbell training is a self-initiated spinning exercise that uses dumbbells to generate momentum while performing exercise movements with varying configurations aimed at concurrently challenging physical and cognitive abilities.

PURPOSE: The main purpose of our study was to explore the effects of momentum-based dumbbell training on cognitive function in older adults with MCI. A secondary purpose was to examine its effects on physical function.

METHODS: Forty-five community-dwelling older adults with MCI were randomly assigned to either a dumbbell training group (DTG; $n=22$) or control group (CG; $n=23$). Participants in the DTG participated in a 3-time weekly exercise session for 12 weeks. All outcome measures were taken at baseline and post-intervention, including Alzheimer's Disease Assessment Scale-Cognitive subscale (ADAS-Cog), Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Trail Making Test-A/B (TMT-A/B), Digit Span Test-Forward/Backward (DST-F), Timed Up & Go (TUG), Timed 10m walking, Functional Reach (FR) and Berg Balance Scale (BBS).

RESULTS: Compared to those in the CG participants in the DTG had significantly improved ADAS-Cog (5.02 points, $F=6.95$, $P=0.012$ and MMSE score (1.23 points; $F=4.84$, $P=0.03$) with moderate and high effect size ($ES=1.28-0.51$). There were significant within-group changes (improvement) in ADAS-Cog ($t=-2.34$, $P=0.03$), MMSE ($t=2.00$, $P=0.06$), MoCA ($t=3.85$, $P<0.01$), TMT-A/B ($t=-2.80$, $P=0.01$; $t=-3.09$, $P=0.01$) and DST-B ($t=2.41$, $P=0.03$). Participants in the DTG improved their functional mobility (TUG=0.81s, $F=4.34$, $P=0.043$). There was no between-group difference in other outcomes.

CONCLUSION: A 12-week momentum-based dumbbell training can improve cognition and physical function in older adults with MCI, especially global cognitive function and mobility.

Supported by the National Natural Science Foundation of China (81572213).

219 Board #40 May 31 11:00 AM - 12:30 PM

Departmental Variations in Wellness And Fitness Characteristics Of Firefighters

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PURPOSE: Firefighters have a very physically demanding and dangerous occupation, resulting in high rates of cardiovascular and musculoskeletal disorders. Specific guidance on implementing wellness and fitness programs to promote adherence and long-term health improvements in firefighters is largely unavailable. The purpose of this study was to assess departmental variations in key wellness and fitness characteristics of firefighters.

METHODS: A cross-sectional study was conducted in career firefighters ($n = 264$; 32 F, 232 M) from 4 fire departments in the Tampa Bay region of Florida. Baseline data were assessed in participants enrolled in a worksite injury prevention trial, including anthropometric and health variables (e.g. BMI, blood pressure, heart rate), physical fitness (back and core muscular endurance, Functional Movement Screen), and health history (e.g. musculoskeletal injury history, Mediterranean Diet Questionnaire, International Physical Activity Questionnaire). Data were compared across the 4 departments.

RESULTS: Significant differences were noted across the departments in systolic blood pressure ($p = 0.0002$), heart rate ($p = 0.003$), physical activity ($p = 0.04$), and low back pain history ($p < 0.0001$). No significant differences were observed in other assessed variables. Of the total sample, 35.6% had high systolic blood pressure, 83.0% were overweight or obese, 60.6% reported a low or moderate physical activity level, and 66.3% reported a history of low back pain.

CONCLUSIONS: This study indicates departmental variations exist in some wellness and fitness characteristics among firefighters within the same region. These results are consistent with subjective observations from our group and others. For optimizing the implementation of wellness and fitness programming in firefighters, efforts should consider departmental variations by emphasizing standardization of approaches across fire departments, particularly when regional initiatives are implemented.

220 Board #41 May 31 11:00 AM - 12:30 PM

VO₂max and HbA_{1c} 3 Months After Participating In High-intensity Aerobic Interval Training Among Persons With Type 2 Diabetes.

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PURPOSE: It remains to be established how participating in exercise interventions affect long-term effects on VO_{2max} and HbA_{1c} among individuals with type 2 diabetes (T2D). The present study investigated VO_{2max} and HbA_{1c} 3 months after participating in a 12 weeks training intervention consisting of high-intensity aerobic interval training (HAIT) (baseline HbA_{1c} of 7.7%). The results were compared with a moderate-intensity continuous training (MICT) group with HbA_{1c} levels below the recommended HbA_{1c} treatment goal of <7.0% (baseline HbA_{1c} of 6.9%).

METHODS: HAIT consisted of 4x4 minutes of walking or running uphill at 85 - 95% of maximal heart rate, and MICT consisted of continuous walking at 70-75% of maximal heart rate. After the training intervention, the participants chose themselves how to exercise during the next three months, and all training sessions were registered.

RESULTS: 19 individuals in each training group completed 12 weeks of supervised training, while 16 in HAIT and 10 in MICT completed the 6 months follow up. 3 months after intervention. HbA1c in HAIT was reduced by 0.7% points to 7.0% (p<0.01), and was thus close to recommended HbA1c treatment goal of <7.0%. The change in HbA1c was found after the intervention (from 7.7 to 7.1%) and was thus unchanged in the last 3 months (7.0%). VO_{2max} increased by 19% during the intervention (from 24.1 to 28.8 ml⁻¹·kg⁻¹·min⁻¹, p<0.01) and was also unchanged in the last 3 months after intervention (28.0 ml⁻¹·kg⁻¹·min⁻¹). No change was found in either VO_{2max} or HbA1c in MICT between the three measurement time points (25.9, 25.4, 26.4 ml⁻¹·kg⁻¹·min⁻¹ and 6.9, 6.8, 6.9%, respectively). The difference between HAIT and MICT after the 12 week intervention was statistical significant for both HbA1c and VO_{2max} (p<0.01).

CONCLUSIONS: HAIT is an effective exercise strategy to improve aerobic fitness and reduce HbA1c in T2D. The results from HAIT were still kept after 6 months.

221 Board #42 May 31 11:00 AM - 12:30 PM
The Relationship Between Gestational Weight Gain, Physical Activity, And Sleep Quality: A Preliminary Report

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PURPOSE: Excess gestational weight gain (GWG) increases the risk for adverse maternal and fetal outcomes. Recent reports link sleep deficiency to excess GWG; however, evidence in non-pregnant women suggests that physical activity improves sleep duration and sleep efficiency. Our objective is to report preliminary findings from a randomized aerobic exercise intervention throughout pregnancy, on the association between sleep quality, GWG, and the modifying effects of physical activity. **METHODS:** Thirteen mothers provided objective physical activity duration, total sleep time, and sleep efficiency via the SenseWear Armband (BodyMedia Inc.) for 5 consecutive days during the 1st, 2nd, and 3rd trimester. Physical activity level (PAL) was expressed as total energy expenditure divided by resting energy expenditure. GWG was calculated as pre-pregnancy weight (measured at 8-13wks) subtracted from weight at delivery. Appropriate versus excess GWG were categorized using 2009 IOM guidelines. **RESULTS:** Sleep duration significantly decreased from the 1st trimester to the 2nd trimester (Mean ± SEM = 436.1 ± 34.7 vs. 381.1 ± 30.0min, p=0.03) and plateaued in the 3rd trimester (381.1 ± 30.0 vs. 306.6 ± 29.0min, p>0.05). There was no difference in sleep efficiency throughout pregnancy. Compared with mothers with appropriate GWG, mothers with excess GWG acquired less sleep (389.6 ± 21.7 vs. 292.1 ± 36.1min, p=0.035) and slept less efficient (81.0 ± 3.8 vs. 61.6 ± 6.4%, p=0.029). Mothers randomized into the exercise intervention had higher sleep duration (412.8 ± 19.7 vs. 301.8 ± 23.8min, p=0.002) and better sleep efficiency (82.5 ± vs. 64.4 ± 4.7%, p=0.007) compared with controls. Multiple linear regression models assessing the independent effects of GWG and exercise intervention on sleep quality demonstrate that aerobic physical activity explains 39% of the variance in sleep duration and 31% of the variance in sleep quality, with no significant effects from GWG. **CONCLUSION:** Our findings suggest that physical activity may be a potentially effective way of improving sleep quality in pregnant women with or without excess gestational weight gain.

222 Board #43 May 31 11:00 AM - 12:30 PM
Effect of Moderate Versus High Intensity Interval Exercise Training on Vascular Function in Inactive Latin-American Adults: A Randomized Clinical Trial

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PURPOSE: Exercise training is effective for improving cardiometabolic health and physical fitness in inactive adults. However, limited research has been conducted on the optimal exercise training intensity for this population. We investigate the effect

of moderate versus high intensity interval exercise training on vascular function and physical fitness in physically inactive adults. **METHODS:** Twenty inactive adults were randomly allocated to receive either moderate intensity training (MCT group) or high intensity interval training (HIT group). The MCT group performed aerobic training at an intensity of 55-75% of the walking on a treadmill at 60-80% heart rate max (HRmax) until expenditure of 300 kcal until the end of training. The HIT group performed running on a treadmill during 4 minutes at 85-95% peak HRmax and had a recovery of 4 minutes at 65% peak HRmax until expenditure of 300 kcal until the end of training. Vascular function (flow-mediated vasodilation, FMD [%], aortic pulse wave velocity, PWV [m·s⁻¹]), blood lipids [fasting glucose, triacylglycerol, total cholesterol, LDL-cholesterol, HDL-cholesterol], blood pressure, and physical fitness (Muscle strength [handgrip [kg]], exercise capacity (VO_{2peak} and graded exercise test duration [minutes]), were measured at baseline and 12-weeks thereafter.

RESULTS: FMD changes were 2.2 (4.9) % in the MCT group, 7.7 (5.3) % in the HIT group (difference between groups -5.4 [95% CI, -10.3 to -0.6 (P<0.001)]. PWV changed 0.1 in the MCT group but decreased -0.3 in the HIT group, (not significantly different from the MCT or HIT group, P between groups = 0.91). Percentage body fat did not change in the MCT group 0.0 (0.8) but decreased in HIT group, -1.1 (difference between groups 1.2 [95% CI, 0.1 to 2.4 P between groups = 0.04]). No significant group differences were observed in physical fitness, blood lipids or blood pressure. **CONCLUSIONS:** HIT is more effective in improving endothelial function and reducing body fat than MCT in inactive Latin-American adults. **Trial registration.** ClinicalTrials.gov NCT02738385, registered on 23 March 2016.

223 Board #44 May 31 11:00 AM - 12:30 PM
Changes in Endothelial Function Following Fat Sugar Snacking With and Without Exercise Training

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 (No relationships reported)

PURPOSE: Caloric excess induces endothelial dysfunction. Exercise can improve endothelial function or mitigate the negative effects of excess caloric intake. We hypothesized that exercise training would prevent deterioration in endothelial function associated with 4 weeks of fat-sugar snacking. **METHODS:** 27 overweight/obese (BMI = 30.0±3.7 kg/m²) males (age = 29±7 yr) underwent 4 weeks of added fat-sugar snacking (+14,579 ±413kcal), in the form of donuts (6 days/week) added to their regular diet. Participants were randomized to one of three conditions: 1,000 kcal/week supervised moderate-intensity (MICT; n=8) exercise (50% peak VO₂), 1,000 kcal/week supervised high-intensity interval (HIIT; n=10) exercise (90-95% peak heart rate), or no-exercise control (CON; n=9). All participants were tested in the morning following a >10 h overnight fast at baseline and 4 weeks. Endothelial function was assessed by brachial artery flow-mediated dilation (FMD) and was further normalized for shear rate (FMD/shear rate). Two-way repeated measures ANOVA was used to detect time, condition, or time x condition interaction effects. **RESULTS:** FMD was unchanged in all groups (Control: Pre FMD = 4.6 ± 1.2 %, Post FMD = 3.7 ± 2.1 %, p=0.28; HIIT Pre FMD = 6.0 ± 2.7%, Post FMD = 5.5 ± 2.3%, p=0.56; MICT Pre FMD = 6.2 ± 2.4%, Post FMD = 5.5 ± 2.4%, p=0.43). With all groups combined there was a trend towards a reduction in FMD (p=0.16) and FMD/shear rate (p=0.09). Baseline diameter, peak diameter, blood flow velocity and shear rate were unchanged within all groups (p > 0.05). **CONCLUSIONS:** The addition of ~14,500 kcal of fat-sugar snacks in the form of donuts to the regular diets of overweight/obese men over a 4-week period was insufficient to induce deleterious changes in endothelial function. The consumption of additional energy predominantly as fat and sugar may have prevented improvements in FMD expected with HIIT and MICT.

224 Board #45 May 31 11:00 AM - 12:30 PM
A Feasibility RCT: Understanding Impact of Community Gardening on Physical Activity and Sedentary Behavior

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PURPOSE: To investigate the feasibility of using accelerometers to objectively measure physical activity (PA) during gardening to provide preliminary evidence for a large scale gardening intervention. **METHODS:** This randomized control trial was conducted in 2016 in a Denver low-income community. Repeated measures of PA and sedentary behavior (SB) were compared at two time points (T1: June and T2: October) between two groups (TG = gardeners and NG = non-gardeners). At both T1 and T2,

12 participants (mean age, 44.09 ± 16.26 years) wore the activPAL accelerometers for a 6-day period (including 2 weekend days). Each day, time spent in sedentary time, standing, walking at cadences above and below 120 steps/min, and number of steps were measured, and energy expenditure (EE) in metabolic equivalent-hour was estimated. The data were analyzed using MatLab and SAS. **RESULTS:** At T1, no significant differences ($p > .05$) for overall (weekday and weekend) sedentary, standing, walking times, and EE were detected between TG and NG. Unexpectedly, the TG had lower step counts (1.25 ± 0.35 vs. 2.05 ± 0.47 hrs, $P < .05$) compared to the NG at the <120 steps/min cadence at T1. From T1 to T2 data, the NG significantly increased time spent sedentary (1.09 ± 0.65 hrs, $p < .05$), significantly decreased time spent standing on weekdays (-0.98 ± 0.33 hrs, $p < .01$), and marginally significantly decreased overall time spent standing (-0.56 ± 0.45 hrs, $p = .09$). No significant changes were found between T1 and T2 in TG, nor did any other variables in either TG or NG change. The increased sedentary time and the decreased standing time in the NG but not TG indicated that gardening may protect against sedentary time and maintain PA. One gardener dropped out at T1 and two NGers started late at T2 (we have to submit the abstract before getting their data). All other participants wore the accelerometers for all six days (24 hrs/day), which indicates a good compliance. **CONCLUSIONS:** The accelerometers successfully tracked subjects' PA and SB for sedentary, standing and walking indicating that activPAL accelerometry is a feasible approach for assessing PA and SB. Although the results should be interpreted cautiously due to the small sample size, which precluded adequate statistical power, the study demonstrated feasibility of testing methods for a large scale gardening study.

225 Board #46 May 31 11:00 AM - 12:30 PM
Compensatory Mechanisms to Exercise Induced Energy Deficit
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In recent years, more emphasis has been put on the importance of the role of exercise and proper diet in successful weight management. Weight loss due to an exercise induced energy deficit without changes in dietary intake is generally less than expected.

PURPOSE: The purpose of this study was to compare 24 hour changes in appetite/satiety and daily physical activity following bouts of either 200 or 400 kcal of aerobic exercise (walking) in sedentary overweight/obese ($BMI \geq 25$) college age females. **METHODS:** Overweight/obese college age girls (n=19) were recruited and scheduled for 3 trials. The exercise trials consisted of walking at 70% of their heart rate reserve on a treadmill until they expended either 200 or 400 kcal. Energy expenditure was verified by indirect calorimetry. The third trial was a non-exercise control. The order of the trials was randomized. Changes in physical activity (sit/lie time, sleep time, and standing time) were measured using the ActivPal² accelerometer during the 24 hours post exercise. Changes in appetite/satiety were measured via Visual Analog Scales immediately before and after the exercise session and at 60, 120, and 180 minutes following each trial.

RESULTS: There were no significant changes in sit/lie time between the 200K (575.7 ± 144.6 minutes), 400K (613.7 ± 90.1 minutes), and control trials (554.0 ± 113.3 minutes). There were no significant changes in sleep time between the 200K (532.6 ± 105.6 minutes), 400K (529.7 ± 91.9 minutes), and control trials (570.9 ± 91.8 minutes). There were no significant changes in stand time between the 200K (223.1 ± 110.1 minutes), 400K (187.5 ± 85.0 minutes), and control trials (216.6 ± 95.0 minutes). There was no difference in the appetite between the 200K (27.4 ± 12.2 cm), 400K (25.4 ± 12.9 cm), and control trials (30.4 ± 12.9 cm). There were no significant changes in satiety between the 200K (30.5 ± 17.5 cm), 400K (33.1 ± 15.0 cm), and the control trials (33.3 ± 14.6 cm).

CONCLUSION: In overweight/obese, college age females an exercise bout of either 200 or 400 kcal does not result in changes in daily physical activity or appetite/satiety in the 24-hour period immediately following the exercise session.

226 Board #47 May 31 11:00 AM - 12:30 PM
Examination Of Cardiovascular Risk Factors Among University Employees Participating In A Workplace Walking Program
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PURPOSE: Worksite sponsored physical activity programs are prevalent at universities in an effort to improve health indicators, including risk factors for cardiovascular disease. The purpose of this project was to compare cardiovascular risk factors of university employees participating in a worksite sponsored walking program versus those who did not participate. **METHODS:** The research was a matched pairs design, with two groups. The study group (n=31) participated in the "Workplace

Walkoff Challenge" for six weeks, while the control group (n=11) did not participate. All cardiovascular risk factors, as defined by ACSM Guidelines, were assessed two weeks prior to the start of the walking program and then repeated during the last week. Risk factors assessed included family history, age, smoking status, physical activity amount, blood pressure, body composition (waist circumference and BMI), dyslipidemia (total cholesterol, HDL, LDL), and fasting glucose. To assess differences in these variables, dependent t-tests were performed.

RESULTS: Walking program participants significantly improved their physical activity amount ($p=.05$), body mass index ($p=.003$), waist circumference ($p=.03$), diastolic blood pressure ($p=.005$) and fasting glucose ($p<.001$) from baseline to end of program. There were no significant improvements for participants in systolic blood pressure or cholesterol (total and HDL). Despite a trend, there was no significant decrease in total number of risk factors following the walking program. The control group had no significant changes in physical activity, BMI, waist circumference, blood pressure or fasting glucose from baseline to follow up. However, the control group had a significant reduction in total cholesterol ($p=.05$). **CONCLUSIONS:** The participants in the walking program had many health indicators improve following the six week walking program. Therefore, short-term worksite walking programs may be effective in improving cardiovascular risk factors. Future research should focus on programming's effect on long-term adherence to physical activity and improvement of health indicators.

227 Board #48 May 31 11:00 AM - 12:30 PM
Occupational Sitting and Physical Activity among College Employees
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Time spent in sedentary behavior (i.e., < 1.5 METs while reclining), is linked to poor health outcomes. Persons who spend considerable periods of time daily in unbroken sitting are at higher risk of cardiometabolic disease. As sedentary time emerges as an independent health risk factor, the workplace has come under greater scrutiny due to its high percentage of computer-based, sedentary jobs. University employees were recently shown to spend 75% of their workday seated (Fountaine et al. 2014). However, apart from this study, little is known about sedentary behavior among employees at academic institutions.

PURPOSE: We subjectively assessed occupational sitting and physical activity of employees at a 4-year, private college. **METHODS:** At the start of the 2016 fall semester, all members ($N = 697$) of the college community received an online version of the Occupational Sitting and Physical Activity Questionnaire (OSPAQ; Chau et al., 2012). The OSPAQ measures perceived time spent in sitting and physical activity. 343 employees (49%) provided complete responses to the survey. Employees reported working 8.3 ± 1.8 hours per day. **RESULTS:** Data were expressed as raw and percent time spent sitting, standing, walking and heavy lifting. Administrators reported spending more hours (46.2 ± 10.0 hr/wk) and days (5.5 ± 0.8 d/wk) at work than faculty (45.0 ± 13.1 hr/wk and 5.1 ± 0.9 d/wk) and staff (40.4 ± 8.6 hr/wk and 5.2 ± 0.8 d/wk). One-way ANOVAs were computed to examine differences among employee categories (staff, administrator, faculty). For time spent walking (68.4 ± 53.4 min/day; $13.9 \pm 10.3\%$ time) or heavy lifting (11.3 ± 28.3 min/day; $2.3 \pm 5.6\%$ time) no significant differences existed among employment categories. Administrators sat (372.2 ± 112.8 mins/day; $73.2 \pm 17.7\%$) significantly more than faculty (314.5 ± 138.8 mins/day; $58.5 \pm 19.6\%$) and staff (315.1 ± 115.8 mins/day; $68.5 \pm 24.2\%$). Faculty stood (136.4 ± 89.2 mins/day; $25.8 \pm 14.8\%$) significantly more than administrators (62.1 ± 49.6 mins/day; $12.4 \pm 9.7\%$) and staff (67.8 ± 80.9 mins/day; $14.1 \pm 16.5\%$). **CONCLUSIONS:** Based upon our findings, targeted behavioral interventions are needed to help reduce the time that administrators spend sitting during their working day.

228 Board #49 May 31 11:00 AM - 12:30 PM
The Influence Of Physical Activities At The Workplace On Private Medical Center Employees
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Being aware of the increase in obesity and sedentary lifestyle, many organizations develop intervention programs to improve the health of their employees by offering them various physical activities at work. **PURPOSE:** To assess the barriers of engaging in physical activity among medical center employees, and the mental and physical impact of participation in physical activity lessons at work. **METHODS:** 231 private medical center employees including physicians, paramedical and administrative staff participated in this study. 135 participants were not active

in the lessons and 96 (70%) who were active, practiced twice weekly in various activities: Pilates, yoga, running, cycling, and Zumba. **RESULTS:** The physical activity group was found to have a higher workplace satisfaction level ($p < .001$), a decrease in burnout ($p < .01$), better health perceptions ($p < .01$), lower weight ($p < .05$), a reduction in chronic morbidity and drug consumption ($p < .05$), less smoking and liquor consumption ($p < .01$), healthier eating and sleeping habits ($p < .001$) and more physical activity outside of working hours ($p < .01$). Among the main barriers to participate in the activity lessons at work for the non-active group were: unsuitable lesson schedule (62%) lack of desire for sport (61%), lack of time (53%), fatigue (44%), prior family commitments (39%), non-payment of activity time (35%), and unawareness of the physical activity programs (27%). **CONCLUSIONS:** Physical activity programs at medical centers promote employees health thereby neutralizing negative aspects such as worker burnout, mental and physical fatigue and increases employee satisfaction at the workplace. Therefore, more promotion of physical activity at the workplace should be encouraged in order to increase employee participation. However, further research is needed in public medical center to verify these research findings among healthcare employees.

229 Board #50 May 31 11:00 AM - 12:30 PM

Everyday Pedelec Use and its Effect on Meeting Physical Activity Guidelines

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While pedelecs became an important element of active transportation, little is known about the physiological responses during their everyday use so far. **PURPOSE:** To compare the heart rate (HR) response during everyday pedelec use and cycling and to determine if pedelecs are a suitable tool to meet American College of Sports Medicine (ACSM) physical activity guidelines for health benefits of 150 min moderate activity (64-76% of maximum HR (HRmax)) per week. **METHODS:** In a crossover design 101 employees recorded HR, duration and intensity of their rides via smart phone app during two periods, lasting two weeks each: one with a provided pedelec (P) and one with their own bicycle (B), in a randomized order. HRmax was determined in graded exercise tests on a cycle ergometer prior to the observation periods. **RESULTS:** The amount of trips per week was significantly higher during P compared to B (5.3 ± 4.3 vs. 3.2 ± 4.0 trips, $p < 0.001$). The average duration of trips did not differ significantly between P and B (37.5 ± 23.5 vs. 40.3 ± 27.8 min, $p = 0.45$). Perceived exertion during the trips was significant lower with P (11.7 ± 1.8 vs. 12.8 ± 2.1 , $p < 0.001$). Total ride time per week was significantly longer during P (174 ± 146 vs. 99 ± 109 min, $p < 0.001$). Average HR during P was significantly lower than during B (109 ± 14 vs. 118 ± 17 , $p < 0.001$) averaging 64 ± 8 vs. $67 \pm 9\%$ HRmax, respectively. There was no difference in the percentage of subjects meeting ACSM recommendations for physical activity between P and B (25 vs. 24% of subjects, $p = 0.86$). **CONCLUSIONS:** In everyday use, average HR during pedelec trips is only three percent lower than during cycling and sufficient to classify the intensity as moderate. Higher usage rates make pedelecs an equal active transportation alternative for fulfilling ACSM guidelines, especially for people who normally would not use a bicycle.
Supported by BMBF Grant 16SNI012D.

230 Board #51 May 31 11:00 AM - 12:30 PM

The Investigation On Health Status And Exercise Habit Of Chengdu Civil Servant

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Health is not only without disease or weakness, but also a good condition in physics, psychology and society. Civil servant is a special group, its health status has been aroused serious concern. **PURPOSE:** To understand the health status and exercise habits of civil servants in Chengdu, and helping to make formulation of the intervention to health status. **METHODS:** Using stratified cluster facilitation sampling method, 500 civil servants were randomly selected from Wuhou, Jinjiang, Qingyang, Jinniu and Chenghua District in Chengdu, conducted questionnaires of Health Rating Scale (SHMS V1.0, 40 questions about physical, psychological and social condition, reliability and validity have been verified) and exercise habit. Statistical analysis, T-test, one-way ANOVA and Pearson correlation analysis were conducted by SPSS19.0, $P < 0.05$ was considered statistically significant. **RESULTS:** ① 500 were sent out, 459 recycled, missing up to 2% were delete, 418 were valid. The healthy is only 6.70% (28/418), psychological unhealthy was the most, accounting for

76.08% (318/418). ② Male civil servants of non-health accounts 77.32%, higher than 68.75% of female ($P < 0.05$). ③ 50 to 59 year-old group was the highest 84.75% ($P < 0.05$), 20-29 was the second. ④ About exercise habits, 70.33% (294/418) are for keep fit. 3/week and 30-60min are the most, 61.72% (258/418) and 53.59% (224/418). Sitting 5-8 h/d and more than 8 h/d are the most, 38.28% (160/418) and 34.45% (144/418). ⑤ Duration time and unhealthy score are significant correlation ($P < 0.05$), while frequency and sitting time are not ($P > 0.05$). ⑥ Less than 30min and 30-60min have great difference in unhealthy score, physical and psychological. Less than 30min and more than 60min shows significant difference in unhealthy score, physical and social ($P < 0.05$). ⑦ 3-5/week and more than 5/week shows significant difference in psychological unhealthy ($P < 0.05$). Less than 3/week shows no significant difference with other group ($P > 0.05$).

CONCLUSIONS: ① The health status of civil servants in Chengdu is not prospective, and their sitting time is a little long. ② Exercising more than 30min can make great difference of health status in physics, psychology and society. Combining with frequency, 3-5/week and more than 30min/time are the best intervention.

231 Board #52 May 31 11:00 AM - 12:30 PM

Feasibility Of A Student-led University Wellness Initiative

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Exercise Science students have a unique opportunity to contribute to the wellness of their university community while also improving their own practical experience. **PURPOSE:** The aim of this study was to assess the feasibility and effectiveness of a low-budget wellness initiative at a small liberal arts university. **METHODS:** Deliberate choices were made throughout the planning phase to reduce cost and improve feasibility, even when it necessitated a less valid approach. Thirty-eight Exercise Science students with varying levels of education volunteered to be research assistants. An entirely online enrollment process was developed using Google Forms that included informed consent, PAR-Q, demographic information, activity history, and wellness. A baseline assessment of physical fitness included height and weight (digital scale with stadiometer), waist and hip circumference, 1-mile walk or 1.5-mile run, and resting and exercise heart rate (assessed via radial pulse). Participants were asked to log their self-reported total minutes of weekly physical activity and average rating of perceived exertion (6-20 scale). The product of activity duration and perceived exertion served as a numerical activity score. The student research assistants then contacted their assigned participants weekly for 10 weeks to record activity and create accountability. **RESULTS:** The feasibility of this study and \$2,000 budget allowed for a maximum of 450 participants. Of the 180 participants who completed the online enrollment process and scheduled their baseline fitness assessment, 117 actually showed up and were tested. While the initiative targeted the entire campus community, our study population included 57 employees (6.3% of all employees) and only 60 students (1.1% of all students). Attrition was greater than expected with 94% of tested participants reporting their activity in week 1, and progressively decreasing to a point where only 47% reported their activity in week 5. **CONCLUSION:** This study was extremely feasible and cost-effective. However, greater care must be taken in marketing the program to students and weekly incentives may need to be offered to improve activity reporting throughout.

232 Board #53 May 31 11:00 AM - 12:30 PM

Testing Intentions: Evaluating The Effectiveness Of Implementation Intentions In A Pedometer-Based Worksite Intervention

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Pedometer-based interventions have been found to be successful in increasing physical activity (PA) during the intervention but adherence is challenging. Implementation intentions (II) are specific plans of action concerning when, how, and where an intended behavior will be enacted. The use of this self-regulatory skill with self-monitoring of the pedometer has the potential to initiate behavior change as well as adherence. **PURPOSE:** To test differences between participants that used both II and a pedometer and those that just used a pedometer. **METHODS:** Employees ($N = 51$) at a mid-sized public university were recruited via employee email to participate in an 8-week pedometer-based intervention. Only employees currently not meeting minimum PA recommendations (< 150 minutes of moderate to vigorous PA/week) could enroll. A 2-arm randomized trial was used to compare the effectiveness of: 1)

only pedometers (PED) (n = 25) and 2) pedometers and II (PED + II) (n = 26) on PA. All participants were asked to track steps daily. Participants in the PED + II group were asked to write three II for each perceived barrier to meeting their step goals in Weeks 1 and 4. Pedometers were reissued for a delayed post assessment 4 weeks after the intervention ended (n = 36). Paired t-tests were used to compare differences between baseline to Week 8 and 12 separately for the 2 groups. **RESULTS:** Significant increase in steps ($p = .004$) were observed from baseline (7100 ± 2452.5) to Week 8 (8542 ± 4244.1) for the both groups combined and for the PED+II group ($p = .004$; mean difference: 1458 ± 1009.2). No difference was observed for the PED group ($p = .112$; mean difference: 1427 ± 2511.1). Average steps significantly decreased ($p < .0005$) from Week 8 (9019.2 ± 4684.3) to Week 12 (6689.3 ± 1983.2) for the both groups combined. There was no between group differences in any comparison ($p = .159 - .854$). **CONCLUSION:** The PED+II group significantly increased steps during the intervention indicating that the behavioral strategy was effective. However, participants in both groups had a significant decrease in steps from the end of the intervention to the delayed-post assessment highlighting the struggle to maintain behavioral changes after the intervention ends. Future interventions should continue to combine behavioral modification strategies to increase adherence.

233 Board #54 May 31 11:00 AM - 12:30 PM
Lifestyle and Health Habits Among Canadian University Community

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PURPOSE: It is estimated that by 2019, 55.4% of the Canadian adult population will be categorized as overweight (34.2%) or obese (21.2%) (Twells et al., 2014). Increase of obesity prevalence, calls for continuous search of effective obesity-prevention and health promotion strategies. Following the work of Perusse-Lachance and colleagues (2010), the present study aimed to further examine the prevalence of obesity and lifestyle habits through environmental factors in a different Canadian university community.

METHODS: A web based-survey assessing lifestyle habits such as physical activity and nutrition was sent by email to all university's students (n=14 500) and employees (n=2000). Students or employees had to be registered as part or full time during the 2016 fall semester to participate in the study. Response rate was 13.3% for students (n=1 989) and 24.3% for employees (n=485). All data were analyzed using SPSS.

PRELIMINARY RESULTS: Results showed that 18.7% of students and 28.5% of staff members were overweight (BMI = 25.0-29.9), 10% of students and 10.7% of staff members were obese (BMI \geq 30.0) while 40% of students and 37% of the employees were currently trying to lose weight. Results also revealed that 50% of staff members and 57% of students were considered sedentary (<150 minutes of physical activity/week).

Regarding fruits and vegetables intake, only 14% of students consumed four or more servings of fruits per day compared to 15% for staff members. In addition, only 15% of students consumed four or more vegetables servings per day as opposed to 26% for staff members. Finally, 91% of employees, compared to 81% of the students, were having breakfast every day.

CONCLUSION: Healthy environments are crucial in the adoption of healthy behaviors (Booth et al., 2001). In this regard, the herein results suggest that overweight and obesity can be an important concern in a well-educated sample and that this issue is associated with various health-related behaviors. These conclusions highlight the need to develop specific health promotion strategies in this Canadian University community.

234 Board #55 May 31 11:00 AM - 12:30 PM
Fitness Perceptions And Practices Of Medical Students From A Patient-Based Learning Curriculum (PBL)

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Purpose: To determine the knowledge of fitness and the fitness habits of medical students at the University of Missouri School of Medicine (UMSOM). There is currently limited research on the association of a Patient-Based Learning (PBL) curriculum with students' fitness as well as their implementation of patient exercise prescription.

Methods: Anonymous surveys were distributed to 394 medical students. Data were entered into the REDCap electronic survey tool and tabulated with REDCap and Microsoft Excel. In the survey, respondents were asked to state the Centers for Disease Control (CDC) recommendations for physical activity in adults. The survey

also included Likert scale questions concerning exercise, and the Godin leisure time exercise questionnaire. Godin scores were calculated and converted to CDC recommended activity levels.

Results: A total of 145 students responded for a response rate of 37%, with 97% agreeing that it is important for physicians to have and exemplify an active lifestyle. However, only 23% met the aerobic physical activity guidelines set by the CDC for adults. Based on the Fisher Exact Test ($P=1.1 \times 10^{-4}$) respondents who met CDC recommendations for exercise also indicated stronger agreement with the statement "I make physical fitness a priority in my life." Although 41% of respondents agree that the medical school curriculum has educated them on appropriate use of exercise, only 2.8% (4/145) were able to correctly state the CDC recommendations for physical activity in adults.

Conclusion: Most medical students in the UMSOM agree that it is important for physicians to maintain an active lifestyle but most do not achieve the CDC recommended level of exercise. Less than half of respondents agreed that the PBL curriculum educated them on appropriate use of exercise, and most could not state the CDC recommendations for physical activity in adults. Healthcare is evolving towards preventative care, including patient exercise counseling and prescription, which may be a current weakness of PBL. Further research is needed to compare PBL curricula to traditional curricula, as well as seeing the ultimate effect on the students' future medical practices.

235 Board #56 May 31 11:00 AM - 12:30 PM
Incorporating Spirituality and Role Models into Physical Activity Programs for Black Women: A Qualitative Inquiry

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Previous research has shown favorable outcomes for incorporating religion and spirituality into (physical activity) PA programs delivered through faith-based or faith-placed settings. Limited research has examined how these concepts can be incorporated into PA programs delivered outside of religious institutions. Likewise, few studies have explored the individuals that Black women consider to be physically active role models and how these role models can be leveraged in a PA program.

PURPOSE. To qualitatively examine how spirituality, religion, and roles models can be incorporated into a PA program for Black women.

METHODS. Twenty-five Black women (M age = 38.5 years, M BMI = 39.4 kg-m²) were enrolled in the study. Focus group guides were designed to gain information on how religion, spirituality, and roles models can be incorporated into a culturally relevant PA program for Black women. Focus groups were audio recorded and transcribed verbatim. Content analysis was used to analyze focus group data.

RESULTS. Participants reached consensus that incorporating aspects of spirituality (i.e., words of affirmation, meditation, mind-body activities) into a PA program was universally acceptable, regardless of religious affiliation. On the other hand, including concepts of religion (i.e., bible verses and/or quotes from religious leaders) was controversial and not recommended among women who did not identify with a religious faith. In reference to the topic of physically active role models, women identified various individuals they considered as role models, including relatives (i.e., their mother, siblings, and children), friends, community leaders, and celebrities (i.e., Michelle Obama, Oprah Winfrey). Participants endorsed the use of these role models in a PA program designed for Black women.

CONCLUSIONS. Findings suggest that including spirituality, as opposed to religion, is an acceptable and motivational concept to include in a PA program for Black women. Similarly, women reported a diverse group of individuals that could be included as physically active Black role models. Designing PA promotion programs to include aspects of spirituality and roles models can enhance the acceptability and salience of the program, which may ultimately lead to increased PA behaviors.

236 Board #57 May 31 11:00 AM - 12:30 PM
Pilates Exercise Improves Balance in Middle-Aged Chinese Women

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PURPOSE: To investigate if an 8-week Pilates exercise program could improve static balance, dynamic balance and core myodynamia strength in middle-aged Chinese women.

METHODS: Sixty middle-aged Chinese women (52-65 years old) were randomly assigned to experimental group (n=30) and control group (n=30). The Pilates exercise

was performed 90 minutes per time, 3 times per week, for 8 weeks, including core myodynamia training, static standing, muscle strength and endurance training of lower extremities. Static balance and dynamic balance tests were performed, and the strength of core myodynamia was measured using a BIODEX balance test system. The SPSS19.0 statistical software was used for data analysis. Paired tests were used for comparison before and after intervention within each group. Group comparisons in changes over time were performed by independent t-tests.

RESULTS: When comparing with themselves before the 8-week Pilates exercise, the women after the exercise had longer time of standing with one foot and eyes' closed (14.68±5.54s vs. 27.68±4.21s), the Romberg experiment with eyes' closed (40.23±6.47s vs. 66.58±7.43s), marching on the spot with eyes' closed (9.35±3.26s vs. 20.74±10.62s) and 8 degree abdominal bridge test (24.57 ± 8.71s vs. 82.78±21.53s) and shorter time of standing and walking (16.36±2.15s vs. 7.93±1.59s), vestibular step test (8.75±1.78s vs. 3.58±2.37s) and the risk of tumbling test (2.42±1.03s vs. 2.11±0.95s), and the difference was statistically significant (P all <0.05). Compared to control group who did not have the 8-week Pilates exercise, the time of standing with one foot and eyes' closed (15.06±4.98s vs. 27.68±4.21s), the Romberg experiment with eyes' closed (39.87±9.01s vs. 66.58±7.43s), marching on the spot with eyes' closed (9.47±4.03s vs. 20.74±10.62s) and 8 degree abdominal bridge test (25.41 ± 6.22s vs. 82.78±21.53s) were prolonged in the experimental group (P all <0.01), and the time of standing and walking (16.86±1.97s vs. 7.93±1.59s), vestibular step test (9.02±2.51s vs. 3.58±2.37s) and the risk of tumbling test (2.39±1.07s vs. 2.11±0.95s) were shorten (P all <0.01).

CONCLUSIONS: After 8 weeks of Pilates exercise, the experimental group' static balance and dynamic balance, and the strength of core myodynamia were improved; and this may reduce the risk for falls.

237 Board #58 May 31 11:00 AM - 12:30 PM
The Effect of University Worksite Walking Program on Physical Activity and Sedentary Behavior Among Employees

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The Centers for Disease Control report that 79% of Americans are not meeting weekly physical activity requirements, increasing the risk of many lifestyle related disease. Due to the many benefits of regular physical activity, university worksites are increasingly offering physical activity programming to encourage employees to be more active throughout the workday. **Purpose:** The purpose of this study was to evaluate the effects of a university sponsored walking program on physical activity amount and sedentary behavior in employees who participated versus those who did not participate. **Methods:** The research was a matched pair design. The study group (n=33) participated in the Workplace Walkoff Challenge (WWC), a six week walking competition held at a small, California university. The control group (n=17) did not participate in the WWC. The International Physical Activity Questionnaire (IPAQ) was utilized to collect vigorous, moderate, and walking MET-Mins⁻¹ per week, and sitting hours during weekdays. Participants also wore an Omron® brand pedometer and reported weekly steps. To assess these variables, dependent t-tests were performed. **Results:** For the participant group, there were significant increases in vigorous (p=.05), moderate (p=.05), and walking (p=.02) MET-Mins⁻¹ per week. There were significant increases in steps from baseline to the last week of the competition (p.01). There were no significant changes in sitting hours per day (p=.39) for WWC participants. For the control group, There were no significant differences in vigorous (p=.18), moderate (p=.35), walking (p=.46) MET-Mins⁻¹ per week for non-participants. There were also no significant increases in steps from baseline to end of competition (p=.24). There were no significant changes in sitting hours per week day (p=.50) for non-participants. **Conclusion:** A six week worksite walking program may be effective in increasing physical activity amount among employees, despite no change in sit time while at the worksite.

238 Board #59 May 31 11:00 AM - 12:30 PM
Reasons For Participants Joining And Continuing An Outdoor Gym In Rio De Janeiro

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The existence of public parks for the practice of physical exercise is common in several places of the world and the explanation could be linked to a health promotion strategy, which seeks to make free leisure activities accessible to citizens. Since this

is a public policy to promote health in the population, it is important to evaluate strategies that provide feedback on investments already carried out, on which we can base the best application of resources. This effectiveness evaluation is necessary as a form of accountability for citizens, allowing re-planning actions, if necessary.

PURPOSE: The objective of this study was to identify the reasons to join an exercise program offered by an outdoor gym located in the university campus, in the city of Rio de Janeiro, Brazil. **METHODS:** This survey relied on the participation of all users of the program "Rio Ar Livre" (RAL) ("Rio Outdoor"), UERJ unit, totaling 44 individuals (8 men and 36 women), with an average age of 64 years, varying from 23 to 87 years. The data were collected through a questionnaire with both closed and semi-open questions, developed exclusively for this investigation. This study was carried out between August and September 2015.

RESULTS: The main reason users frequented this physical activity program was "Due to the decision to improve fitness/to stay fit (women [W]: 57%; men [M]: 37.5%). The most cited positive points were: the "Participation of the teacher and trainee" (W: 88.6%; M: 75%), "Location of UERJ in relation to the participant's residence" (W: 60%; M: 62.5%) and the "attendance" (W: 62.8%; M: 75%). On the question of negative points: "Cleanliness" received the most votes (W: 57%; M: 37.5%).

CONCLUSION: It was concluded that the gym's structure is one of its negative points. However, aspects such as location, gym access and, especially, the competence of personnel working in the gym (RAL-UERJ) are probably the factors leading the user to join the program and remain enrolled in it. Supported by FAPERJ (E-26/210.231/2014).

239 Board #60 May 31 11:00 AM - 12:30 PM
Effect of an Educational Program Promoting Regular Physical Exercises in Subjects With Knee Osteoarthritis

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PURPOSE: The purpose of this study was to investigate the effects of an educational program emphasizing the regular practice of physical exercise on physical fitness, functional capacity and daily- living physical activity levels in patients with knee osteoarthritis (OA). **METHODS:** Two hundred and thirty-nine (239) patients in the public health system (male and female), with primary or secondary knee OA (degree I to IV in the Kelgreen and Lawrence scale), and with referral for OA clinical treatment were randomly allocated to intervention (IG; n = 112) and control groups (CG; n = 127). All subjects of both groups underwent assessment for physical fitness (six-minute-walking- tests), functional capacity (seat-to-stand, Up-and-Down-stairs and Timed-Up-and-Go tests) and daily-living physical activity (IPAQ short-version), before (pre), during (6-months) and after (12- months) the follow-up. Statistical analysis was performed with ANOVA two-way (group x time) with repeated measurements, Chi-square test and the Bonferroni's t test. **RESULTS:** During six months of follow-up, the IG showed significant improvements ($P < 0,05$) in Up-and-Down-stairs (19%), seat-to-stand (30%) and Timed-Up-and-Go (32.5%) tests, as well as a reduction of Body Mass Index (BMI) ($P < 0,05$), which were maintained during the 12 months. There was also an increase in the percentage of self identified "actives" and "very actives" subjects and reduction in the percentage of sedentary subjects in the IG during follow-up ($P < 0,05$). The CG improved only the Up-and-Down-stairs tests during the 6-months follow-up. There was also an increase in the percentage of very actives subjects in GC, however, this increase was lower than that was observed in the IG. There were no significant improvements on muscular capacity, aerobic capacity and flexibility during the 12-months follow-up in both groups. **CONCLUSIONS:** These results suggest that an educational program promoting the regular practice of physical exercise may be an effective tool for improving functional capacity in patients with knee OA.

A-41 Free Communication/Poster - Aging

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

**240 Board #61 May 31 9:30 AM - 11:00 AM
Using Accelerometers to Quantify Exercise Intensity of Exercise Classes in Older Adults**

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Accelerometers offer detailed minute-by-minute information over extended periods pertaining to physical activity behavior. Furthermore, accelerometers are typically placed on the right hip. However, accelerometers placed on the hip may not determine exercise intensity during an entire workout in older adults.

PURPOSE: The first purpose of this study was to use accelerometers to determine the duration of time spent in certain intensities during exercise classes for older adults. The second purpose of the study was to examine the intensity level during those exercise classes as determined by accelerometers placed on the hip and wrist.

METHODS: A total of sixty seven older adults (age: 73.8 ± 14.5 yrs, weight: 71.0 ± 19.0 kg) were recruited. Twenty-five of them wore an accelerometer placed on the right hip (H) and an accelerometer placed on the right wrist (W). All individuals participated in exercise classes that included periods of cardiovascular, strength, and balance exercises. In order to quantify exercise intensity, cut points (cpm) of sedentary (≤ 100 cpm), light (101-799 cpm), and moderate (800-5722) intensity were used. A two-tailed independent t test was used to examine differences between H and W in the amount of time spent in sedentary, light, and moderate exercise intensity. Statistical significance was set at $p < 0.05$.

RESULTS: Overall, the participants engaged in 17.1 ± 5.8 minutes of light and 12.3 ± 8.8 minutes of moderate intensity activities. Furthermore, the majority of the participants (91%) perceived the intensity as moderate. The average time spent in light exercise intensity was 19.1 ± 4.5 and 7.4 ± 2.1 minutes for the H and W accelerometers, respectively. The average time spent in moderate intensity activity was 11.4 ± 6.1 and 35.0 ± 4.2 minutes for the H and W accelerometers, respectively. There was a significant ($p < 0.01$) difference between the accelerometers for light and moderate exercise intensity.

CONCLUSIONS: The data showed that very little of the activity met the moderate intensity threshold by accelerometer data, but this was dependent on the placement of the accelerometer. Furthermore, the data suggests that in order to fully comprehend the intensity of an exercise class for older adults, accelerometers must be worn on both the hip and the wrist.

**241 Board #62 May 31 9:30 AM - 11:00 AM
A Comparison of Upper Body Strength and Body Composition Between Elderly from Costa Rica and Kansas**

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An increased lifespan and body adiposity as people age are considered risks factors for all-cause mortality. Handgrip strength is a considered a powerful predictor of cause-specific and total mortality in older disabled women and to cardiometabolic risk in aging populations. Ethnic-specific heterogeneity of risk factors calls for comparative studies to better understand competent prevention and management, which might be one of the essential steps toward elimination of ethnic disparities for several diseases.

PURPOSE: To compare the upper body strength and body composition in elderly from Costa Rica (CR) and Kansas (KS). **METHODS:** Older adults from CR (men = 26, women = 52, mean age = 68.91 ± 4.79 yr.) and KS (men = 35, women = 65, mean age = 72.84 ± 5.59 yr.), underwent handgrip strength and body composition measurements (dual-energy X-ray absorptiometry). **RESULTS:** Men (31.24 ± 7.02 %) had lower %BF than women (41.28 ± 5.87 %; $p \leq 0.001$). Women (15.0 ± 1.7 kg/m²) had lower lean tissue mass index than men (18.0 ± 1.7 kg/m²; $p \leq 0.001$). Women (6.2 ± 0.8 kg/m²) had lower appendicular lean soft tissue index than men (8.1 ± 1.0 kg/m²; $p \leq 0.001$). KS participants (1.16 ± 0.11 g/cm²) had higher total bone mineral density than CR participants (1.08 ± 0.11 g/cm²; $p \leq 0.001$), and men (1.21 ± 0.11 g/cm²) had higher total bone mineral density than women (1.08 ± 0.09 g/cm²; $p \leq 0.001$). Significant correlations ($p \leq 0.003$ for all) were obtained between handgrip strength

and body height ($r = 0.72$), body weight ($r = 0.56$), arms bone mineral density ($r = 0.67$), total bone mineral density ($r = 0.56$), lean arms mass ($r = 0.78$), total lean mass ($r = 0.81$), body fat% ($r = -0.48$), body fat mass index ($r = -0.22$), lean tissue mass index ($r = 0.59$), and appendicular lean soft tissue index ($r = 0.69$). **CONCLUSIONS:** Differences in body composition and handgrip strength were found in older adults from CR and KS. Ethnic-specific heterogeneity on biologic factors and physical-related performance allows for culturally diverse prevention programs for the elderly.

**242 Board #63 May 31 9:30 AM - 11:00 AM
Association Of Agility With Muscle Strength, Balance, Mobility And Physical Activity Status Of Older Women**

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It has been reported that body-weight supported stepping training increases the walking speed of healthy older women. This suggests that stepping with body weight unloading improves the walking ability. We hypothesized that stepping in a sitting position is associated with the physical fitness, walking ability and the physical activity status of older people.

PURPOSE: The purpose of this study was to examine the association between the stepping rate (agility) and the muscle strength, balance, mobility and the physical activity status of older women.

METHODS: The participants included 108 healthy older women (age: 74 ± 5 years; range: 65-89). The stepping rate, muscle strength (handgrip strength, knee extension strength), balance (one-leg standing time with eyes open), mobility (timed up-and-go test [TUG], maximum walking speed) and physical activity of the participants were measured. The maximal stepping rate in 10 seconds, as measured using an industrial stepping rate counter (Stepping Counter; Yagami), was used as an index of agility. The participants were instructed to perform alternating steps with each leg as quickly as possible for 10 seconds, while in a sitting position. The total number of step for both legs was used as the participant's score. The physical activity status was measured for two weeks using a uniaxial accelerometer. A multiple regression analysis was used to evaluate the association between the stepping rate and each of the other variables.

RESULTS: The stepping rate was 74.8 ± 14.2 (range 34-108) times/10s and was not correlated with age. A multiple regression analysis adjusted for age revealed that the, stepping rate was associated with handgrip strength ($\beta = 0.345$, $p < 0.00$), knee extension strength ($\beta = 0.218$, $p < 0.05$), one-leg standing time ($\beta = 0.312$, $p < 0.01$), TUG ($\beta = -0.239$, $p < 0.05$), maximum walking speed ($\beta = -0.446$, $p < 0.001$) and the percentage of time engaged in low intensity PA ($\beta = -0.245$, $p < 0.05$).

CONCLUSION: The present study showed the association between agility and muscle strength, balance, walking ability and physical activity of physically independent older women.

**243 Board #64 May 31 9:30 AM - 11:00 AM
Inter-rater And Test-retest Reliability Of The Y-balance Test In Healthy Women 50-80 Years Old**

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The assessment of dynamic balance through the use of standardized objective measures is important to identify impairments which may increase fall risk in older adults. Many of the current clinical balance tests are not challenging enough to assess balance and identify fall risk in healthy older adults. A test which may be appropriate for healthy older adults is the Lower Quarter-Y Balance Test (LQ-YBT). The LQ-YBT is a test of dynamic motor control at the limits of stability in single-leg stance which has typically been researched in younger athletic populations to evaluate dynamic balance and risk for injury. **PURPOSE:** To determine the inter-rater and test-retest reliability of the LQ-YBT in healthy women from 50-80 years old. **METHODS:** Eighty-six potential participants were screened and data collection included 60 healthy women 50-80 years old, with mean age $64.3 (\pm 7.9)$ years. Each participant completed the LQ-YBT in a standardized manner as described in the LQ-YBT manual. The scores for each participant were independently determined and recorded to the nearest centimeter by two examiners. After a 5-minute rest, a subset of eight participants performed the LQ-YBT a second time in the same session for the purpose of test-retest reliability. The maximum distance reached in each direction, normalized for leg length, was used for data analysis. Intraclass Correlation Coefficients [ICC (2,1)] were used to determine the test-retest and interrater reliability of the normalized reaches in each direction and the composite scores. **RESULTS:** The LQ-YBT demonstrated excellent

inter-rater reliability with ICC values of 0.98 to 1.0 for the various directions, and 1.0 for the composite scores, bilaterally. The test-retest ICC values were also excellent ranging from 0.75 to 0.93 for the various reaches and 0.96 and 0.95 for the right and left lower extremity composite scores, respectively. **CONCLUSION:** The LQ-YBT demonstrated excellent inter-rater and test-retest reliability in healthy women 50-80 years old and may be considered for use as a measure of dynamic balance in this population.

244 Board #65 May 31 9:30 AM - 11:00 AM
Purine Metabolites and HGPRT Activity in Male Speed-Power vs Endurance Masters Athletes Aged 20-90 Years

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PURPOSE: According to recent studies, purine metabolism better reflects exercise response and muscle adaptation than widely used indicators. Consequently, we proposed using purine derivatives, especially plasma hypoxanthine (Hx) concentration and erythrocyte HGPRT activity as indicators of training status in highly trained young athletes. The aim of this study was to compare the effects of many years' sprint and endurance training on levels of purine derivatives and HGPRT activity. **METHODS:** Master sprinters (SP, n=52), master endurance runners (ER, n=86) and healthy control participants (CO, n=60), age range 20-90 years, were compared. They underwent a treadmill test until exhaustion. Venous blood samples were drawn at rest and post exercise. Hx, xanthine (X), uric acid (UA) and erythrocyte HGPRT activity were assayed by means of HPLC method. Regression analyses were performed to show the relationships between purine derivatives and HGPRT activity and age. **RESULTS:** Resting and post-exercise Hx were similar in both athletic groups and different from the CO group, in which highest Hx values were observed. Resting and post-exercise X were only different between SP and CO groups. Resting HGPRT and post-exercise UA were different between all three groups. Age explained 87-96%, 69-94%, 17-55% and 41-54% of variance in Hx, X, UA and HGPRT, respectively, except for UA in the CO group (1-5%). The relationships between age and Hx and resting X were nonlinear (polynomial function of degree 2). The age-related changes in UA were only minimal in athletes and virtually nonexistent in the CO group. **CONCLUSION:** The age-related elevation in resting and post-exercise Hx suggests that the exercise-induced energetic stress considerably progresses with ageing. Increased Hx levels, despite increasing HGPRT activity that supports ATP resynthesis through the purine salvage pathway, bring about a delayed restoration of the adenine nucleotide (AdN) pool through the energy-consuming *de novo* synthesis. One can expect that in older subjects, subsequent high-intensity exercise bouts will require longer recovery to restore the AdN pool. In practical terms, older athletes should plan their high-intensity workout having regard to these implication of ageing. Supported by National Science Center Poland Grant 2013/09/B/NZ7/02556

245 Board #66 May 31 9:30 AM - 11:00 AM
Improving Power Output in Older Adults Utilizing Plyometrics in an AlterG Treadmill

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In older adults, muscular strength has been shown to decline by up to 1-2% per year, and muscular power declines at an even higher rate. Plyometric training has shown benefits for increasing muscle force, power, and agility in adolescents and recreational adults; however, data on older adults is lacking. The AlterG treadmill allows for improved mobility, strength, and safety while improving functional capacity related to endurance, strength, and power. **PURPOSE:** To determine the effects of performing plyometrics in an AlterG treadmill on power output and functional strength in older adults when compared to traditional strength training. **METHODS:** Twenty-three subjects were randomized to a strength (SG) (n = 8), plyometric (PG) (n = 8), or control (CG) (n = 7). SG and PG exercised 3x/week for 8 weeks and CG performed no exercise. SG performed sets of 3x10 at 65-80% of one-repetition maximum (1RM) (estimated from 3-5RM) on the leg press (LP), leg extension (LE), and single leg lunge (LL). PG performed 3x10 in the squat jump, single leg bound, and power skipping at an intensity range of 65-80% body mass. Timed sit-to-stand and stair climb, estimated maximal muscular strength, and isokinetic power during leg flexion and extension were compared pre and post intervention. A 2 x 3 repeated measures ANOVA was used to determine differences between groups. Data was reported as percent change from baseline. **RESULTS:** Significant improvements occurred in the PG in the timed sit-to-stand (22.11 ± 8.48%, p = 0.013), timed stair climb (14.68 ± 6.28%, p = 0.002),

and stair climb power (16.59 ± 9.07%, p < 0.001). PG and SG significantly increased their estimated 1RM in the LE and LL (p < 0.05). PG was significantly more powerful at all 3 velocities in both flexion and extension except at 60°/sec extension, ranging from 24.54 ± 19.94% to 85.74 ± 62.23% (p < 0.001). PG increased muscular strength similarly or better than SG without performing resistance training. **CONCLUSIONS:** Eight weeks of plyometrics in an AlterG treadmill improved functional strength and power in older adults, accomplished through performing exercise requiring less total work per exercise session. Results suggest that plyometrics, if modified and performed in a safe environment, can increase muscular strength and power and improve functional abilities in older adults.

246 Board #67 May 31 9:30 AM - 11:00 AM
Strength Decline Of Sedentary Adult Men In Different Age Groups

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The muscle decline and your functional capacity have age association, strength capacity also be relation with life style. For health men, this factor still suffer the effects somatopause, but the data for sedentary men still need scientific attention. **PURPOSE:** The purpose of this study was to compare the muscle strength of sedentary adult men with different age group. **METHODS:** The sample was 331 sedentary men divided in tree groups of according with age 21-29 years (G1), 30-39 years (G2) and 40-49 years (G3). All sample non physically active <150 minutes for week. The subjects were anthropometric measurements, 1 minute of abdominal test (IAT), flexion strength of the elbow (FSE). It was made a descriptive statistic, and ANOVA one way with Tukey's post hoc (p<0.05). **RESULTS:** For men was verify a decline in the IAT of 26.8% (p=0,001) comparing G1 with G3 and 23,1% (p=0,001) when compared G2 with G3. But for FSE non significant results was verify in the different age group. **CONCLUSIONS:** We can conclude for the IAT and body mass was verify a significant reduction as advancing age in sedentary men. however that in the flexion strength elbow not detected a strength decline as advancing age in sedentary men.

247 Board #68 May 31 9:30 AM - 11:00 AM
Comparisons of Fat Free Mass and Fat Mass between Active and Inactive Older Women

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Purpose: To compare the fat free mass and fat mass between active and inactive older women. **Methods:** Participated in this investigation 44 older women, mean aged of 66.0 (±4.5years-old). Sample was classified as inactive (Inactive group - IG, n=18), who was not enrolled in an exercise program in the previous six months, and active (Active group - AG, n=26), who have been participating regularly in the last six months in an exercise program (bench stepping group exercise - BSGE) promoted by the physical education department in the Technological Federal University of Parana. Body composition was analyzed by the Dual Energy X-Ray Absorptiometry (DXA) equipment. Data were described by mean and standard deviation and analyzed by the independent T-test using the SPSS software (p<0.05). **Results:** Comparisons between groups showed that IG had a significantly lower fat free mass for all measurements - right and left upper limb (1665.5±467.4 and 1506.8±443.4grams VS 2066.9±328.3 and 1866.9±282.2 gram, respectively), trunk (1996.1±3629.4 VS 22380.8±3695.9 gram), and right (5108.4±600.3 VS 6083.7±616.5 gram) and left (5112.8±738.6 VS 5979±542.0 gram) lower limb (all p<0.05). Also, the IG had a higher %fat mass for right (47.0±6.0) and left (47.4±7.0) lower limb than active group (42.2±4.8 and 42.5±4.8, respectively) (all p<0.05). **Conclusion:** Older women who participated in a bench stepping group exercise program had a better body composition than their inactive peers. This results were more evident for fat free mass which has been positively associated with functional-physical fitness and successful aging. Also, it is consensus that the accumulation of fat mass increases the risk for several metabolic and cardiovascular diseases, then the maintenance of %fat mass is crucial for a preventive health perspective.

248 Board #69 May 31 9:30 AM - 11:00 AM
Dynamic Postural Control by Body Mass Index and Walking Speed in Korean Elderly
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(No relationships reported)

PURPOSE: To investigate the influence of body mass index (BMI) and walking speed on postural control in Korean elderly

METHODS: A total of 127 elderly (76.4±7.0 yrs, 155.5±8.1 cm, 60.8±10.2 kg, 25.2±3.5 kg/m²) walked on a force platform for 4.5 meter distance on their pace and parameters of postural control such as Envelope Area (ENV), Rectangle Area (REC), total length from center of pressure (TLC), and Sway Velocity (SV) were measured. Based on their walking speed, they were divided into three groups; slow (S, n=41, 6.5<sec), average (A, n=47, ≤6.5 sec), and fast (F, n=44, ≤5 sec). In addition, based on their BMI, they were grouped as; normal weight (NW, n=35, 21.3±1.3, range 18.5-22.9), overweight (OW, n=38, 24.2±0.5, range 23.0-24.9), and obese (OB, n=54, 28.5±2.5 kg/m², 25≤). Their physical fitness was also measured by 2-min Step Test, 30-second Chair Stand, 8-Ft Up and Go, and One-leg Standing.

RESULTS: No differences in age and height were noticed when compared by groups of BMI. Body weight, fat content, and waist circumference were greater as BMI was higher (p<0.05). ENV (299±285, 316±286, and 252±253 mm²), REC (699±720, 985±2137, and 619±683 mm²), TLC (333±175, 331±175, and 289±117 mm), and SV (17±9, 17±9, and 14±6 mm/sec in NW, OW, and OB, respectively) were not different between groups of BMI. When compared by walking speed, all postural parameters such as ENV, REC, TLC, and SV were not different among S, A, and F. When physical fitness variables were analyzed, no group differences by walking speed and BMI were noticed.

CONCLUSION: The degree of sway of center of pressure during walking in elderly was not different when it was compared by groups of BMI and walking speed. Capability of maintaining body balance in elderly population during locomotion may not be predicted by their BMI or walking speed.

249 Board #70 May 31 9:30 AM - 11:00 AM
Maximal Velocity Adaptions During Unilateral Resistance Training In Older Adults
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Maximal velocity parameters are negatively affected by aging; however, little is known regarding the short-term effects of resistance training (RT) on maximal velocity variables in older adults. Furthermore, whether or not unilateral RT induces maximal velocity adaptations in the untrained limb has not been determined. **PURPOSE:** To examine the effects of unilateral RT on maximal velocity parameters of the ipsilateral and contralateral leg in older males. **METHODS:** Twenty-one untrained older males were randomly assigned to a training (TG; n = 10, age = 64.70 ± 6.91 yrs.) or control (CG; n = 11, age = 65.56 ± 11.56 yrs.) group. The TG performed 3 sessions per week of unilateral isokinetic RT for 4 weeks. RT sessions consisted of maximal concentric knee extensions at 45°·s⁻¹ for 4 sets of 10 repetitions. Subjects were instructed to "kick out as hard and fast as possible" during each RT session. Maximal concentric isokinetic testing of the knee extensors for the trained (TL) and untrained (UL) leg at 500°·s⁻¹ (ISOK₅₀₀) was performed before (PRE), at week 2 (MID), and after week 4 (POST) of RT. There was no resistance during ISOK₅₀₀, with the exception of the lever arm mass, as the velocity was above all subjects' maximum velocity. The highest velocity attained (PV; deg·s⁻¹) and the linear slope of the velocity-time curve (RVD; deg·s⁻²) were recorded for analysis. For the TL and UL, one-way repeated measures analyses of variance were used for the TG and CG separately. **RESULTS:** PV and RVD remained unchanged in both legs for the CG (p > 0.05). PV did not change in the TL (p = 0.084), while RVD increased from PRE to POST (+5.8%; p = 0.029) and MID to POST (+4.1%; p = 0.038). PV (p = 0.644) and RVD (p = 0.523) were unaltered in the UL. **CONCLUSION:** RVD appears to be more sensitive to change during the early-phase of RT compared to PV in older males. However, neither PV nor RVD in the UL appear to be affected by short-term unilateral RT. Since many neural adaptations are expressed bilaterally, the improvement in RVD for only the training leg suggests the adaptation is more likely mechanical in origin.

250 Board #71 May 31 9:30 AM - 11:00 AM
The Self-Reported Exercise Habits of Older Adult Women and the Associated Effects on Physical Fitness
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ABSTRACT

The amount of time that older adults exercise is influenced by their fitness, physical function, and self-efficacy to participate in physical activity. As the population of older adults is continuing to increase and become more diverse, it will be important to recognize and investigate differences among them, including variance in exercise time. The usefulness of self-report instrumentation by older adults to determine the optimal amount of time spent exercising to enhance fitness components and physical function is still largely unknown.

Purpose: To investigate the relationship between self-reported exercise habits, fitness levels, and physical function among healthy older adult women. **Methods.** Two groups of older adult women (M_{age} = 69 years) were instructed to continue their normal routines of attending group exercise classes at the local YWCO for a 10-week period. Group 1 (n=15) self-reported a weekly average that was equal to or lower than 360 minutes of exercise per week. Group 2 (n=15) consisted of those participants who reported averaging more than 360 minutes of exercise per week. The Senior Fitness Test (SFT) was used to assess the overall fitness and physical function of both groups of participants at baseline, after five weeks, and again after 10 weeks of exercising. **Results.** Statistical analysis showed no significant interaction effect for time*group (p<0.05) for chair stands [F(2,52)=2.288, p=.112], arm curls [F(2,52)=2.138, p=.128], 2-min step [F(2,52)=1.048, p=.358], chair sit & reach [F(2,52)=1.290, p=.284], and back scratch tests [F(2,52)=1.102, p=.340]. However, a significant interaction effect existed for time*group for the 8-foot Up & Go test [F(2,52)=4.685, p=.013]. **Conclusion.** Study findings suggest that perhaps 360 minutes of exercise per week in a community-based setting such as the Athens YWCO is the threshold for considerably improving mobility, coordination, and dynamic balance as measured by the 8-foot Up & Go task in older adult women. Also, further consideration should be given to utilizing tests similar to the 8-foot Up & Go that are designed to be more sensitive and complex when assessing the physical fitness of older adults.

251 Board #72 May 31 9:30 AM - 11:00 AM
Preliminary Validation Of The Virtual Short Physical Performance Battery In Older Adults With Multiple Sclerosis
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Abstract

Purpose: There are relatively few measures for studying physical function involving older adults with multiple sclerosis (MS), including non-supervised outcomes administered within a patient's home. However, such measures are necessary considering the prevalence and associated consequences of MS and aging on physical function. The objective of this study was to perform a preliminary examination of the validity of the virtual Short Physical Performance Battery (vSPPB) and its associations with objectively-measured levels of moderate-to-vigorous physical activity (MVPA) and cognitive function.

Methods: A sample of 30 older adults with MS (≥60 years of age) underwent assessments of cognitive function, completed a battery of lower and upper extremity function assessments, including the vSPPB, and wore an accelerometer for a 7-day period. Spearman correlations (r) were conducted based on an expected differential pattern of associations with measures of upper and lower extremity function and for MVPA and cognitive function.

Results: vSPPB scores demonstrated strong associations with measures of lower extremity function (r=0.55-0.81), and weak associations with a measure of upper extremity function (r=0.16). The total SPPB (9.2 (2.3)) and vSPPB (6.9 (2.4)) scores were similar and moderately correlated (r=0.76) and the component scores of the SPPB and vSPPB were moderately to strongly correlated (r=0.41-0.58). Total vSPPB scores demonstrated moderate associations with minutes of MVPA per day (r=0.46). There were no significant associations between vSPPB scores and any of the cognitive measures.

Conclusion: We provide preliminary evidence that supports the validity of scores from the vSPPB as a measure of perceived lower extremity function that provides unique information for inclusion in clinical research and practice involving older adults with MS.

252 Board #73 May 31 9:30 AM - 11:00 AM
Beneficial Effects of Senior Functional Fitness to Manage Blood Pressure in Community-dwelling Older Adults
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 (No relationships reported)

Purpose: To investigate the relationships and difference of senior functional fitness between varied levels of blood pressure (BP) and functional fitness assessments with community-dwelling older adults.

Method: 1003 community-dwelling residents aged 65 to 95 (Male, n=384, age =74yrs; female, n=615, age =69yrs) volunteered to participate in the study during 2010-2015. Participants completed 6 functional fitness tests, blood pressure measured and a health-screening questionnaire. The senior functional fitness including flexibility, muscle strength, muscle endurance, aerobic endurance, and body agility/dynamic balance. The **classification of Blood Pressure for Adults**: Normal systolic blood pressure (SBP) <120 and diastolic blood pressure (DBP) <80 mmHg (NOR); Prehypertension SBP 120-139 or DBP 80-89 mmHg (PRE); Stage 1 hypertension SBP 140-159 or DBP 90-99 mmHg (1st); Stage 2 hypertension SBP ≥160 or DBP ≥100 mmHg (2nd). One-way ANOVA and Pearson's product moment correlation were used to determine plasticity of functional fitness of individual BP.

Result: Senior functional fitness had the significant correlations with blood pressure ($p < .05$). In aerobic endurance, NOR is better than 2nd (1.36%) ($p < .005$). Furthermore, significant differences were observed in lower limbs muscle endurance, NOR is higher than 1st and 2nd (8.71%, 1.46%) ($p < .005$). In lower body flexibility, NOR is better than 2nd (98.51%) ($p < .005$). However, in upper body flexibility, NOR and PRE were better than 1st and 2nd ($p < .005$). In body agility/dynamic balance, NOR is faster than 1st and 2nd (9.87%, 16.4%) ($p < .005$).

Conclusion: The participants with better control of the blood pressure have better lower extremity muscle endurance, ability, balance, lower and upper extremity flexibility. The cardiovascular function and upper body flexibility were the most direct influence factors to prevent or manage hypertension.

Keywords: prehypertension, older adults, functional fitness

253 Board #74 May 31 9:30 AM - 11:00 AM
Effects of Resistance Training on Physical Exercise Capacity and Vascular Function Among Elderly Women
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 (No relationships reported)

Aging is associated with a decline in physical exercise capacity and in limb blood flow that could lead to a reduction in overall functional capacity. Exercise training has emerged as an effective therapy to improve the decline in physical and vascular function. **PURPOSE:** The purpose was to examine the effects of whole-body resistance training (RT) on physical exercise capacity and microvascular function among elderly women.

METHODS: Fifteen women (age: 69 ± 7.45 years) were referred by physicians as apparently healthy and signed informed consents prior to testing. These women participated in whole-body RT program performed, 2 days/week for 8 weeks. Before and after training muscle strength [One repetition maximum (1RM) for chest press, biceps curl, leg extension, and leg curl], physical exercise capacity [i.e., six-minute walk test (6MW)], and microvascular function (i.e., vascular reactivity) were measured.

RESULTS: The 1RM for all the muscle strength outcomes increased significantly [chest press: 29.74%, pre = 8.64 ± 2.46 ; post = 11.21 ± 2.91 kg; biceps curl: 37.02%, pre = 9.02 ± 2.45 ; post = 12.36 ± 2.49 kg; leg extension: 19.95%; pre = 34.24 ± 11.76 ; post = 41.07 ± 14.53 kg; leg curl 25.33%; pre = 36.00 ± 8.92 ; post = 45.12 ± 8.52 kg]. The 6MW test increased significantly 15.76% [pre = 564.20 ± 90.83 ; post = 653.10 ± 50.78 m, ($p < .05$)]; and the vascular reactivity index [measured by fingertip digital thermal monitoring] also increased significantly 13.36% [pre = 2.17 ± 0.44 vs. post = 2.46 ± 0.36 , ($p < .05$)].

CONCLUSIONS: Clearly, these findings demonstrate that whole-body RT is capable of increasing physical exercise capacity and microvascular function among elderly women. This study underlies the importance of whole-body resistance exercise training as part of a healthy and active lifestyle in elderly women.

254 Board #75 May 31 9:30 AM - 11:00 AM
Fitness Correlates Of Golf Performance, Exercise Enjoyment, And Mood In Senior Women Golfers
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Senior golfers (≥ 50 yrs of age) constitute approximately 5 million of the 20 million "committed" U.S. golfers (National Golf Foundation, 2016). This number emphasizes that golf is a lifelong physical activity. **PURPOSE:** To investigate the relationships among golf-specific fitness measures, golf performance, exercise enjoyment, and mood alteration. **METHODS:** Female senior golfers completed golf histories, 17 golf-specific fitness screening tests (TPI-fit; *Tiltest Performance Institute*®), golf swing analyses, and the Physical Activity Enjoyment Scale (PACES). Heart rate (HR), ratings of perceived exertion (RPE), and Total Mood Disturbance (TMD) scores on the Profile of Mood States were measured before and after a 6-min walk test (6MWT). Pearson correlations were calculated. **RESULTS:** Descriptive characteristics, means \pm SD: Age (yrs) = 64.1 ± 8.0 ; Body weight (kg) = 71.1 ± 14.3 ; TPI-fit and golf swing analyses = 17.3 ± 4.4 , 13.1 ± 7.9 , "lower is better"; 6MWT (ft) = 1906 ± 213 (67th %ile), RPE = 13.1 ± 2.0 "somewhat hard", HR (b/min) = 127 ± 20 , %HRmax = 81 ± 15 "vigorous." Age was not correlated with any variables, except months of playing golf per year ($r = -0.56$, $p = 0.03$) with older golfers playing fewer months than younger golfers. Age when beginning golf participation was positively correlated with handicap, average scores for 9- and 18-holes, and number of golf swing errors ($r_s = 0.71$, 0.68 , 0.65 ; $p_s < 0.03$). Golfers' body weights were correlated with better TPI-fit scores ($r = -0.64$, $p = 0.01$) and average scores for 9- and 18-holes of golf ($r = -0.67$, -0.65 ; $p_s \leq 0.02$) representing greater strength or leverage during the golf swing. Golfers with better TPI-fit scores tended to have higher exercise enjoyment ($r = -0.42$, $p = 0.09$). TMD scores on the POMS improved (97.4 ± 13.9 , 89.5 ± 15.2 ; $p = 0.06$) after only 6-min of high intensity walking. Greater 6MWT HRs were correlated with greater TMD improvements ($r = 0.49$, $p = 0.05$). **CONCLUSIONS:** Senior women golfers with more years of golf experience, or who were heavier, performed better on TPI golf-specific fitness and swing tests. The women also reported enjoying exercise and desirable changes in mood after aerobic exercise. Future studies of senior women golfers are needed to continue examining the role of golf participation in seniors' fitness levels and overall subjective well-being.

255 Board #76 May 31 9:30 AM - 11:00 AM
Relationships Among and Differences between Muscle Quality and Functional Performance in Younger and Older Women
 Mitchel A. Magrini, Ryan J. Colquhoun, Alejandra Barrera-Curiel, Ryan M. Thiele, Tyler W.D. Muddle, Jason M. DeFreitas, Doug B. Smith, Nathaniel D.M. Jenkins. *Oklahoma State University, Stillwater, OK.*
 (No relationships reported)

The quality of skeletal muscle has been identified as an important factor that is used to describe intramuscular changes associated with muscle function in aging. Traditionally, muscle quality (MQ) has been calculated as maximal muscle strength expressed per unit of muscle mass. More recently, however, the echo intensity (EI) of skeletal muscle ultrasound images has been used as a surrogate measure of muscle quality. **Purpose:** The purpose of this study was to examine the relationships among and differences between commonly-used measures of MQ and functional performance in younger (YW) and older women (OW). **Methods:** 15 YW (mean \pm SD: 22 ± 2 yrs) and 15 OW (74 ± 5 yrs) completed this study. Muscle cross section area (mCSA) and EI of the rectus femoris were measured from ultrasound scans at the midpoint of the thigh. Each participant completed two maximal voluntary isometric knee extension contractions (MVICs) to determine MVIC strength. Each participant also completed three maximal velocity sit-to-stand movements, during which power and movement velocity were measured. MQ was calculated as MVIC strength \div mCSA. Independent samples t-tests were used to analyze differences between YW and OW and Pearson's correlation coefficients were also used to analyze the relationships among the dependent variables in the YW and OW. **Results:** MVIC strength (166 ± 37 vs 105 ± 28 Nm), mean velocity (0.6 ± 0.1 vs 0.4 ± 0.1 m/s), peak velocity (0.9 ± 0.2 vs 0.7 ± 0.1), mean power (435 ± 81 vs 299 ± 57 W), peak power (1070 ± 265 vs 597 ± 127 W) were greater and EI (39 ± 8 vs 52 ± 10 au) was lower in the YW than OW, respectively. There was no difference in muscle quality ($p = 0.96$). EI and MQ were not significantly related ($r = 0.12$) in the YW, but were significantly related in the OW ($r = 0.54$). EI was inversely related to mCSA in the YW ($r = -0.53$) and OW ($r = -0.54$). In addition, MVIC was significantly related to mCSA ($r = 0.75$) in the OW, and was not significantly related to EI or MQ in either the YW or OW. **Conclusion:** There were age-related differences in muscle strength, muscle size, echo intensity, and functional performance, but no age-related difference in traditionally measured MQ. EI was related to MQ in the OW, but not the YW. Although EI has been used as a surrogate for MQ, these data suggest that MQ and EI may reflect different qualities of skeletal muscle in aging.

A-42 Free Communication/Poster - Blood Flow Restriction

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

**256 Board #77 May 31 9:30 AM - 11:00 AM
Acute Neuromuscular Adaptations In Response To Low-intensity Blood-flow Restricted Exercise And High Intensity Resistance Training**

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Numerous studies have reported similar neuromuscular adaptations between low-intensity (LI) blood-flow restricted exercise (LI BFR) and high-intensity (HI) resistance training. Unfortunately, since none of these experimental designs individualized BFR levels to each participant, their findings are difficult to interpret. **PURPOSE:** To compare the acute effects of LI BFR (80% of absolute vascular occlusion pressure) with LI non-BFR and HI training on muscle torque, activation and neuromuscular fatigue. **METHODS:** Ten men (23.8 ± 5.4 yrs) exercised at 20 (LI) and 75% (HI) of 1 repetition maximum. LI consisted of 4 sets of knee extensions (30+15+15+15 repetitions) with and without BFR. HI included 4 sets of knee extensions (10+10+10+10 repetitions) without BFR. BFR pressure was determined individually using resting blood-flow measurements. Torque was determined during maximal voluntary contractions (MVC) before and after exercise. Surface electromyographic activity (root mean square - RMS and median frequency - MF) was recorded for the rectus femoris (RF) and vastus medialis (VM) muscles, before and after each session of training, during isometric contractions performed at 20% MVC. **RESULTS:** Torque decreased post-HI and LI BFR (-9.5 and -7.8%, respectively; p<.05), but not after LI without BFR. The MF was reduced following HI in the VM and the RF muscles (-5.3 and -12.5%, respectively; p<.05). Conversely, the impact of LI BFR on reducing MF was limited to the RF muscle (-10.7%, p<.05). The RMS values for the VM only increased after LI BFR (+26.3%, p<.05). In contrast, while RMS decreased by 19.0% post-HI (p<.05), this was not seen after LI with or without BFR. **CONCLUSION:** LI BFR is as effective as HI in decreasing post-exercise MVC. However, since our data unequivocally demonstrate that the neuromuscular impact of HI is more profound than that of LI BFR, it should be emphasized that the use of high mechanical loads represents a stronger stimulus for muscular adaptation.

**257 Board #78 May 31 9:30 AM - 11:00 AM
Acute Effects of Blood Flow Restriction Cuffs During Aerobic Exercise on Hemodynamics in Females**

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PURPOSE: The purpose of this study was to investigate the acute effects of a 20-minute walk/run at 40% VO₂ with and without blood flow restriction (BFR) cuffs on pulse rate (PR), stroke volume (SV), cardiac output (CO), cardiac ejection time (CET), systemic vascular resistance (SVR) and total vascular impedance (TVI) when compared to a 60-minute walk/run at 65% VO₂ without BFR in females. **METHODS:** Seventeen female subjects, between the ages of 18 and 40, were familiarized with the study protocol, had thigh circumference (THC) measured, and performed the Bruce protocol on the first day. BFR cuff inflation was based on THC. The three randomized sessions: 1) 40% VO₂ with BFR for 20 minutes (BFR-20min), 2) 40% VO₂ without BFR for 20 minutes (no-BFR-20min), and 3) 65% VO₂ without BFR for 60 minutes (no-BFR-60min). Each session began with the subject reaching a hydration status at or below 1.010. Once the hydration levels were reached, the subject would lie down, in the supine position, and have baseline hemodynamics measured. Following baseline measurements, the subject walked/run at a randomly predetermined intensity and time with or without BFR cuffs. BFR cuffs were taken off immediately after the 20-minute BFR condition. Post measurements of hemodynamics were taken at 10, 20, and 40 minutes following exercise. Conditions were separated by at least 48 hours. **RESULTS:** Significant condition main effects were found in PR (p<.01, BFR-20min vs. no-BFR-60min), SV (p<.01, BFR-20min vs. no-BFR-60min), CET (p<.04 no-BFR-20min vs. no-BFR-60min). Significant time main effects were found in PR (p<.01), SV (p<.01), CO (p<.04), CET (p<.01), SVR (p<.04), and TVI (p<.01). Significant condition*time interactions were found in PR (p<.01), SV (p<.01), CO (p<.02), SVR (p<.04), and TVI (p<.01).

CONCLUSIONS: The BFR-20min condition, at 40% VO₂, elicited higher SV and lower PR responses than the no-BFR-60min condition using 65% VO₂, which might be caused by the use of a lower intensity that produced a lower sympathetic nervous system response. Furthermore, the no-BFR-60min condition produced a lower response in SVR and TVI than the no-BFR-20min condition that may have been caused by a greater release of nitric oxide from the session length that was thrice as long.

**258 Board #79 May 31 9:30 AM - 11:00 AM
Impact of Blood Flow Restricted Cycle Training in College-Aged Triathletes on Performance and Physiological Parameters**

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(No relationships reported)

Aerobic exercise training with blood flow restriction (BFR) has been reported to increase aerobic capacity and muscle strength and volume. However, there is no evidence that such a training strategy increases performance in athletes. **PURPOSE:** To elucidate the effects of a 4 week BFR cycle training protocol on aerobic capacity, muscle function and performance variables in triathletes of a university club. **METHODS:** Eighteen healthy university triathletes were randomly assigned to BFR group (n = 12; 19 ± 1 yrs) or no BFR group serving as the control (CON; n = 6; 20 ± 1 yrs). Both groups trained by cycling for 30 minutes, 3 days/week for 4 weeks. BFR was performed for 15 minutes total during each session as 5 minutes with BFR followed by 5 minutes without BFR, by applying cuffs to the upper thighs. The BFR group was further subdivided into two groups: one group with compression set to 160 mmHg (constant pressure, BFR-CP, n = 6); in the other, the compression was gradually increased from 160 to 190 mmHg over 4 weeks (incremental pressure, BFR-IP, n = 6). All tests were performed before (Pre) and after 4 weeks of training (Post). Triathlon-specific performance tests were used: 5000-m run and 1500-m swim time trials and a 20-min bike distance trial, as well as the evaluation of peak oxygen uptake (VO_{2peak}), one legged knee extensor strength, and thigh muscle cross sectional area (CSA). Two-way repeated ANOVAs were used (BFR vs CON or BFR-CP vs BFR-IP and Pre vs Post) with significance accepted as p<0.05. **RESULTS:** VO_{2peak} significantly increased after the training (main effect of time) and significant group-by-time interactions were detected (3198 to 3449 mL/min and 3152 to 3212 mL/min in BFR and CON). However, a post-hoc analysis indicated no significant interaction in VO_{2peak} between BFR-CP (3137 to 3396 mL/min) and BFR-IP (3259 to 3501 mL/min). Although the 5000-m run time was significantly shorter after the training (main effect of time), no significant interaction were detected (20.3 to 19.8 min and 20.1 to 19.8 min in BFR and CON). Lastly, there were no significant effects of training on muscle strength or CSA, 1500-m swim time, or 20-min bike distance. **CONCLUSIONS:** In this group of university triathletes, 4 weeks of BFR cycle training increased aerobic capacity, but had no added effect on muscle strength and volume or performance test outcomes.

**259 Board #80 May 31 9:30 AM - 11:00 AM
Influence Of The Degree Of Blood Flow Restriction On Muscular Activity During Bench Press Exercise**

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Abstract; It has been reported that blood flow restriction (BFR) induced increases in muscle activation are correlated with decreased muscle blood flow resulting from external compression (i.e. higher relative pressures) (Sugaya M; 2011). However it has been reported that higher relative pressures may not be necessary with low-intensity exercise with BFR (Loenneke JP et al; 2015). **PURPOSE:** The purpose of this study was to compare the effects of resistance exercise with different degrees of BFR on muscle activation. **METHODS:** 15 healthy adults performed 3 sets of bench press exercise (30, 15, and 15 reps; load: 30% 1RM) during 4 different BFR conditions: non pressure (N-BFR), low pressure BFR (L-BFR), middle level pressure BFR (M-BFR), and high pressure BFR (H-BFR). Surface EMG was recorded from the pectoralis major muscle (PM), anterior deltoid muscle (AD), and the triceps brachii muscle (TB), EMG amplitude (RMS) normalized as the relative exercise intensity (%) was analyzed (2-way repeated measures analysis of variance, and multiple post hoc test). **RESULT:** During 3 sets of exercise, gradual increases in RMS were observed in all muscles. The RMS of AD were 44.0±9.4-52.4±12.1-54.7±13.2 (mean±SD, %, 1set-2set-3set, N-BFR), 47.4±11.6-57.4±15.9-61.9±17.4 (L-BFR), 42.1±8.0-58.3±12.2-65.4±15.7 (M-BFR), and 47.0±12.3-68.2±25.9-77.3±33.9 (H-BFR). Interactions

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between BFR conditions and sets for AD had significant effects ($F=2.53, p<0.05$). The main effect of BFR conditions was significant for PM, average of 3 sets (mean \pm SD, %), N-BFR: 46.8 \pm 7.6; L-BFR: 52.4 \pm 14.3; M-BFR: 52.2 \pm 11.7 < H-BFR: 61.5 \pm 21.1, $F=3.06, p<0.05$, but was not significant for TB (N-BFR: 46.5 \pm 14.7; L-BFR: 55.9 \pm 20.1; M-BFR: 50.5 \pm 10.8; H-BFR: 52.1 \pm 17.4, $F=0.86, p>0.05$). **CONCLUSION:** These findings indicate that muscle activation was affected by relative differences in applied pressure for non-restricted trunk muscles (i.e. PM and AD), but not affected for restricted limb muscle (i.e. TB). Previous studies have focused on restricted limb muscle following single-joint resistance training. Therefore, it is important that the influence of the degree of blood flow restriction on muscle activation is investigated in multi-joint exercise. :

260 Board #81 May 31 9:30 AM - 11:00 AM
Can Blood Flow Restriction Augment Post Activation Potentiation in College-Aged?

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 (No relationships reported)

It has been shown that blood flow restriction (BFR) can enhance muscular performance, however, it remains unknown if BFR can augment post activation potentiation (PAP). **PURPOSE:** To determine whether BFR can enhance PAP induced by either whole body vibration (WBV) or isometric maximal contractions (IMVC) as measured by jump performance in college-aged males. **METHODS:** Resistance trained men ($n=20$) ages 18-30 years participated in a randomized, crossover design with repeated measures. Subjects visited the lab on 4 occasions. The first visit was for familiarization, and the second visit was the control condition (CON - 3 vertical jumps (VJ) to calculate jump height and power, followed by 10 min rest, then 3 VJ). For visits 3 and 4, subjects performed 2 different treatment conditions (pre, treatment, post), separated by 30 minutes of rest on each day. The 4 treatment conditions included whole body vibration (WBV), whole body vibration with BFR (WBVK), maximal voluntary contractions (MVC) and maximal voluntary contractions with BFR (MVCK) both via deadlift. Repeated measures ANOVA compared conditions for percent changes in power and jump height as well as for the raw power and height values (time (2) x condition (5)). **RESULTS:** There were significant differences in percent change in jump height for 3 of the 4 interventions compared to CON (-1.5 \pm 1.0): WBV 3.0 \pm 9.9% ($p=.002$); WBVK 2.8 \pm 9 ($p=.002$); and MVCK 3.5 \pm 1.0 ($p=.006$) but not for the MVC condition 0.8 \pm 1.2 ($p=.145$). There were no significant differences in percent change in jump power for any condition. For raw jump height (inches), there was a significant condition x time interaction ($p=.001$) and a significant main effect for time ($p=.004$) or about a 1 inch increase from pre to post across all conditions) but no significant main effect for condition ($p=.100$). There were no significant main effects or interaction effect for jump power (W). **CONCLUSION:** The 4 conditions (not including CON) significantly improved jump height (but not power), however, the addition of BFR did not enhance PAP or jump performance. These findings suggest the BFR protocol may not have been a strong enough stimulus to enhance PAP since we used a constant restriction pressure for all subjects (160 mmHg) rather than individualizing the pressures based on total occlusion pressures.

261 Board #82 May 31 9:30 AM - 11:00 AM
Blood Flow Restriction Training Improves Functional Tests Associated with Return to Sport After Injury

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 (No relationships reported)

Introduction:

Traditional strength training with high load resistance is not practical for patients with orthopedic injuries and often not tolerated well by sedentary individuals. Blood flow restricted training (BFRT) is an emerging way to increase muscle strength using low loads and high repetitions. However, whether this strength training method also transfers to functional outcomes used in rehabilitation, such as hop testing, is unknown. We hypothesized that BFRT would significantly improve muscle strength and hop test performance used in making return to sport decisions.

Methods:

4 healthy females and 7 males (24.5 \pm 7.25 years old) who were not currently participating in strength training completed the study. Kaatsu BFRT bands were placed on the subjects' thighs while they performed leg extension, calf raises, and leg press exercises starting at 30% of their 1 RM max, 3 times per week for 6 weeks. Resistance was adjusted every other training session. Isometric quadriceps strength was measured on a Biodex. Single leg hop and triple hop performance were measured before and after the study. Strength and hop distances were compared before and after KAATSU strengthening with a paired t-test.

Results:

Significant improvements were found for peak quadriceps strength (pre: 170.0 \pm 47.98 N, post: 197.1 \pm 57.2 N, $p=.037$), single leg hop (pre: 128.9 \pm 33.8cm, post: 154.2 \pm 33.4cm, $p=.007$), and triple hop (pre: 405.5 \pm 106.4cm, post: 428.4 \pm 104.1cm, $p=.025$).

Conclusions:

BFRT is associated with significant improvements in muscle hypertrophy and functional improvements in healthy subjects. There were significant improvements in hop testing distances, indicating the benefits of BFRT extend beyond improved strength. Subsequent studies should evaluate the possibility of creating BFRT programs that target injury-specific muscle groups when high load resistance training is contraindicated due to surgery or injury.

262 Board #83 May 31 9:30 AM - 11:00 AM

Acute Effects Of Aerobic Exercise With Blood Flow Restriction Cuffs On Arterial Compliance In Males

Magalie Sanchez, Margarita Gonzalez, Brittany Esparza, Patrick Murphy. *University at Texas Rio Grande Valley, Brownsville, TX.*
 Email: magalee717@yahoo.com
 (No relationships reported)

PURPOSE: The purpose of this study was to examine the acute effects a 20-minute run, at 40% VO₂, with and without blood flow restriction (BFR) cuffs has on systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and pulse pressure (PP) when compared to a 60-minute run at 65% VO₂ without BFR in males. **METHODS:** On the first session, seventeen male subjects (between the ages of 18 and 50) were familiarized with the study protocol, measured for thigh circumference, and performed the Bruce protocol. Inflation of BFR cuffs was based on thigh circumference. Conditions were randomized into three sessions, 1) a 60-minute walk/run without BFR cuffs at 65% VO₂ intensity, 2) 20-minute walk/run at 40% VO₂ intensity with the BFR cuffs inflated, and 3) 20-minute walk/run at 40% VO₂ intensity without BFR. Participants were required to show up hydrated, reaching a status at or below 1.010, and with at least 8-hour fasted during the three separate randomized sessions. After the subject reached set hydration levels, they would lie down in a supine position and have baseline blood pressure measurements taken. After blood pressure was taken, subject would walk/run for 20 or 60 minutes at a moderate intensity (40% or 65% VO₂) with or without BFR cuffs. BFR cuffs were placed before condition three and were taken off immediately post exercise. Upon completion of the exercise, participants laid back into the supine position and had post measurements, of blood pressure, taken post 10, 20, and 40 minutes. Sessions were separated with at least 48 hours. **RESULTS:** Significant condition main effects were found in SPB ($p<.05$). Significant time main effects were found in SPB ($p<.02$) and PP ($p<.05$). Significant condition time main effects were found in SPB ($p<.01$) and DBP ($p<.01$). **CONCLUSION:** The results conclude that the 60-minute condition had lower post SBP measurements than the 20-minute BFR and non-BFR conditions, which can be caused by vasodilation, due to the possible increase in nitric oxide, that created less pressure in the arteries from the large difference in activity length when compared to the 20-minute sessions.

263 Board #84 May 31 9:30 AM - 11:00 AM

Differences in Neuromuscular Adaptations After Two Weeks of Conventional vs Blood Flow Restriction Resistance Training

Danny D. Dominguez, Patrick Gage Murphy, Brittany N. Esparza, Gabriela Soto, Roberto Osornio, IV, Ulku Karabulut, Murat Karabulut. *University of Texas at Rio Grande Valley, Brownsville, TX.*
 (No relationships reported)

PURPOSE: The purpose of the study was to determine the neuromuscular changes in the rectus femoris (RF) muscle as measured by electromyography (EMG) following short-term resistance training with and without blood flow restriction (BFR). **METHODS:** 12 males (age = 27.4 \pm 6.3 years; height = 171 \pm 7 cm; weight = 79.8 \pm 13.2 kg) performed six sessions of lower body unilateral resistance training using a leg extension machine. The leg on which BFR was applied was determined through randomization leg dominance. Each training session consisted of unilateral knee extensions with and without blood flow restriction. Electromyography data was recorded for each participant during two isometric maximum voluntary contractions (MVC) and two isokinetic knee extension tests (180°/s and 60°/s) using a Biodex System 4 Pro™. EMG was recorded from the RF during these tests. Resistance training consisted of six non-consecutive sessions of knee extension exercises performed in a time frame of two weeks. For the BFR group, subjects trained for a total of four sets (30, 15, 15, 15) at an intensity of 20% 1RM. The contralateral limb was trained with two sets of 11 repetitions at an intensity of 70% 1RM without BFR. The volume of exercises was similar for both conditions. **RESULTS:** No condition*time interactions or condition and time main effects were observed for root mean square (RMS), mean RMS (mRMS), yMax (yRMS), and median frequency (MDF) in both MVC and isokinetic 180°/s and 60°/s ($p>0.05$). **CONCLUSIONS:** Both training conditions resulted in insignificant changes and there was no significant difference found between time points. It could be concluded that this was not enough time or stimulus to note major differences across modalities in relation to neuromuscular adaptations of the RF as measured by EMG. Further studies should investigate the effects of higher volume load on neuromuscular adaptations.

A-43 Free Communication/Poster - Cardiovascular Disease

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

**264 Board #85 May 31 9:30 AM - 11:00 AM
Long-term Changes Following Weight Loss in Older Patients with Heart Failure with Preserved Ejection Fraction**

Thomas Becton¹, James Muller², Peter Brubaker, FACSM², Barbara Nicklas¹, Dalane W. Kitzman¹. ¹Wake Forest School of Medicine, Winston-Salem, NC. ²Wake Forest University, Winston-Salem, NC. (Sponsor: Peter Brubaker, FACSM)
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(No relationships reported)

Heart failure with preserved ejection fraction (HFpEF) is the most common form of heart failure among older persons, and >80% of patients are overweight/obese. Increased adiposity is associated with numerous systemic impairments that contribute to HFpEF pathophysiology, and is significantly correlated to severity of exercise intolerance, the primary symptom in HFpEF. Yet only one study has examined the effects of caloric restriction (CR) with or without aerobic training (AT) in older HFpEF patients. The Study of Caloric Restriction and Exercise Training (SECRET) demonstrated that a short-term (20-weeks) CR or AT+CR intervention resulted in significant weight loss and led to significant improvements in peak VO₂ and quality of life. However, whether these changes are sustained over time is not known.
PURPOSE: To evaluate long-term changes in exercise function and body composition in older HFpEF patients after completion of the SECRET interventions. **METHODS:** Sixteen patients, from CR or AT+CR groups (≥10 kg weight loss), underwent maximal treadmill exercise and DXA body composition assessment 29 ± 11 months (range 10-47 months) after completion of their SECRET trial participation. Paired t-tests were used to compare changes over time. Pearson correlations were used to explore the relationship between body composition measures. **RESULTS:** Compared to status at trial end, at follow-up, mean weight change was +5.2 ± 3.8 kg. There was a significant increase in fat mass (+4.9 kg, p<0.001), but not lean mass (+0.3 kg, p=0.67). There was a significant correlation between change in total mass and fat mass (r = 0.75, p=0.001), but only a trend between change in total mass and lean mass (r = 0.49, p=0.053). There was also a significant decrease in relative peak VO₂ (-2.2 ± 2.1 ml/kg/min, p=0.003) and exercise time (-2.4 ± 2.6 min, p=0.006), with a trend for absolute peak VO₂ (-87 ± 152 ml/min, p=0.062). **CONCLUSIONS:** While CR and AT+CR in older HFpEF patients produces significant improvements in exercise tolerance associated with improved body composition, these positive changes appear to diminish during long-term follow-up, and regained weight appears to be mostly fat. This suggests a need for long-term interventions to prevent weight regain and maintain improvements in physical function and body composition in older HFpEF patients.

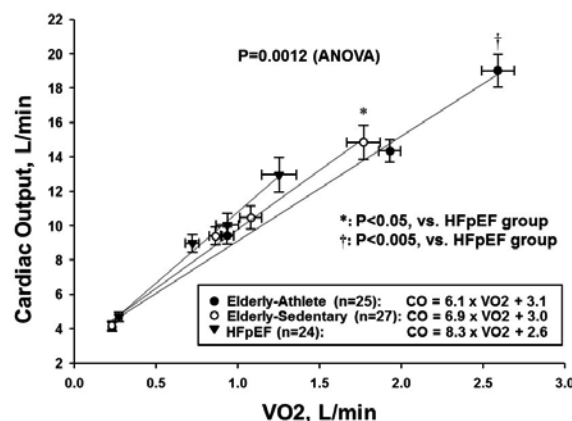
**265 Board #86 May 31 9:30 AM - 11:00 AM
PeakVO₂-cardiac Output Relationship During Exercise In Seniors Who Are Sedentary, Athletic, And HFpEF Patients**

Michinari Hieda, Sarma Satyam, Christopher Hearon Jr., Justin Lawley, Ashley Hardin, Mitchel Samels, Jose Martinez Diaz, Braden Everding, Dean Palmer, Lisa Hicklen, Margot Morris, Sheryl Livingston, Jeungki Yoo, Qi Fu, Rong Zhang, Benjamin D. Levine. *The Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital, Dallas, TX.*
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(No relationships reported)

PURPOSE: The purpose of this study was to evaluate the relationship between O₂ uptake (VO₂) and cardiac output (Qc) during exercise in seniors who were sedentary, athletic, and Patients with HFpEF.
METHODS: Based on lifestyle physical activity level categorization, elderly-sedentary seniors (n=27, 69±5 yrs) and elderly-athletic seniors (n=25, 68±3 yrs), and patients with heart failure with preserved ejection fraction (HFpEF) (n=24, 71±7 yrs) were selected and underwent cardiopulmonary exercise testing. A modified Astrand-Saltin incremental treadmill protocol was performed to determine VO₂ and ventilatory gas exchange using the Douglas bag technique. Cardiac output (Qc) was measured with the C2H2 rebreathing method. Peak arterial-venous O₂ difference (peak AV-O₂ diff) was calculated by Fick equation (peak VO₂ divided by peak Qc). The slope of the relationship between changes in VO₂ and Qc during exercise was calculated by ΔQc/ΔVO₂.
RESULTS: Peak VO₂ and peak Qc was lower in HFpEF group than the other groups (peak VO₂: HFpEF: 13.1±3.6; vs. Sedentary: 23.5±4.4; vs. Athlete: 39.5±5.3 ml/kg/

min, P<0.001 (ANOVA) as was peak Qc: HFpEF: 12.7±4.1; vs. Sedentary: 14.8±4.1; vs. Athlete: 19.0±6.0 L/min, P<0.001 (ANOVA)). Peak AV-O₂ diff in HFpEF group was the smallest in the 3 groups (HFpEF: 9.7±2.3; vs. Sedentary: 12.2±3.0; vs. Athlete: 14.3±3.6 %, P<0.0001 (ANOVA)), and the Athlete group was greater than the Sedentary group (P=0.04 (Wilcoxon rank-sum)). The relationship between Qc and VO₂ (slope of ΔQc/ΔVO₂) is shown in Figure.
CONCLUSIONS: Both reduced Qc and AV-O₂ diff contribute significantly to the impairment of exercise capacity in HFpEF through Qc is augmented for a given VO₂. Lifelong exercise training enhances Qc and peak AV-O₂ diff in the elderly population and normalizes Qc/VO₂ relationship.

Relationship between Cardiac Output and VO₂



**266 Board #87 May 31 9:30 AM - 11:00 AM
Self-Reported Screen Time is Independently Associated with Cardiometabolic Disease Risk Factors in Young Adults**

Kathleen R. Connor, 83843¹, Katrina Taylor², Devin Drummer³, Megan C. Nelson¹, Chantal Vella, FACSM¹. ¹University of Idaho, Moscow, ID. ²Eastern Washington University, Cheney, WA. ³Central Washington University, Ellensburg, WA.
(No relationships reported)

Research has shown that self-reported screen time is linked to cardiometabolic disease risk factors in children. Whether this association extends to young adults has not been investigated. **PURPOSE:** To determine the associations between self-reported screen time and individual cardiometabolic disease risk factors in young adults. **METHODS:** Sixty-six young adults volunteered for the study (mean±SD: age 20.6±1.4 y; BMI 24.3±3.6 kg/m²; body fat 22.7±8.8%; peak oxygen consumption [VO₂peak] 45.7±7.7 ml/kg/min). Sedentary behavior and screen time (television viewing, video games and computer games) were self-reported using the Sedentary Behavior Questionnaire. Moderate-to-vigorous physical activity (MVPA) was objectively measured by 7 d of accelerometer wear. Cardiometabolic disease risk factors were measured using standard procedures and included waist circumference, blood pressure, glucose, triglycerides (TG), high-density lipoprotein cholesterol (HDL) and low-density lipoprotein cholesterol (LDL). Body composition was estimated by BOD POD and VO₂peak was measured by indirect calorimetry using an incremental treadmill test to exhaustion. Multiple regression was used to analyze the independent associations between screen time and individual cardiometabolic disease risk factors with sedentary behavior, MVPA, age, and sex used as covariates in the models. **RESULTS:** On average, screen time (14.8±11.6 h/week) accounted for 25% of total sedentary behavior (59.0±25.8 h/week). Screen time was positively associated with BMI (R²=0.19, β=0.35, p=0.02), waist circumference (R²=0.19, β=0.43, p<0.01), fat mass (R²=0.39, β=0.34, p=0.01), and TG (R²=0.24, β=0.43, p<0.01), and negatively associated with VO₂peak (R²=0.66, β=-0.39, p<0.01). These associations were independent of total sedentary behavior, MVPA, age and sex. Screen time was not associated with blood pressure, glucose, HDL or LDL (p>0.05).
CONCLUSIONS: Our findings suggest that screen time is related to individual cardiometabolic disease risk factors in young adults. Screen time accounted for 25% of sedentary time and may be an important area to target for chronic disease prevention programs in young adults.
Funded by CTR-IN NIH NIGMS #1U54GM104944-01A1

WEDNESDAY, MAY 31, 2017

267 Board #88 May 31 9:30 AM - 11:00 AM
The Relationship Between CAD Risk Factors And Carotid Intima-media Thickness (cimt) In Children
 Daniel J. White. *University of New England, Biddeford, ME.*
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 (No relationships reported)

Increased carotid intima-media thickness (CIMT) is accepted as an early indicator for the development of atherosclerotic coronary artery disease (CAD). The presence of CAD risk factors is shown to have a negative influence on CIMT. As obesity rates increase in children which negatively alters CAD risk factors, it is unclear how this might alter CIMT. **PURPOSE:** The purpose of this study was to determine if there is a relationship between children's CIMT and CAD risk factors as well as number of CAD risk factors combined. **METHODS:** One hundred and nineteen children (age 10.51±0.52, height 147.2±7.05cm, and weight 46.51±12.21kg) took part in the CIMT assessment. Subjects were randomly selected from the Cardiovascular Health Intervention Program. Subjects had previously completed a fasting blood lipid and glucose profile, height, weight, and resting blood pressure to evaluate CAD risk factors. A licensed sonographer completed scans on the right and left common carotid using the ultrasound unit (Terason t3200) with a linear transducer probe. CIMT was measured using the software The Carotid Analyzer for Research Version 6. **RESULTS:** An increase in CIMT was observed in the right ($p<.05$), left ($p<.01$) and combined right and left CIMT ($p<.001$) in children with an elevated BMI ($>85^{th}$) Vs those with a healthy BMI. The children with elevated blood pressure ($>95^{th}$) had an elevated CIMT in both the left ($p<.001$) and combined left and right CIMT ($p<.05$). In respect to elevated blood glucose ($> 100\text{mg/dl}$), only an elevated CIMT was observed in the right CIMT ($p<.05$). When comparing CIMT to number of CAD risk factors, an increase in CIMT ($p<.05$) was observed in children with 2+ CAD risk factors Vs 0 CAD risk factors. **CONCLUSION:** It appears elevated BP, BMI and glucose have a negative influence on CIMT in children. Changes in CIMT (left VS right) appear to be different based on the CAD risk factor of interest. Children with 2+ CAD risk factors appear to have an adverse effect on CIMT, strongly suggesting the need for early healthy life-style intervention. This research supports previous research looking at CIMT in children with CAD risk factors. Funding provided by Clark Charitable Foundation (Subcontract from Children's National Medical Center, Washington, DC)

268 Board #89 May 31 9:30 AM - 11:00 AM
The Effect of Moderate Resistance Exercise on Arterial Stiffness With and Without the Valsalva Maneuver
 Nicole M. Fortunato, Christa Winter, Elizabeth O'Neill, Samuel A.E. Headley, FACSM. *Springfield College, Springfield, MA.*
 (Sponsor: Samuel Headley, FACSM)
 (No relationships reported)

Resistance exercise has been said to increase arterial stiffness. The Valsalva maneuver can be used while performing resistance exercise, and may also contribute to negatively altering arterial stiffness. **PURPOSE:** The study was designed to determine the effect of moderate intensity resistance exercise on arterial stiffness with and without the Valsalva maneuver. **METHODS:** Subjects ($N = 13$) consisted of males between 18-30 years old who were familiar with resistance training. All subjects completed one session of moderate intensity resistance exercise (60% of 1-RM) with the Valsalva maneuver, and a second session without the Valsalva maneuver in a counterbalanced order. Pulse wave velocity (PWV) was used to measure arterial stiffness before exercise, 10 min post, 30 min post, and 60 min post exercise. **RESULTS:** No significant interaction $F(3,36) = 0.74, p = .54$ was found between the condition of Valsalva maneuver, or no Valsalva maneuver, and the test occasion. No significant main effect $F(1,12) = 0.02, p = .89$ was found for the treatment condition of Valsalva maneuver and no Valsalva maneuver. Also, no significant main effect $F(1,96, 23.57) = 0.18, p = .84$ was found for test occasion (pre-exercise, 10 min post, 30 min post, and 60 min post exercise). **CONCLUSION:** Moderate intensity resistance exercise with and without the Valsalva maneuver did not negatively affect arterial stiffness.

269 Board #90 May 31 9:30 AM - 11:00 AM
Patterning Of Physiological And Perceptual Responses To Exercise: Effect Of Sympathetic Blockade
 Kade Davison, Braden L. Mitchell, Gaynor Parfitt, Simon Spedding, Roger G. Eston. *University of South Australia, Adelaide, Australia.*
 (No relationships reported)

The rating of perceived exertion (RPE), a subjective indicator of exercise intensity, is becoming increasingly popular for monitoring and prescribing exercise intensity in clinical populations. It remains unclear whether the relationship between RPE and oxygen uptake (VO_2) is affected by perturbations to the sympathetic nervous system.

Purpose: To determine whether acute sympathetic blockade alters the relationship between heart rate (HR), RPE and VO_2 during incremental exercise. **Methods:** Eleven healthy adults completed two graded exercise tests (GXT) on a motorized treadmill, under a β_2 receptor antagonist and placebo. Treadmill speed increased by 2 $\text{km}\cdot\text{h}^{-1}$ every 2 min and participants reported their RPE (Borg 6-20 RPE Scale) each min until exhaustion. The VO_2 and HR were measured continuously. Linear regression modelled the growth of individual participant relationships of RPE and HR with VO_2 . To account for differences in peak HR between conditions, values were expressed relative to the peak HR from each GXT. Paired sample t-tests assessed differences in the slope (b) of the individual regression models between conditions. **Results:** The $\text{VO}_{2\text{peak}}$ and HRpeak were lower during β -blockade (51.9 ± 5.3 vs 48.6 ± 7.5 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, $p<0.05$; 192.7 ± 8.2 vs 156.0 ± 23.1 $\text{b}\cdot\text{min}^{-1}$, $p<0.01$, respectively). As expected, the slope for the relationship between HR and VO_2 was greater during β -blockade (b 0.37 ± 0.03 vs 0.48 ± 0.07 , $p<0.01$), however, there was no significant difference in the slope of the RPE: VO_2 relationship (b 3.34 ± 0.71 vs 3.30 ± 0.77 , respectively $p>0.05$) and no significant difference in b when HR was expressed relative to the peak HR during the GXT (b 0.71 ± 0.07 vs 0.73 ± 0.07 , $p>0.05$). **Conclusion:** Despite a marginally lower $\text{VO}_{2\text{peak}}$, the relationship between RPE and VO_2 remains unchanged by sympathetic blockade, whereas the absolute HR: VO_2 relationship is significantly altered. This means that RPE can be used in place of HR to determine metabolic work or estimate fitness sub-maximally in individuals taking β -blockade.

270 Board #91 May 31 9:30 AM - 11:00 AM
Exercise-induced Change in Metabolites and Associations with Cardiometabolic Risk Factors
 Andrea M. Brennan¹, Mark Benson², Jordan Morningstar³, Robert E. Gerszten⁴, Robert Ross, FACSM¹. ¹Queen's University, Kingston, ON, Canada. ²Brigham and Women's Hospital, Boston, MA. ³Massachusetts General Hospital, Boston, MA. ⁴Beth Israel Deaconess Medical Center, Boston, MA.
 Email: 12ab87@queensu.ca
 (No relationships reported)

Exercise-induced improvement in risk for chronic disease is attributed to changes in body composition, cardiorespiratory fitness, blood pressure and glucose metabolism; however, the underlying mechanism is unclear. Metabolomics offers the technology needed to investigate large numbers of metabolites that may participate in biochemical pathways of exercise-induced improvement in cardiometabolic risk. **PURPOSE:** To investigate the impact of an exercise intervention on plasma metabolites and whether changes in metabolite levels are related to changes in cardiometabolic risk factors. **METHODS:** A secondary analysis was performed in 216 middle-aged abdominally obese men and women ([mean (SD)], 52.4 (8.0) years) originally recruited to participate in a 6-month randomized controlled trial examining the effects of exercise amount and intensity on cardiometabolic risk factors. 139 metabolites were profiled by liquid chromatography-mass spectrometry. Cardiorespiratory fitness (CRF) was assessed using standard open-circuit spirometry during a maximal graded exercise test. Waist circumference (WC) was measured at the superior edge of the iliac crest. 2-hour glucose was measured in response to a 2-hour 75-g oral glucose tolerance test. Systolic (SBP) and diastolic blood pressure (DBP) was measured using an automated BP monitor. **RESULTS:** Seven metabolites significantly changed in the exercise compared to control group ($p<0.05$). There were no significant associations at the adjusted p-value ($p<0.0004$) between change in metabolites and change in 2-hour glucose, SBP or DBP. Change in leucine ($B=-0.29$), isoleucine ($B=-0.30$) and UDP-N-acetylglucosamine ($B=-0.40$) were negatively associated and citric acid isocitric acid ($B=-0.29$) was positively associated with change in CRF. Change in UDP-N-acetylglucosamine ($B=0.46$) was positively associated with change in WC ($p<0.0004$). **CONCLUSION:** These findings represent a more global effort to uncover the biochemical pathways in which exercise elicits its cardiometabolic effects. These observations implicate several metabolites that may serve as biomarkers or have a direct regulatory role in pathways related to exercise and improved cardiometabolic status.

Supported by Canadian Institute of Health Research Grant

271 Board #92 May 31 9:30 AM - 11:00 AM
Time Course for Blood Pressure Changes with Aerobic Exercise in U.S. Veterans
 Shakeelah Sutton. *Veterans Affairs Medical Center, Washington, DC.* (Sponsor: Peter Kokkinos, FACSM)
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 (No relationships reported)

It is well-established that regular exercise training decreases resting blood pressure (BP). However, the length of exercise training necessary to lower resting BP is not well-defined.

PURPOSE: To assess the time course of exercise-induced BP changes in individuals with resting systolic BP ≥ 130 and/or diastolic BP ≥ 80 mm Hg.

METHODS: Veterans were enrolled in a 12-week hospital-based exercise program that consisted of aerobic exercise two to three times per week. Resting BP was taken manually at the beginning of each session. Exercise intensity was maintained at 60% -80% of heart rate reserve.

We assessed resting BP in 93 patients (61.5 ± 7.8 years) who completed the 12-week intervention. Qualifying resting BP was defined as systolic BP ≥130 mmHg and/or diastolic BP ≥80 mmHg at baseline. Baseline and post BP was obtained during stress tests administered before and after the intervention. Midpoint BP was comprised of the average BP obtained during week 6 of the intervention. Two sided paired sample t-tests were applied.

RESULTS: There was a significant decrease in mean resting systolic BP after 6 weeks of exercise from baseline (138.7 ± 14.6 vs. 130.3 ± 14.1 mmHg; p<0.001). A significant decrease was also found in resting diastolic BP between these two time points (79.9 ± 7.3 vs 74.9 ± 9.1 mmHg; p<0.001). No significant changes in resting BP were observed between midpoint and post-intervention time points. Post-intervention resting systolic BP (129 ± 13.6 mmHg; p<0.001) yielded a 9.7 mmHg decline from baseline while diastolic BP (73.6 ± 9.8 mmHg; p<0.001) yielded a 6.3 mmHg decline (Table).

CONCLUSION: Resting systolic and diastolic BP were significantly lowered after 6 weeks of aerobic exercise training. No additional changes were observed in BP at 12 weeks of exercise. Thus, exercise BP is lowered after just six weeks of aerobic exercise training or approximately 12-18 sessions.

Table.

Resting Blood Pressures During 12-Week Exercise Intervention

	Baseline	Midpoint	Post
Systolic BP (mmHg)	138.7 ± 14.6	130.3 ± 14.1	129 ± 13.6
Diastolic BP (mmHg)	79.9 ± 7.3	74.9 ± 9.1	73.6 ± 9.8

272 Board #93 May 31 9:30 AM - 11:00 AM
The Relationship Between Initiation of Cardiac Rehabilitation and Readmission Rates for Patients with Metabolic Syndrome

Lee Anne Siegmund, Mark McClelland, James Bena. *Cleveland Clinic, Cleveland, OH.*
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 (No relationships reported)

Phase II cardiac rehabilitation (CR) has been shown to be effective at reducing risk factors associated with cardiovascular disease (CVD). A delay in starting CR has been associated with poorer fitness outcomes. The risk of CVD more than doubles in the presence of metabolic Syndrome (MetS). The association between initiation of CR, and hospital readmissions in patients with MetS was previously unknown.

Purpose: We sought to determine the relationship between the length of time to the start of CR, and hospital readmissions in patients with MetS. Further, we aimed to determine if there was an association between demographic and clinical variables, and hospital readmissions in this patient population.

Methods: We examined the records of 353 CR patients at a quaternary medical center who had MetS. Continuous measures were imputed using predicted mean matching regression, while categorical measures were imputed based on logistic models. Readmissions prior to beginning CR were excluded.

Results: Patient readmissions within 90 days were more likely to be non-white (p=0.026) and have a time to CR initiation of ≤ 30 days (p<0.001). Patients readmitted at ≤ 6 months were more likely to be non-white (p<0.001) and have time to CR ≤ 60 days (p = 0.017). Of 54 patients readmitted within 6 months, 75.9% began CR within 60 days and 56.9% were non-white. In multivariable models for readmission within 6 months, those of white race (OR 0.42 [0.18, 0.97]; p=0.041) were less likely to be readmitted. Patients who began CR early were 2.47 times more likely to be readmitted by 6 months (OR 2.47 [1.22, 5.02]; p=0.012).

Conclusions: Patients with MetS were more likely to be readmitted if they were non-white. Early uptake to CR resulted in higher likelihood of readmission at ≥ 90 days. These results raise questions about the health status and other unique traits of patients with MetS who begin CR early. Future studies should focus on designing CR programs to meet the needs of non-whites and those who may be sicker at the onset of CR.

273 Board #94 May 31 9:30 AM - 11:00 AM

The Immediate Blood Pressure Lowering Effects of Acute Concurrent Exercise: A Meta-Analysis

Alyssa Jones¹, Lauren ML Corso¹, Hayley V. MacDonald², Blair T. Johnson¹, Jill Livingston¹, Linda S. Pescatello, FACSM¹.
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(No relationships reported)

Our recent meta-analysis on the blood pressure (BP) lowering effects of concurrent exercise training (CET) found systolic BP (SBP) and diastolic BP (DBP) were moderately reduced an average of ~3 mmHg overall. However, large SBP/DBP (~9/8 mmHg) reductions were noted among adults with hypertension, indicating the potential clinical utility of CET as antihypertensive lifestyle therapy. **PURPOSE:** To perform a meta-analysis to determine whether acute concurrent exercise (CE) is also efficacious antihypertensive lifestyle therapy. **METHODS:** Databases were searched for controlled studies that included: adults (≥19 yr), a single bout of CE, and measured BP pre- and post-CE and control. Analyses followed random-effects assumptions.

RESULTS: 8 studies and 13 interventions (k) qualified. Subjects (N=109) were young to middle-aged (35.9±16.4 yr), overweight (26.7±3.1 kg/m²) men (34.6%) and women (65.4%) with a resting SBP/DBP of 122.3±11.9/76.6±7.2 mmHg. Among the total sample, 38.6% (N=42) had hypertension, 12.4% (N=14) prehypertension, and 49.0% (N=53) normal BP. Acute CE was performed at moderate-to-vigorous intensity (aerobic=65.6±17.5% maximum oxygen uptake, resistance=63.9±16.5% one-repetition maximum) for 55.0±6.1 min, with 53.9% of the interventions performing aerobic first. Aerobic exercise interventions included walking (38.5%, k=5), cycling (38.5%, k=4), running (15.4%, k=2), and step aerobics (7.7%, k=1) for 29.1±3.0 min. Dynamic resistance exercise interventions were performed on machines for 26.1±4.9 min, and consisted of 2.8±1.2 sets of 11.5±5.4 repetitions per set for 5.9±1.2 exercises. BP was measured in the laboratory for 89.2±45.4 min post-CE. Overall, acute CE elicited large reductions in SBP (d_i [95% CI]= -0.84 [-1.23, -0.44]; -9.2 mmHg), but not DBP (d_i [95% CI]= -0.08 [-0.27, 0.11]; -0.6 mmHg) compared to control. We observed significant heterogeneity for SBP (I² [95% CI]= 82.7% [71.6%, 89.4%]) and DBP (I² [95% CI]= 49.7% [4.9%, 73.43%]), but no significant moderators emerged. **CONCLUSION:** Similar to CET, acute CE leads to clinically meaningful reductions in SBP (~9 mmHg), but in contrast to CET, not DBP. The BP lowering patterns appear to differ between acute and chronic CE, findings that should be confirmed in future randomized CE trials.

274 Board #95 May 31 9:30 AM - 11:00 AM

Blood Pressure Reductions Following A 12-week Isometric Training Program: Lab-based Vs. Home-based Approach

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(No relationships reported)

PURPOSE: The American Heart Association (AHA) identified isometric exercise training (IET) as a "potential" supplementary therapy for blood pressure management (Class IIB Level of Evidence C), highlighting a need for further investigation. Importantly, reductions in resting blood pressure (RBP) following IET have been reported in laboratory environments, but data regarding the use of IET in the community are lacking. **METHODS:** Fourteen hypertensive participants (24-60 years) were randomized to one of three conditions; standard laboratory face-to-face delivered IET, home administered IET (with instructional video), and a control condition. IET groups completed handgrip IET at 30% maximal voluntary contraction three days per week for twelve weeks. Changes in resting BP were assessed every six weeks during the training period and six weeks post-training. **RESULTS:** Twelve weeks of IET induced a clinically significant reduction in group mean SBP (class -8.77±6.34; home -8.10±6.13; control -5.77±6.41 mmHg; weeks: p=0.06; treatment p= 0.14). Interestingly, six weeks after training had ended, group mean blood pressure was further reduced in the class condition of IET and SBP was still lower compared to pre-training measures in the home condition, whereas control participants trended towards pre-study measures (class -11.00±7.05; home -6.90±5.68; control -4.55±3.04 mmHg). **CONCLUSIONS:** Twelve weeks of IET produced a clinically relevant reduction in RBP. Similar reductions were observed in both home and class IET conditions with continued reductions taking place post training. These data suggest that self-administered IET in a cohort of hypertensive participants was as effective compared to a laboratory-based setting. Therefore, IET may be an effective and practical intervention for self-management of RBP in the wider community. Additional research is needed, accounting for other factors that affect RBP, to further confirm, IET as an effective intervention for reducing RBP. Supported by a Faculty Research Grant at UNC-Charlotte

WEDNESDAY, MAY 31, 2017

A-44 Free Communication/Poster - Cardiovascular Responses to Exercise

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

275 Board #96 May 31 11:00 AM - 12:30 PM

Acute Electrical Muscle Stimulation Of The Lower Extremities Enhances The Vascular Endothelial Function

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The use of electrical muscle stimulation (EMS) has been shown to potentially improve or compensate for disadvantages in disabled or chronic patients with physical inactivity. However, little is known about the effects of EMS on the arterial function. **PURPOSE:** The aim of this study was to evaluate the effects of EMS to the lower extremities on the vascular endothelial function determined by flow-mediated vasodilation (FMD). **METHODS:** Eight healthy adult men were studied under two experimental trials (EMS and control without any stimulation) in the supine position. In the EMS trial, both lower leg and thigh muscles were sequentially stimulated at 4 Hz for 20 min. Before and after each trial, the brachial systolic and diastolic blood pressure (SBP and DBP) were measured. In order to measure the FMD, a forearm cuff was inflated to 50 mmHg over their SBP for 5 minutes with subsequent deflation. The right brachial artery diameter was measured using a high-resolution ultrasound device. The FMD was then estimated as the percent change in the arterial diameter over the baseline value at maximum dilation during reactive hyperemia. **RESULTS:** In the EMS trial, the FMD was significantly elevated immediately after (12.1±1.1%) and at 30 min after EMS (11.0±0.9%) compared with rest (9.2±0.8%). However, there were no significant changes in the control trial (9.3±0.9% at rest, 9.4±0.8% immediately after C trial, and 9.2±0.9% at 30min after C trial). Immediately after and 30min after each trial, significant differences in the FMD were found between the EMS and control trials ($p < 0.05$). No significant changes were found in the SBP/DBP in either trial. **CONCLUSIONS:** Acute EMS appears to improve the vascular endothelial function. These findings suggest that chronic EMS might be useful for reducing the risk of cardiovascular disease in people suffering from partial paralysis or arthritis as well as in healthy subjects.

276 Board #97 May 31 11:00 AM - 12:30 PM

Prolonged Sitting-Induced Lower Limb Vascular Dysfunction: The Effect of Oxidative Stress

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Prolonged sitting has been reported to result in significant vascular dysfunction due to increases in lower limb pressure and subsequent reductions in shear stress. Oxidative stress, a known modulator of vascular function, has been reported to increase in the vasculature in response to high pressures, but contrary findings exist when attempting to directly link the connection between increased pressure, oxidant production, and resulting vascular dysfunction. Therefore, the direct role of oxidative stress on the observed vascular dysfunction during prolonged sitting is currently unknown. **PURPOSE:** This study sought to examine the impact of oxidative stress on prolonged sitting-induced vascular dysfunction, measured via passive leg movement, by administering an acute oral antioxidant prior to the sitting session. **METHODS:** Seven young (24 ± 1 yrs) healthy males completed two 3-hour sessions of prolonged sitting. Subjects were given either an oral antioxidant (AO) containing 2 grams of vitamin C or a placebo (PL) pill. The supplementation took place following the baseline measures and immediately prior to the sitting session and all supplementation was double-blinded with at least 72 hours separated the two sitting sessions. Leg vascular function was assessed with passive leg movement (PLM) immediately prior to sitting, 1.5 hours, and 3 hours after the onset of the sitting session. **RESULTS:** Leg vascular function (assessed via PLM-induced hyperemia) was revealed to be significantly reduced following the three hours of prolonged sitting in the PL condition when evaluated as both Δ LBF (Baseline: 1214 ± 229; 3 hours: 904 ± 196 ml·min⁻¹; $p < 0.05$) and LBF area under the curve (AUC) (Baseline: 500 ± 158; 3 hours: 293 ± 99 ml·min⁻¹; $p < 0.05$). The AO condition resulted in a significant attenuation in lower limb vascular dysfunction after 3 hours of prolonged sitting expressed as both Δ LBF (Baseline: 1193 ± 330; 3 hours: 1040 ± 242 ml·min⁻¹; $p = 0.3$) and LBF area under the curve (AUC) (Baseline: 500 ± 158; 3 hours: 378 ± 99 ml·min⁻¹; $p = 0.2$). **CONCLUSION:**

Prolonged sitting-induced lower limb vascular dysfunction, assessed by PLM, was attenuated in response to an acute antioxidant supplementation. These findings implicate oxidative stress as a modulator of vascular function during prolonged sitting.

277 Board #98 May 31 11:00 AM - 12:30 PM

Tart Montmorency Cherries (prunus Cerasus L.) Acutely Modulate Vascular Function In The Absence Of Improvements In Cognition.

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Cerebral blood volume and metabolism of oxygen declines as part of human ageing and has been related to cognitive decline. There is some evidence to suggest that polyphenol-rich foods play an important role in delaying the onset or attenuating the progression of age-related health disorders such as cardiovascular and Alzheimer's disease, and to improve cognitive function. **PURPOSE:** The aim of this study was to assess the impact of Montmorency tart cherry juice consumption on pre-frontal cortical haemodynamics, cognitive function and blood pressure in middle-aged adults. **METHODS:** Twenty-seven healthy middle aged adults were recruited to take part in the study; the mean ± SD age, stature, mass and BMI were 50 ± 6 years, 170.7 ± 9.1 cm, 76.0 ± 16.0 kg and 26.1 ± 4.9 kg/m², respectively. Participants received either a 60 mL dose of a Montmorency tart cherry concentrate (MC) or a placebo (PLA) in a randomised, double blind, placebo-controlled, crossover design study with a >14 day wash-out period between conditions. Cerebrovascular responses (cerebral blood flow volume, total-, deoxy-, and oxy-haemoglobin), cognitive performance, mood and blood pressure were assessed at baseline and 1, 2, 3 and 5 h following consumption. Total-, deoxy- and oxy-haemoglobin were also continuously measured during the 60-min resting/absorption period immediately following supplementation. **RESULTS:** There were significant differences in concentrations of total and oxy-haemoglobin during the last three epochs of the resting/absorption period ($p \leq 0.05$) and during the cognitive task period 1 h post consumption ($p \leq 0.05$). Furthermore, MC consumption significantly lowered systole ($p \leq 0.05$) over a period of 3 h, with peak reductions of 6 ± 2 mmHg at 1 h post MC consumption relative to the placebo. Cognitive function and mood were not affected. **CONCLUSIONS:** The findings suggest that MC concentrate can acutely modulate CBF in the prefrontal cortex characterized by increased concentrations of both total- and oxy-haemoglobin. Despite this, the results do not translate to improvements in cognition or mood in the hours following consumption. Importantly, these data support previous findings observations that demonstrate a significant improvement in systole following MC supplementation.

278 Board #99 May 31 11:00 AM - 12:30 PM

Blood Flow in Humans During Low-Load Exercise with and without Blood Flow Restriction

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(No relationships reported)

Blood flow restriction (BFR) in combination with exercise has been well studied, however, little is known about the actual blood flow response to this type of exercise. The range of applied pressures in the research is wide, and previous studies have only examined the blood flow response using the same pressure for every individual independent of limb size, and have only done so at rest, after inflation of the cuff, and following exercise. No investigations have examined this response using relative applied pressures as a percentage of arterial occlusion pressure (AOP) nor have they investigated this within an exercise bout. **PURPOSE:** To measure blood flow before, during, and after low-load elbow flexion exercise combined with no restriction (NOBFR), 40% of AOP (40BFR), and 80% of AOP (80BFR). **METHODS:** 140 participants (women=75, men=65) were randomized into one of three conditions. After AOP and one-repetition maximum (1RM) measurement, ultrasound measures of standing blood flow at rest in the right brachial artery were taken. Participants performed four sets comprising 75 total goal repetitions of elbow flexion at 30% 1RM. Blood flow was measured between sets and at one and five minutes post-exercise. **RESULTS:** Blood flow decreased following inflation, with no difference between BFR conditions (40BFR: 38.1 ml·min⁻¹ vs. 80BFR: 36.3 ml·min⁻¹, $p=0.85$). Men had greater blood flow than women in all conditions at all time points (411.6 vs. 214.0 ml·min⁻¹,

respectively, $p < 0.001$). Maximum blood flow was decreased during exercise with pressure (NOBFR=406.7 ml·min⁻¹, 40BFR=311.1 ml·min⁻¹, 80BFR=188.5 ml·min⁻¹, $p < 0.001$). Blood flow tended to increase across sets regardless of condition. One minute following cuff deflation, blood flow was higher in 80BFR than in 40BFR for women only (372.2 vs. 253.1 ml·min⁻¹, $p = 0.005$). One minute following cuff deflation, there was no group difference in blood flow for men (NOBFR=675.2 ml·min⁻¹, 40BFR=715.4 ml·min⁻¹, 80BFR=666.3 ml·min⁻¹, $p = 0.75$).

CONCLUSIONS: The reduction in exercise-induced blood flow during BFR is pressure-dependent, with higher pressures eliciting a decrease in the magnitude of the hyperemic response. Blood flow increased above baseline during all BFR conditions; the use of relative applied pressures ensures that full occlusion does not occur during exercise.

279 Board #102 May 31 11:00 AM - 12:30 PM

Forearm Blood Flow Regulation Following Maximal Strength Training-induced Improvements in Work Efficiency

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(No relationships reported)

Maximal strength training (MST) improves submaximal work efficiency (WE) in the arms. However, since assessment of muscle oxygen uptake ($\dot{V}O_2$) during exercise is lacking, the behavior of MST-induced adaptations is unknown, and it remains elusive if metabolic and vascular responses in arms may contrast what has been observed in legs. **PURPOSE:** To investigate responses in arm blood flow and arteriovenous oxygen difference ($a-vO_{2diff}$) during steady state exercise following MST. **METHODS:** Thus, utilizing Doppler-ultrasound and a catheter placed in the subclavian vein for measurements of blood flow and $a-vO_{2diff}$, we assessed steady state WE and peak responses in seven young males (24±2(SD) years) following a six-week handgrip MST intervention. **RESULTS:** As expected, MST improved maximal strength (49±9 to 62±10kg) and rate of force development (923±224 to 1086±238N·s⁻¹), resulting in a reduced submaximal $\dot{V}O_2$ (31±9 to 25±10mL·min⁻¹) and concomitantly increased WE (8.8±2.3 to 11.7±3.6%) (all $p < 0.05$). In turn, the WE-improvement led to a reduced blood flow (486±102 to 395±114mL·min⁻¹), mediated by a lower heart rate (66±4 to 59±7beats·min⁻¹) and blood velocity (43±8 to 32±6cm·s⁻¹) (all $p < 0.05$). Conduit artery diameter and $a-vO_{2diff}$ remained unaltered. The peak test revealed increased time to exhaustion (948 to 1104seconds; $p < 0.05$), and a tendency towards increased peak work rate ($p = 0.06$), but no change in peak oxygen uptake. **CONCLUSION:** Despite arguments of metabolic and vascular limb-specific differences, these results reveal that the mechanisms responsible for WE adaptations following small muscle mass MST in the upper extremities is a direct reflection of what has been documented for lower extremities. Additionally, our data show that the advantageous reductions in blood flow is regulated through conduit artery blood velocity.

280 Board #101 May 31 11:00 AM - 12:30 PM

Cardiovascular, Perceptual and Metabolic Demands Associated with Low-intensity Blood Flow Restriction Cycling

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(No relationships reported)

The use of blood flow restriction (BFR) during very-low-intensity walking can improve aerobic and anaerobic capacity; however, no research exists which has examined BFR during more ecologically valid aerobic exercise, such as intensities consistent with the American College of Sports Medicine guidelines for low- to moderate-intensity. **PURPOSE:** To examine the acute cardiovascular, metabolic and perceptual responses to aerobic BFR exercise at intensities consistent with the American College of Sports Medicine guidelines. **METHODS:** Eighteen healthy males (23 ± 3 y) completed, in a randomized and counterbalanced order, low-intensity (LI), low-intensity with BFR (LI_{BFR}) and high-intensity (HI) interval cycling sessions. These included a standardized warm-up and three 2-min intervals with 2-min of recovery cycling (10W) between efforts. During HI, LI and LI_{BFR} sessions efforts were set to 85%, 40% and 40% of peak power, respectively. During LI_{BFR}, 80% arterial occlusion was applied to both legs during the efforts and removed during recovery. Continuous measures of heart rate (HR), cardiac output (CO) and oxygen consumption ($\dot{V}O_2$) were recorded. Blood pressure and rating of perceived exertion (RPE) were measured at the end of each interval. Lactate was measured pre- and post-session. **RESULTS:** Blood pressure, HR, CO, $\dot{V}O_2$, lactate and RPE were greatest during HI (range; $p = 0.01$ to $p = 0.04$). During the intervals, blood pressure,

HR and CO were greater during LI_{BFR} compared with LI (range; $p = 0.01$ to $p = 0.04$). $\dot{V}O_2$ measured during the recovery periods were greater in LI_{BFR} compared with LI ($p = 0.01$; for all time points). Post-session lactate was greater ($p = 0.01$) during LI_{BFR} (6.3 ± 0.49 mmol·L⁻¹) compared with LI (2.8 ± 0.29 mmol·L⁻¹). Importantly, mean arterial pressure during the third interval (124.2 ± 2.3 mmHg vs. 113.9 ± 2.5 mmHg) was greater ($p = 0.01$) in LI_{BFR} compared with HI. **CONCLUSION:** LI_{BFR} results in greater cardiovascular and metabolic stress compared with LI alone, and therefore could provide an alternative modality to increase aerobic fitness for individuals not able to perform exercise at high-intensity. However, LI_{BFR} may not be suitable for all populations, specifically those with vascular dysfunction.

281 Board #102 May 31 11:00 AM - 12:30 PM

Prior Aerobic Exercise Attenuates Prolonged Sitting-induced Leg Endothelial Dysfunction

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(No relationships reported)

PURPOSE: Prolonged sitting leads to leg endothelial dysfunction; however, it remains unknown whether this impairment can be prevented with prior exercise. It is also unknown if, in the absence of exercise, standing is an effective alternative strategy to sitting for conserving leg endothelial function. Accordingly, the purpose of this study was two-fold: 1) to test the hypothesis that prior exercise prevents sitting-induced endothelial dysfunction; and 2) to test the hypothesis that standing is an effective substitute to sitting for maintenance of leg endothelial function. **METHODS:** Eleven young healthy subjects (7 men; 4 women) completed three experimental trials: sitting, prior exercise + sitting, and standing. Following baseline popliteal artery flow-mediated dilation (FMD) measurements, subjects maintained a supine position for 45 min in the sitting and standing trials or performed 45 min of self-paced cycling (71.3 ± 3.0% HR_{max}) in the prior exercise + sitting trial. Thereafter, subjects were immediately positioned into a seated or standing position, according to the trial, for 3 hours and then popliteal artery FMD measures were repeated. **RESULTS:** Popliteal artery FMD was impaired after 3 hours of sitting (3.75 ± 0.5% vs. 1.57 ± 0.71%, $P < 0.05$) and this impairment was attenuated by prior cycling exercise (3.95 ± 0.41% vs. 3.10 ± 0.83%, $P > 0.05$). Furthermore, 3 hours of standing did not have a significant impact on popliteal artery FMD (4.10 ± 0.45% vs. 3.97 ± 0.65%, $P > 0.05$). **CONCLUSIONS:** Prolonged sitting-induced leg endothelial dysfunction can be partially prevented by prior aerobic exercise. Moreover, in the absence of exercise, standing represents an effective substitute to sitting for maintaining normal leg vascular function.

282 Board #103 May 31 11:00 AM - 12:30 PM

Normobaric Intermittent Hypoxia Increases Middle Cerebral Arterial Blood Flow Velocity With No Systemic Hypertension

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Purpose: To study vascular responses to intermittent hypoxia (IH) exposures. **Methods:** Six healthy men (26 ± 1 yr) were exposed to 5 IH bouts, each comprising 6-min breathing 10% O₂ interspersed with 4 min breathing room air. During IH, middle cerebral arterial blood flow velocity (V_{MCA} , Ez-Dop), blood pressure (BP, NIBP100D), O₂ saturation (SaO₂, Radiometer), breathing frequency (F_R), tidal volume (V_T , Universal Ventilation Meter), inspired and expired O₂ and CO₂ fractions (1100 Medical Gas Analyzer; Perkin-Elmer) were continuously monitored. **Results:** The SaO₂ was decreased during 6-min IH ($P < 0.001$), which was more significant in the 5th than the 1st bout of IH exposures ($P < 0.001$). The V_{MCA} was significantly increased by IH and its magnitude was greater in the 5th than the 1st bout of IH exposures ($P = 0.002$). IH did not change mean BP (MBP) from the baseline (min 0) during either the 1st or 5th bout (see Table). Minute ventilation (V_E) was stimulated by IH ($P = 0.023$) with no difference between the bouts. The increased V_E was driven by increases in V_T because f_R remained constant throughout IH exposures. There was a decrease ($P < 0.001$) in partial pressure of end-tidal CO₂ ($P_{ET}CO_2$) during IH, which was not different between the 1st and the 5th bouts of IH exposures.

Time (min)		0	1	2	3	4	5	6
SaO ₂ (%)	1 st bout	97.3±0.3	91.3±0.5	84.4±1.0	81.2±1.1	79.1±1.3	76.9±1.3	74.4±1.5
	5 th bout	94.6±0.5	86.6±0.8	78.9±0.5	74.3±1.2	71.7±1.4	70.2±1.6	69.2±1.7
V _{MCA} (cm/s)	1 st bout	54.4±2.4	55.8±2.4	57.0±2.5	58.5±2.8	60.6±3.6	62.4±3.2	63.3±3.5
	5 th bout	58.6±2.3	59.6±2.3	61.4±2.4	63.6±2.9	68.3±2.8	68.5±3.4	68.5±3.9
MBP (mmHg)	1 st bout	88±3	86±4	85±3	84±4	83±4	83±4	83±4
	5 th bout	86±3	85±3	83±3	83±3	83±4	83±3	83±3
V _T (L)	1 st bout	0.82±.10	1.06±.20	1.33±.36	1.26±.36	1.20±.28	1.11±.23	1.33±.29
	5 th bout	0.77±.13	0.95±.19	0.97±.21	0.99±.16	1.21±.29	0.96±.12	1.27±.18
F _{br} (br/min)	1 st bout	13.3±1.6	12.7±1.7	12.5±1.8	13.1±2.1	13.3±2.0	12.5±2.0	12.5±1.9
	5 th bout	12.6±1.7	12.5±1.9	13.1±2.0	13.1±1.8	13.5±2.3	13.0±2.2	12.9±2.1
P _{ET} CO ₂ (mmHg)	1 st bout	42.4±0.3	41.1±0.6	40.1±0.6	39.4±0.5	38.9±0.6	38.9±0.5	39.2±0.5
	5 th bout	42.6±0.5	40.4±0.7	39.8±0.6	39.4±0.8	38.8±0.7	38.7±0.9	38.4±0.9

Conclusion: Normobaric IH exposures enhance cerebral perfusion, which is mediated by a moderate hypoxemia. There is no hypertensive response during the IH exposures.

283 Board #104 May 31 11:00 AM - 12:30 PM
Skin Perfusion and Vascular Conductance during Steady State Exercise are Unaffected by Aging or Heart Disease

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(No relationships reported)

PURPOSE: To examine the effect of healthy aging and ischemic heart disease on skin perfusion (SkP) and vascular conductance (VC) during relatively short-duration (15 min), steady state, normothermic cycle exercise. **METHODS:** All participants were physically active at least 60 min per week at the time of recruitment. SkP was collected (laser-Doppler flowmetry) in 10 young (24±4 yrs) healthy men (YH), 10 older (58±6 yrs) healthy men (OH), and 9 older (61±8 yrs) men with documented ischemic heart disease (IHD) during seated rest and at 60±5% and 75±5% of peak oxygen uptake (VO_{2peak}). VC was calculated as perfusion units (p.u.)/mean arterial pressure, while maximal dilatory capacity was determined using iontophoresis of 3% sodium nitroprusside. A two-way ANOVA with repeated measures was used to determine aging (YH vs. OH) and IHD (OH vs. IHD) comparisons for SkP and VC across experimental conditions. **RESULTS:** VO_{2peak} was not significantly different between YH and OH (mean±SD, 46±6 vs. 44±6 ml.kg⁻¹.min⁻¹ respectively, p=0.535) but was ~34% lower in IHD (29±6 ml.kg⁻¹.min⁻¹, p<0.001 vs. OH). There were no significant aging or IHD interaction effects for SkP or VC across experimental conditions (all p≥0.153). Maximal dilatory capacity was ~12% lower in OH vs. YH (98±36 vs. 111±53 p.u. respectively, p=0.558) and ~25% lower in IHD vs. OH (73±28 p.u., p=0.096). SkP at 75% VO_{2peak} as a percentage of maximal dilatory capacity was not significantly affected by either aging (32±17 vs. 40±22% in YH and OH respectively, p=0.343) or IHD (47±39%, p=0.872 vs. OH). **CONCLUSION:** During relatively short-duration exercise at similar relative intensity, SkP and VC do not appear to be adversely affected in aging adults with and without IHD. However, older adults and people with IHD may utilise a higher percentage of their maximal dilatory capacity during exercise.

284 Board #105 May 31 11:00 AM - 12:30 PM
Hemodynamic Changes Following High-Velocity Circuit Resistance or Treadmill Training in Adults with Cardiometabolic Risk Factors

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Cardiometabolic syndrome (CMS) is classified as a combination of maladaptive cardiovascular and metabolic abnormalities that includes hypertension, dyslipidemia, and blood vessel dysfunction. These outcomes can negatively influence hemodynamics (HDYN) via a decrease in myocardial efficiency due to increased afterload and/or decreased vascular elasticity. Studies have reported changes in HDYN during and following acute exercise in clinical populations. However, there is a paucity of information on how high-velocity circuit resistance training (CRT) compared to continuous treadmill exercise (TM) affects these parameters at rest. **PURPOSE:** To compare the effects of CRT, TM and no exercise (CONT) on HDYN variables at rest in older adults with multiple CMS risk factors. **METHODS:** Eleven women (66.4 ± 6.4 years) participated in 12-weeks of CRT or TM. Stroke volume (SV), cardiac index (CI), systemic vascular resistance (SVR), end-diastolic volume (EDV), ejection fraction (EF), and oxygen consumption (rVO₂) were measured by impedance electrocardiography and indirect calorimetry before and after training. **RESULTS:** A within-group analysis revealed significant increases in CI (MD=0.257, SE=.092, p=.023) and EDV (MD=31.10, SE=11.96, p=.032), a trend towards an increase in SV (MD=8.63, SE=4.28 p=.07) and a decrease in SVR (MD=-154.15, SE=71.07, p=.06) for CRT. TM resulted in significant increases in CI (MD=.218, SE=.080, p=.026) and EDV (MD=26.16, SE=10.36, p=.035); however, increases were not comparative to those seen with CRT. The CONT group showed a significant decrease in rVO₂ (MD=-1.60, SE=.64, p=.03). No significant differences were observed for EF. At post-testing CONT resulted in a decrease in rVO₂ approaching significance compared to TM (MD=-3.10, SE=1.12, p=.07). CRT demonstrated more favorable changes in SV, CI, SVR and EDV than TM or CONT. However, these changes did not reach statistical significance. **CONCLUSION:** These preliminary results indicate that CRT and TM lead to significant favorable changes in CI and EDV, however, CRT showed greater improvements in each and a trend towards improvements in HDYN when compared to TM and CONT. It is expected that completion of testing on existing subjects will further strengthen our results.

285 Board #106 May 31 11:00 AM - 12:30 PM
Impact of Short-term Training Camp on Aortic Pressure in Collegiate Endurance Runners

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(No relationships reported)

PURPOSE: Stiffening of the aorta may be a possible cause of increased aortic blood pressure (BP) reflecting increased cardiac workload. We have previously reported that in regularly highly-trained endurance athletes, arterial stiffness increases after a short-term training camp characterized by greater training volume. As a follow-up study, we investigated the effect of such exercise on aortic BP. **METHODS:** In a total of 36 regularly highly-trained collegiate endurance runners, pulse wave analysis was performed before and after a seven-day training camp for evaluating aortic BP and the round-trip travel time (TR) of the pressure wave which is a surrogate index of aortic stiffness. They underwent a group training (three sessions per day mainly consisted of long distance running and sprint training). Variables of interest were compared between two groups based on accomplishment of the task (running at least 26 km per day). **RESULTS:** In the accomplished group, TR significantly shortened after the camp. In addition, aortic systolic BP and pulse pressure slightly but significantly elevated despite no significant changes in brachial BP and pulse pressure. Such significant changes were not observed in the unaccomplished group. Additionally, there was a significant correlation between the training distance during the camp and the change in aortic systolic BP (r=0.490, P<0.001). **CONCLUSION:** These results suggest that, even in regularly highly-trained endurance athletes, aortic BP increases acutely after the short-term vigorous training camp, and it is partly due to stiffening of the aorta. In addition, the greater training volume could be a cause of increased aortic BP but not in brachial BP.

286 Board #107 May 31 11:00 AM - 12:30 PM
Time Course Of Acute Exercise-induced Impairment Of Endothelial Dependent Vasorelaxation

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Regular endurance exercise improves endothelium dependent vasorelaxation. However, the initial stress of acute exercise may impair vascular function prior to the beneficial adaptive response. **PURPOSE:** The purpose of this study is to examine the effects of acute exhaustive exercise on endothelial-dependent vascular function. **METHODS:** 7-9 mo old, male, Wistar rats were divided into four groups (n=6/group): sedentary (SED), 6h post-exercise (6h), 24h post-exercise, and 48h post-exercise. Exercise consisted of one bout of exhaustive treadmill exercise lasting between 30-40 min. Endothelium dependent vasorelaxation was assessed in ring segments of the aorta by constructing an acetylcholine dose response curve (10^{-10} - 10^{-5} M) in a wire myograph. **RESULTS:** Maximal vasorelaxation was impaired in 6h (70.1±5.2%) and 24h (76.2±4.4%) compared to SED (86.9±4.2%) and 48h (83.7±4.4%). EC_{50} for 6h (3.9e⁻⁷) was significantly (p<0.05) greater than SED (1.3e⁻⁷) and 48h (1.5e⁻⁷). **CONCLUSIONS:** These data suggest that acute, exhaustive treadmill exercise results in impaired endothelial dependent vasorelaxation up to 24h post-exercise and returns to sedentary levels within 48h.

287 Board #108 May 31 11:00 AM - 12:30 PM
The Effect Of Inorganic Nitrate And Exercise On Blood Pressure In Pre-and Hypertension Subjects.

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Dietary supplementation of inorganic nitrate (NO-3) reduces blood pressure (BP) in normal and hypertensive subjects. An acute bout of exercise also reduces BP in many normotensive and in most hypertensive individuals. The possible additive hypotensive effect of NO-3 plus exercise has not been investigated in pre- and hypertensives. **PURPOSE:** To assess whether intake of NO-3 followed by maximal exercise may potentiate the hypotensive effect of both procedures. **METHODS:** Ten pre- or hypertensive subjects participated in a randomized double-blind study one week apart. (7 men, 3 women) (BP ≥ 120/80mmHg) (Systolic Blood Pressure SBP/Diastolic Blood Pressure DBP). Subjects arrived in the fasting condition and without medications and ingested either a fruit and vegetables juice containing 250 g of NO-3 (8 mmol/L of NO-3) (N) or nitrate depleted juice (P). After 90 minutes post supplementation, they performed a MAXCAP-T treadmill test. BP was obtained 10 minutes post arrival (BP1), 90 minutes post dietary supplementation (BP2), immediately Post MAXCAP-T (BP3), 10 minutes after MAXCAP-T (BP4), and 150 minutes post MAXCAP-T (BP5). Statistics anova, paired t test, t test two groups. **RESULTS:** After ingestion of N, SBP and DBP were reduced by 11 and 6 mmHg, respectively. Meanwhile, after P, SBP decreased 3 mmHg while DBP did not change. Following MAXCAP-T, SBP increased less after N than P (26 vs 31 mmHg, P<0.05). DBP decreased 2 and increased 5 mmHg with N and P, respectively (P<0.05). Ten minutes after MAXCAP-T, SBP was 20 and 11 mmHg lower than BP1 for N and P respectively (P<0.05). The difference between N and P was significant (P<0.05). DBP was reduced 10 mmHg with N with no changes in P. After 150 minutes of MAXCAP-T, SBP was 24 and 16 mmHg lower than BP1 for N and P, respectively (p<0.05). Meanwhile, DBP was 8 mmHg lower than BP1 for N without significant changes for P. **CONCLUSIONS:** Ingestion of inorganic nitrate decreased SBP and DBP before exercise and prevented increases in SBP and DBP immediately after acute maximal exercise. The combination of NO-3 and exercise resulted in greater decreases in BP in pre- and hypertensive patients as compared with P.

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Independent and Combined Effects of Heat Stress and Exercise on Arterial Stiffness

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Several studies have established that arterial stiffness, assessed via pulse wave velocity (PWV), is reduced following passive heat stress or exercise. Yet, no study to date has simultaneously investigated the cumulative effects of exercise and heat stress on measures of PWV. **PURPOSE:** Determine the independent and combined effects of heat and exercise on arterial stiffness. **METHODS:** Nine subjects (n=3 females, 46±11 years old; 24.1±2.8 kg/m²) completed four trials, with different interventions, in a randomized order. In a control trial subjects rested supine (CON). In order to independently test the effect of heat stress, subjects were passively heated (i.e. no exercise) in a hot environment (~40°C) while wearing a water perfusion suit with hot water (PH). In two other trials, subjects cycled at ~50% of VO_{2peak} in a hot (~40°C; HC) or cool (~15°C; CC) environment. Prior to interventions and in the hour following interventions, pulse wave velocity (PWV), via Doppler ultrasound, was assessed at the tibial, radial, femoral and carotid artery sites. Central PWV (C_{PWV}) was assessed using measures between the carotid/femoral artery sites, while peripheral stiffness was assessed using the radial/carotid (U_{PWV}), and tibial/femoral (L_{PWV}) artery sites. Mean body temperature (T_b) was measured with skin and rectal thermistors. **RESULTS:** No significant changes in T_b were observed during the CON and CC trials. However, the PH and HC trials elevated T_b 2.69±0.23°C and 1.67±0.27°C, respectively (p<0.01). No changes in any measure of PWV were observed in the CON, CC, or HC trials (p>0.05). However, in the PH trial U_{PWV}, but not C_{PWV} or L_{PWV} was reduced immediate post (-107±81 cm/s) and 15 minutes (-93±82 cm/s) post heating (p<0.05). **CONCLUSIONS:** Contrary to previous data, we did not observe changes in arterial stiffness following aerobic exercise (i.e., CC). Further, although heat stress alone reduced arterial stiffness (specific to the upper peripheral arteries), when combined with exercise in the heat, there was no change in arterial stiffness (i.e., HC). This suggests that heat stress has an independent effect on arterial stiffness that is obliterated when combined with exercise.

289 Board #110 May 31 11:00 AM - 12:30 PM
Atrial Natriuretic Peptide Augmented Following Aquatic Treadmill Exercise

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Aquatic treadmill (ATM) exercise training has been shown to reduce blood pressure reactivity to exercise to a greater degree than land treadmill (LTM) exercise training. Furthermore, ATM exercise tends to elicit a greater post-exercise hypotensive response and an acute augmentation in flow-mediated dilation (FMD). However, the mechanisms for such changes are unclear, and previous research showed no differences in plasma nitrates or nitrites between modes. **Purpose:** To determine the effects of an acute bout of ATM and LTM exercise on atrial natriuretic peptide (ANP), norepinephrine (NE), and epinephrine (EPI) in pre-hypertensive men. **Methods:** Following BP screening and a maximal exercise test, 13 men (33 ± 11 years, 27.7 ± 10.6% fat, 39.3 ± 7.7 ml·kg⁻¹·min⁻¹ 130 ± 7/77 ± 7 mmHg) completed an acute bout of both ATM and LTM at 60% VO_{2max} for a duration required to expend 300 kcal (~30 minutes). Blood samples were obtained pre-exercise and immediately post-exercise. Blood samples were analyzed for ANP, NE, and EPI. **Results:** All results are displayed in the table. The percent increase in ANP was significantly greater (p<0.05) for ATM than LTM exercise. There were no significant differences in the change in NE or EPI between modes. **Conclusion:** ANP is released by the atria in response to increased volume load on the heart, and plays a role in blood pressure regulation through both vasodilatory effects and renal natriuretic/diuretic effects. Water submersion is known to increase venous return and preload on the heart. Increased ANP levels observed following ATM exercise in the present study may explain in part the previous findings of an augmented post-exercise hypotensive response and augmented FMD with ATM exercise.

	ATM				LTM				p-Value
	Pre	IPE	Change	%Change	Pre	IPE	Change	%Change	
ANP (pg/mL)	47.1 ± 43.3	56.1 ± 51.7	9.0 ± 29.2	34.3 ± 47.0*	59.2 ± 67.3	53.4 ± 57.1	-5.7 ± 34.4	-9.0 ± 40.0*	0.04*
NE (pg/mL)	409.1 ± 134.9	582.9 ± 143.8	173.8 ± 89.2	48.4 ± 27.3	371.1 ± 131.1	546.4 ± 140.7	175.3 ± 74.8	52.9 ± 28.1	0.77
EPI (pg/mL)	50.6 ± 46.3	64.5 ± 39.4	13.9 ± 19.2	71.9 ± 78.1	52.6 ± 33.8	60.1 ± 54.8	7.5 ± 26.8	8.0 ± 34.7	0.07

Values represent mean ± SD.
ANP: atrial natriuretic peptide; NE: norepinephrine; EPI: epinephrine.
P-Values represent comparison between modes for %change variable by dependent t-test. *p < 0.05

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Experimental Intermittent Ischemia Augments Exercise-Induced Inflammatory Cytokine Production

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(No relationships reported)

Acute exercise-induced transient increases in inflammatory cytokines are linked to the beneficial vascular effects of exercise, but the underlying mechanisms that promote appearance are contingent on numerous factors (e.g. muscle mass recruited, exercise intensity/duration, etc.). Evidence suggests that a lack of oxygen and/or blood flow to working muscle modifies cytokine appearance. However, little is known about the inflammatory response to intermittent ischemia in working muscle.

PURPOSE: Determine the extent to which local inflammation is involved in the response to ischemic exercise by reproducing the peripheral arterial disease (PAD)-associated phenomenon of intermittent claudication without the presence of potential confounding comorbidities frequently exhibited by patients with PAD.

METHODS: 14 healthy males performed unilateral isometric forearm contractions for 30 minutes with and without experimental ischemia. Blood was drawn at baseline, 5 and 10 minutes into exercise, at the end of exercise, and 30, 60, and 120 minutes after exercise.

RESULTS: Oxygen saturation levels, as measured by near-infrared spectroscopy, were reduced by 10% and 41% during non-ischemic and ischemic exercise, respectively ($P < 0.001$). Non-ischemic exercise did not affect cytokine values during exercise (all $P > 0.05$). Ischemic exercise enhanced concentrations of basic fibroblast growth factor, interleukin (IL)-6, IL-10, tumor necrosis factor- α , and vascular endothelial growth factor at the end of exercise by 148%, 197%, 129%, 154%, and 164% ($P < 0.05$), respectively, but IL-8 was not influenced by ischemic exercise ($P > 0.05$).

CONCLUSION: In conclusion, the present study demonstrates that ischemic, small muscle endurance exercise elicits local inflammatory cytokine production, compared to non-ischemic exercise. The effect of ischemic exercise with PAD-associated comorbidities may impact the inflammatory response during and after exercise.

FUNDING: This study was supported by funds from the Office of the Vice President for Research and the College of Education at the University of Georgia (to N.T.J.).

DISCLOSURES: J.R.M. is Chief Operating Officer and K.K.M. is President of Infrared Rx. The other authors report no conflicts of interest, financial or otherwise.

291 Board #112 May 31 11:00 AM - 12:30 PM

To Discern Differences of Cardiovascular Response Over Four Rounds of a High-Intensity Functional Training (Hift) Session.

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PURPOSE: To Discern Differences of Cardiovascular Response Over Four Rounds of a High-Intensity Functional Training (HIFT) Session. **METHODS:** Participants with at least four weeks of experience with HIFT were recruited ($n=100$; age= 31.25 ± 7.2 years; $\dot{V}O_{2peak} = 45.9 \pm 6.0$ ml/kg/min). Participants completed a graded exercise test to determine peak oxygen consumption ($\dot{V}O_{2peak}$) and heart rate (HR_{peak}). Participants returned to the laboratory after one week to perform as many rounds (1 round: 250-meter row, 20 kettlebell swings and 15 thrusters) of HIFT in 15 minutes. All repetitions were summed at the end and analyzed as a round. During the graded exercise test and HIFT, oxygen consumption and HR were measured via a Cosmed K4b2 portable metabolic system. Average $\% \dot{V}O_{2peak}$ and average $\%HR_{peak}$ of each

round was determined by taking the average heart rate and oxygen consumption of each round and dividing by HR_{peak} and $\dot{V}O_{2peak}$ of the treadmill test. Two-way (4×2) repeated measures analysis of variance was conducted with rounds as the within-subjects and physiological response ($\%HR_{peak}$ and $\% \dot{V}O_{2peak}$) as the between-subjects factor to determine whether $\%HR_{peak}$ and $\% \dot{V}O_{2peak}$ responded the same across rounds 1-4 of the HIFT workout (time \times HR and $\dot{V}O_2$ interaction). Independent samples t-tests were used to compare $\% \dot{V}O_{2peak}$ and $\%HR_{peak}$ for each round with an adjusted alpha of 0.0125. **RESULTS:** A significant interaction was found between the measure of cardiovascular response and round [$F(1,176) = 31.65$, $p < 0.001$] indicating $\%HR_{avg}$ and $\% \dot{V}O_{2avg}$ responded differently across rounds. A significant difference ($p < 0.001$) between $\% \dot{V}O_{2peak}$ and $\%HR_{peak}$ was found for all rounds [Round 1: $76.9 \pm 8.9\%$ vs. $83.1 \pm 8.4\%$; Round 2: $80.6 \pm 9.3\%$ vs. $86.8 \pm 8.7\%$; Round 3: $79.3 \pm 9.9\%$ vs. $89.3 \pm 5.8\%$; Round 4: $78.6 \pm 9.6\%$ vs. $91.5 \pm 6.5\%$]. **CONCLUSION:** Our results suggest that HR and $\dot{V}O_2$ did not respond the same over four rounds of HIFT; thus, simply estimating HR response during HIFT would overestimate the metabolic demands of the activity. The progressive increase in $\%HR_{peak}$ may be due to increases in thermoregulatory demands causing an increase in cardiac output, while metabolic demands remain relatively constant. Future investigations should aim to determine the mechanism underlying of the dissociation between HR and $\dot{V}O_2$ during HIFT.

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Bench Press With and Without Blood Flow Restriction on Hemodynamics and Pulse Wave Reflection

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(No relationships reported)

Hemodynamic and pulse wave reflection responses to upper-body resistance exercise (RE) with and without blood flow restriction (BFR) are unclear. **PURPOSE:** To evaluate the differences between bench press with and without BFR on hemodynamics and pulse wave reflection in resistance-trained men. **METHODS:** Sixteen resistance-trained men participated in the study. Hemodynamics and pulse wave reflection were assessed before and after low-intensity bench press with BFR (LI-BFR), traditional high-intensity bench press without BFR (HI), and control (CON). The LI-BFR utilized of 4 sets with repetitions of 30, 15, 15, and 15 at 30% 1-repetition maximum (1RM) and 30 seconds rest between sets. The HI consisted of 4 sets of 8 repetitions at 70% 1RM and 60 seconds rest between sets. The CON consisted of supine rest for 10 minutes. A repeated measures ANOVA was used to evaluate the conditions (LI-BFR, HI, CON) across time (rest, recovery) on hemodynamics and pulse wave reflection. **RESULTS:** There were significant ($p \leq 0.05$) increases in heart rate after LI-BFR (Rest: 57 ± 10 bpm; Rec: 62 ± 11 bpm) and HI (Rest: 57 ± 14 bpm; Rec: 69 ± 13 bpm) compared to rest and CON. There were no changes in aortic and brachial systolic blood pressure (BP) after any condition. However, there were significant ($p \leq 0.05$) reductions after HI-BFR in aortic (Rest: 66 ± 9 mmHg; Rec: 61 ± 6 mmHg) and brachial (Rest: 60 ± 5 mmHg; Rec: 65 ± 9 mmHg) diastolic BP compared to rest. There were significant ($p \leq 0.05$) condition by time interactions after LI-BFR and HI for augmentation index (AIx) (LI-BFR: Rest: $10.0 \pm 5.6\%$, Rec: $27.2 \pm 12.1\%$; HI: Rest: $12.2 \pm 9.0\%$, Rec: $22.3 \pm 8.1\%$), AIx at 75 bpm (LI-BFR: Rest: $1.1 \pm 7.6\%$, Rec: $21.6 \pm 14.5\%$; HI: Rest: $4.5 \pm 12.7\%$, Rec: $19.5 \pm 10.4\%$), augmentation pressure (LI-BFR: Rest: 3.9 ± 2.2 mmHg, Rec: 13.3 ± 6.9 mmHg; HI: Rest: 5.2 ± 3.9 mmHg, Rec: 9.6 ± 3.7 mmHg) and wasted left ventricular energy (LI-BFR: Rest: 838 ± 513 dynes s/cm², Rec: 2961 ± 1743 dynes s/cm²; HI: Rest: 1116 ± 849 dynes s/cm², Rec: 1983 ± 904 dynes s/cm²) such that they were augmented compared to rest and CON, with no differences between LI-BFR and HI. **CONCLUSION:** These data suggest that LI-BFR significantly decreases aortic and brachial diastolic BP. In addition, LI-BFR and HI significantly alter pulse wave reflection in a similar fashion.

Funded by School of Health Sciences at Kent State University

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Abstract Withdrawn

294 Board #115 May 31 11:00 AM - 12:30 PM

Validity Of Forearm Oxygen Uptake During Handgrip Exercise: Assessment By Ultrasonography And Venous Blood Gas

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ABSTRACT:

Assessment of forearm oxygen uptake ($\dot{V}O_2$) during handgrip exercise is a keenly investigated concept for observing small muscle mass metabolism. Although a combination of Doppler-ultrasound measurements of brachial artery blood flow and blood gas drawn from a deep forearm vein has been utilized to calculate forearm $\dot{V}O_2$

for more than two decades, this experimental design has, somewhat surprisingly, not been validated. **PURPOSE:** To evaluate the reliability and accuracy of this technique following handgrip exercise. **METHODS:** Test-retest measurements were performed with ~0.25 watt (W) steady state increments in ten healthy young (24±3(SD) yrs.) males during handgrip exercise. **RESULTS:** $\dot{V}O_2$ and workload exhibited a linear relationship ($p < 0.01$) following all submaximal workloads (0.50W:43.8±10.1 mL·min⁻¹; 0.75W:53.8±14.1 mL·min⁻¹; 1.00W:63.4±16.3 mL·min⁻¹; 1.25W:72.2±17.6 mL·min⁻¹), while the final increment before exhaustion was non-significant, marking a $\dot{V}O_2$ -plateau (1.5W:79.2±18.6 mL·min⁻¹). In turn, blood flow exhibited a concomitant relationship ($p < 0.01$) with $\dot{V}O_2$ (0.50W:359±86 mL·min⁻¹; 0.75W:431±112 mL·min⁻¹; 1.00W:490±123 mL·min⁻¹; 1.25W:556±112 mL·min⁻¹; 1.50W:622±131 mL·min⁻¹) while arteriovenous oxygen difference ($a-vO_{2diff}$) remained constant following all workloads (123±11-130±10 mL·L⁻¹). The average $\dot{V}O_{2test}$ -retest difference was -0.4 mL·min⁻¹ with ±2SD limits of agreement (LOA) of 8.4 and -9.2 mL·min⁻¹, respectively, while coefficients of variation (CV) ranged from 4-7%. Accordingly, test-retest blood flow difference was 11.9 mL·min⁻¹ (LOA:84.1 mL·min⁻¹; -60.4 mL·min⁻¹) and again CV ranged between 4-7%. Test-retest difference for $a-vO_{2diff}$ was -0.28 mL·dL⁻¹ (LOA: 1.26 mL·dL⁻¹; -1.82 mL·dL⁻¹) with CV ranging from 3-5%. **CONCLUSION:** Our results reveal that forearm $\dot{V}O_2$ -assessment by Doppler-ultrasound and direct venous sampling is a valid experimental design across a range of exercise intensities, and suggest that this method can be applied for assessment of small muscle mass metabolism in occupationally relevant forearm musculature.

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Cognitive Task Impairs Dynamic Cerebral Autoregulation During Normoxia And Hypoxia.

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Hypercapnia-induced cerebral hyper-perfusion or hypoxia attenuates dynamic cerebral autoregulation (CA). On the other hand, performing cognitive task increases both anterior and posterior cerebral blood flow via frontal and occipital lobe activation and this cognitive tasks-induced cerebral hyper-perfusion attenuates dynamic CA. **PURPOSE:** The aim of the present study was to examine whether cognitive task-induced impairment in dynamic CA was enhanced by hypoxia condition. **METHODS:** To test our hypothesis, we identified dynamic CA during the Go/No-Go task under normoxia and hypoxia conditions. This study examined the relationship between mean arterial pressure (MAP) and mean middle cerebral artery blood velocity (MCA V_{mean}) during the Go/No-Go task. Dynamic CA and steady-state changes in MCA V_{mean} in relation to changes in arterial pressure were evaluated using transfer function analysis. **RESULTS:** MCA V_{mean} increased with the Go/No-Go task ($P=0.022$), but the different response of MCA V_{mean} between normoxia and hypoxia conditions was not observed ($P=0.850$). In the transfer function analysis, the low frequency (LF) and very LF (VLF) phase shift decreased during the Go/No-Go task (LF and VLF; $P < 0.001$ and $P=0.01$). However, the decreases in LF and VLF phase shift during the Go/No-Go task was not modified by hypoxia condition ($P=0.617$ and $P=0.981$). **CONCLUSIONS:** Similarly with change in MCA V_{mean} , dynamic CA was attenuated during cognitive task. In contrast to our hypothesis, hypoxia did not affect this phenomenon.

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Effects of Blood Flow Restriction Training on Vascular Reactivity & Morphology in Older Subjects. A Randomized Controlled Trial.

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The positive effects of low intensity blood flow restriction (BFR) training on muscle mass and strength are well documented. Less investigated, however, are the effects and safety of this intervention on the vascular health of older adults. **PURPOSE:** to compare the effects of low intensity resistance training (RT) with BFR and high intensity RT without BFR on body composition, muscle strength and vascular function in older adults. **METHODS:** Through a randomized controlled trial, 29 eutrophic, inactive elderly, aged 72±7 years old, weight 63.1±10.7 kg, body mass index 25.2±2.6 kg/m², were divided in three groups as follows: BFR - exercise intensity set at 30% of 1 repetition maximum (RM) with BFR promoted by a pressure cuff inflated throughout the session at 50% of the resting systolic blood pressure; Control (CON) - exercise intensity set at 30% of 1 RM without BFR; HI - exercise intensity set at 70% of 1 RM without BFR. All subjects performed two exercises for lower limbs and two for upper limbs, three days a week during three months. The RT included three sets of 10 RM

with one minute of resting between sets. All the results were presented as mean±SD. A one way ANOVA, followed by the Bonferroni post-hoc test were used to compare the relative gains (%Δ) among groups. **RESULTS:** Differently to HI, BFR significantly increased arm muscle mass ($P=0.03$) assessed by dual energy x-ray absorptiometry when compared to CON. Handgrip strength was higher in both BFR and HI groups ($P < 0.001$). Three months of either BFR or HI were not deleterious to vascular reactivity assessed by venous occlusion plethysmography ($P > 0.05$ when groups were compared) and microvascular morphology assessed by nailfold videocapillaroscopy ($P > 0.05$). **CONCLUSIONS:** BFR training was able to increase mass and strength of small muscles in older adults, with no deleterious effects in vascular function. Future studies should investigate the possible risks and benefits of this intervention in frail elderly with sarcopenia.

Table 1. Body composition, hand grip strength, isometric knee extension test, vasoreactivity and microvascular morphological maliford results among groups.

	Control (n=10)			High Intensity (n=9)			Blood Flow Restriction (n=10)			P Value
	Before	After	% Δ	Before	After	% Δ	Before	After	% Δ	
Bone mineral density (kg)	2.146±0.4	2.146±0.4	-0.140±0.8	1.84±0.2	1.84±0.4	-0.21±0.5	2.26±0.7	2.26±0.7	2.6±0.9	0.31
Arm muscle mass (kg)	4.2±1.3	4.2±1.4	-1.3±0.10±6	3.7±0.1	3.9±0.1	5.7±0.1	4.1±1.5	4.7±1.1	23.3±2.9*	0.03
Leg muscle mass (kg)	12.4±3.1	12.3±3.1	-0.8±1.0	11.9±2.8	12.0±2.9	1.1±0.8	13.1±3.6	13.5±3.4	3.9±0.1	0.29
Peak torque (Nm)	91.1±33.9	97.2±46.8	4.9±11.7	91.4±22.9	104.1±22.8	12.6±11.7	99.3±23.3	102.3±30.2	3.1±21.1	0.26
Total work (J)	848.0±340.5	879.2±73.9	3.1±8.9	849.6±226.8	925.3±245.4	10.7±14.7	820.6±226.8	862.5±280.0	5.8±20.4	0.43
Hand grip strength (kg)	22.5±7.9	22.7±7.9	1.1±3.6	20.4±5.8	23.8±5.2	13.2±17.1*	26.3±8.4	31.3±8.5	20.6±8.4*	<0.001
%-FBF Hyperemia (%)	751.4±307.2	867.3±330.1	33.5±66.9	465.5±137.1	683.7±280.4	46.6±46.3	774.6±389.1	739.3±381.2	13.3±70.6	0.53
%-FBF Nitroglycerine (%)	171.3±69.9	149.8±59.9	-9.3±55.1	148.2±36.4	172.6±75.4	23.4±65.4	156.6±87.1	109.5±48.9	-18.6±35.9	0.25
FCD (in mm)	26.3±7.9	31.8±18.3	26.46±7.8	24.9±17.9	32.4±17.8	81.4±27.6	25.6±18.1	26.7±5.6	89.1±17.9	0.51

*FBF Hyperemia - Percent of increment of forearm blood flow reactive hyperemia related to baseline; %FBF Nitroglycerine - Percent of increment of forearm blood flow after sublingual spray of nitroglycerine related to baseline; FCD - Functional capillary density. * P < 0.05 when compared to control group.

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The Effects of Resistance Exercise on Forearm Blood Flow and Vasodilatory Capacity Between Sexes

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An acute bout of resistance exercise (RE) has been suggested to have a negative effect on vascular function. However, no studies have evaluated differences between the sexes after free-weight resistance exercises. **PURPOSE:** To evaluate the effects of free-weight resistance exercises on forearm blood flow (FBF) and vasodilatory capacity between sexes. **METHODS:** Resistance-trained men (n=14) and women (n=13) between the ages of 18-30 yrs volunteered to participate. One-repetition maximum (1RM) was assessed on the squat, bench press and deadlift. FBF and vasodilatory capacity were assessed using venous occlusion plethysmography. FBF, mean arterial pressure (MAP) and forearm vascular conductance (FVC) were assessed at baseline and 15 minutes after each condition. Vasodilatory capacity was assessed at rest and followed by 5 minutes of circulatory occlusion (220 mmHg) to induce reactive hyperemia before and 20 minutes after an acute bout of RE. The RE consisted of 3 sets of 10 repetitions at 75% 1RM on the squat, bench press and deadlift. Two minutes of rest was given between sets and exercises. Each participant also completed a quiet control session of the same duration. Area under the curve (AUC) was also utilized to determine differences in blood flow. Data were analyzed by an ANOVA to examine the effects of gender by time by condition. Tukey HSD was used as a post-hoc test if the interaction was deemed significant. **RESULTS:** There were no significant sex differences at rest for any of the variables. Furthermore, there were no significant sex by time by condition interactions for any variable. There were significant increases in FBF (Rest: 8.4±6.0ml/100ml tissue/min; Recovery: 21.0±12.9ml/100ml tissue/min, p=0.0001), and FVC (Rest: 0.101±0.676ml/min/100ml/mmHg; Recovery: 0.273±0.180 ml/min/100ml/mmHg, p=0.0001) after the RE, but not the Control. A significant time by condition interaction was noted for MAP (Rest: 82±7mmHg; Recovery: 76±4mmHg, p=0.003) such that it was reduced after RE. While there was no increase in vasodilatory capacity, there was a significant increase in AUC (Rest: 149.0±81.0units; Recovery: 286.4±145.1units, p=0.0001) **CONCLUSION:** These data demonstrate that microvascular function is increased similarly between resistance-trained men and women after an acute bout of RE.

298 Board #119 May 31 11:00 AM - 12:30 PM

Calf Venous Compliance Differences in Male and Female Adults

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Similar to changes in arterial compliance with fitness and aging, venous compliance in the lower extremities of adults improves with higher fitness and declines with increasing age. In young adults, males have a higher venous compliance than females, a difference that does not appear related to hormonal fluctuations. Most previous studies have used small groups to make these comparisons. **PURPOSE:** To determine the calf venous compliance differences in males and females in a larger group of adults. **METHODS:** 71 females and 102 males volunteered for this

project. Participants underwent anthropometric assessment, a submaximal graded exercise test, and assessment of calf venous compliance. Utilizing venous occlusion plethysmography, calf pressure-volume relations were determined using the quadratic regression equation $[(\Delta\text{limb volume}) = \beta_0 + \beta_1 * (\text{cuff pressure}) + \beta_2 * (\text{cuff pressure})^2]$. Calf venous compliance was calculated as the first derivative of the pressure-volume relation during cuff pressure reduction. Sex differences in anthropometric variables, fitness, and compliance (β_1 , β_2 , and the slope of the pressure compliance relationship) were analyzed with a simple ANOVA. **RESULTS:** The males and females were of similar age [102 males (26±12 yrs), 71 females (28±17 yrs)] and fitness level (males 50.24±19.55 ml*kg⁻¹*min⁻¹ vs. females 47.84±16.03 ml*kg⁻¹*min⁻¹). The males were larger in size (BMI: 25.07±3.81 kg/m²; calf volume: 585.79±116.70 cm) than the females (BMI: 23.78±4.3 kg/m²; calf volume: 497.52±132.31cm). Females had significantly larger β_0 values than males, but males had significantly higher β_2 values than females indicating higher calf venous compliance [males; $\Delta\text{Limb Volume} = 0.6665 \pm 1.89051 + 0.0939 \pm 0.1119 (\text{Cuff Pressure}) - 0.0212 \pm 0.20587 (\text{Cuff Pressure})^2$ vs. females; $\Delta\text{Limb Volume} = 1.8384 \pm 5.28027 + 0.1083 \pm 0.12568 (\text{Cuff Pressure}) - 0.0009 \pm 0.00107$]. Compliance @ 20mmHg was significantly higher in males than females (0.28 ± 0.83mmHg vs. 0.06 ± 0.02 mmHg respectively). **CONCLUSION:** Consistent with previous research, this large data set found males to have higher calf venous compliance than females and females to have higher net capillary filtration than males.

299 Board #120 May 31 11:00 AM - 12:30 PM
Exaggerated Cardiovascular Response to Muscle Mechanoreflex Activation in Type 2 Diabetic Rats
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Evidence suggests that the cardiovascular response to physical activity is excessively heightened in patients with type 2 diabetes mellitus (T2DM). However, the mechanisms underlying this exaggerated circulatory responsiveness remain to be fully elucidated. The exercise pressor reflex (EPR) is a primary contributor to autonomic cardiovascular regulation during physical exercise. Mechanically (mechanoreflex) and metabolically (metaboreflex) sensitive components mediate EPR function. We have shown previously that the metaboreflex is overactive in T2DM whereas the function of the mechanoreflex remains undetermined in this disease. **PURPOSE:** To assess mechanoreflex activity in T2DM rats. It was hypothesized that the heightened cardiovascular response to exercise in T2DM is induced, in part, by functional alterations in the muscle mechanoreflex. **METHODS:** T2DM was induced in Sprague-Dawley rats by a combination of both a low-dose streptozotocin injection (30-35 mg/kg, ip) and a 14-16 wk high-fat diet. In control rats (normal diet; no streptozotocin; n=34) and T2DM (n=10) rats, the EPR was activated by electrically-inducing hindlimb muscle contraction via stimulation of spinal ventral roots. The mechanically-sensitive component of the EPR was selectively activated by passively stretching hindlimb muscle. **RESULTS:** Compared to control animals, sympathetic and pressor responses to EPR activation were significantly greater in T2DM rats (RSNA: $\Delta = 122 \pm 20$ vs. 61±8 %, P<0.05; MAP: $\Delta = 49 \pm 5$ vs. 20±2 mmHg, P<0.05). Passive stretch likewise evoked greater increases in RSNA ($\Delta = 81 \pm 16$ vs. 31±5 %, P<0.05) and MAP ($\Delta = 38 \pm 7$ vs. 13±2 mmHg, P<0.05) in T2DM rats compared to healthy controls. **CONCLUSIONS:** These data demonstrate the skeletal muscle mechanoreflex is overactive in T2DM. This is an important finding as it suggests that both the metaboreflex (as previously reported) and mechanoreflex contribute significantly to the generation of EPR overactivity in T2DM possibly accounting for the abnormally large cardiovascular response to exercise in this disease. *Supported by the Lawson & Rogers Lacy Research Fund in Cardiovascular Disease*

300 Board #121 May 31 11:00 AM - 12:30 PM
Peripheral and Central Blood Pressure Response to Handgrip Exercise Coupled with Blood Flow Restriction
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Low intensity exercise coupled with blood flow restriction (BFR) produces comparable strength gains and skeletal muscle hypertrophy, compared to non-BFR training at higher intensities. However, the cardiovascular response (e.g., blood pressure-BP) to this type of exercise remains controversial. **PURPOSE:** To examine peripheral and central BP responses to low and high-intensity, unilateral handgrip exercise performed with and without BFR. **METHODS:** Eight college-aged males (Age=24±5 yrs; BMI=30±7 kg/m², handgrip max voluntary contraction-MVC=52±8 kg) underwent three 5-minute bouts (counter-balanced, 10 mins rest) of rhythmic handgrip (1-2 sec duty cycle, 20 squeezes/min) performed at a low (40% MVC) and high-intensity (60%

MVC) with and without proximal occlusion (80-100mmHg, 50-80% arterial occlusion assessed via radial artery Doppler-ultrasound). Peripheral BP's (brachial artery) were obtained using the oscillometric method, and a proprietary transfer function was applied to the pulse waveform to estimate central aortic BP's [systolic, diastolic, mean arterial pressure (MAP) and rate-pressure product (RPP=heart rate x systolic BP)]. **RESULTS:** Peripheral systolic and diastolic BP, MAP and RPP were greater than central pressures at BL (e.g., peripheral systolic BP=130±6 vs. central systolic BP=113±5 mmHg; P<0.001), and across each handgrip bout (P<0.05). Compared to BL, both peripheral and central MAP increased, with the greatest change occurring during high-intensity handgrip with BFR (+17±4, P<0.001). Similar findings were observed for peripheral and central systolic and diastolic BP, and RPP (e.g., central RPP at BL=7296±621, vs. 40% BFR=8217±612, vs. 60% with BFR=9441±686, vs. 60% without BFR=9237±629; P<0.001). **CONCLUSION:** These preliminary findings indicate that low intensity, unilateral handgrip exercise performed with BFR produces a comparable BP response (i.e., magnitude increase for MAP) as high intensity handgrip without BFR; however, RPP was greater during high intensity handgrip both with and without BFR, compared to low intensity with BFR.

301 Board #122 May 31 11:00 AM - 12:30 PM
Post-Exercise Blood Pressure and Autonomic Balance Following Continuous and Intermittent Exercise Bouts
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PURPOSE: To examine the post-exercise response of blood pressure and cardiac autonomic balance following a continuous bout of exercise (CONT) compared to multiple intermittent bouts (INT) resulting in the same volume of exercise. **METHODS:** Participants (n=18; age: 23.8±3 yr; 12 females, 6 males) completed both 30 minutes of CONT and 30 min of INT cycling exercise (3, 10-min bouts) at 60% VO_{2max} on 2 separate days. The order of the conditions was randomized and the INT bouts were separated by ~4 hours. Systolic (SBP) and diastolic blood pressure (DBP) were assessed with a continuous noninvasive BP monitor before exercise (PRE) and at 5, 30, 60, and 120 min of seated recovery following CONT and the final INT bout. Spectral measures of heart rate variability, reported as high- (HF) and low-frequency (LF) power, were also obtained from an electrocardiogram at the same time points. LF/HF was reported as a measure of autonomic balance. A 2-way ANOVA was used to compare BP and measures of autonomic control between conditions and over time. A significance level of 0.05 was used for all tests. **RESULTS:** Table 1 shows the values for BP during the conditions. There was a main effect of time on SBP such that it was significantly lower at all post-exercise time points compared to PRE. There were no significant changes in DBP between conditions or over time. Furthermore, there was a main effect of time on LF/HF such that it was higher at 5 minutes post-exercise (CONT: 1.23±0.04; INT: 1.17±0.03) compared to PRE (CONT: 1.10±0.02; INT: 1.06±0.02) and 60 (CONT: 1.11±0.03; INT: 1.10±0.03) and 120 min (CONT: 1.10±0.02; INT: 1.07±0.02) post-exercise. **CONCLUSION:** Both CONT and INT resulted in similar post-exercise reductions in SBP and alterations in autonomic balance. Accumulating exercise in multiple bouts appears to result in a similar post-exercise BP response as the same volume of exercise done continuously.

Table 1.

		PRE	5 min	30 min	60 min	120 min
SBP (mmHg)	CONT	120.3 ± 2	111.0 ± 3*	108.0 ± 3*	105.4 ± 3*	108.5 ± 3*
	INT	121.2 ± 2	111.8 ± 3*	108.6 ± 3*	108.5 ± 4*	105.9 ± 3*
DBP (mmHg)	CONT	65.8 ± 2	65.9 ± 2	67.3 ± 2	65.7 ± 2	66.4 ± 2
	INT	67.0 ± 2	67.9 ± 2	65.1 ± 2	64.0 ± 2	65.9 ± 2

* P<0.05 vs. PRE; Data are mean ± SE

302 Board #123 May 31 11:00 AM - 12:30 PM
Acute Hypotension After High-intensity Interval Exercise in Metabolic Syndrome Patients
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PURPOSE: The purpose of this study was to compare the magnitude of post-exercise hypotension (PEH) after a bout of high intensity interval training (HIIT) in comparison to an isocaloric bout of traditional moderate intensity continuous exercise (CE). **METHODS:** After supine rest fourteen obese (31±1 kg·m⁻²) middle-age (57±2 y) metabolic syndrome patients (84% hypertensive) underwent a bout of HIIT (45 min)

and CE (70±5 min) in a random order and then returned to supine recovery for another 45 min. Exercise trials were isocaloric and compared to a no-exercise trial (CONT). Before and after exercise we assessed blood pressure (BP), heart rate (HR), cardiac output (Q), systemic vascular resistance (SVR), intestinal temperature (T_{INT}), forearm skin blood flow (S_kBF) and percent dehydration.

RESULTS: During CONT blood pressure and the rest of variables remained unchanged. HIIT produced larger PEH than CE (systolic BP -14±4 versus -4±2 mmHg; $P=0.024$) and larger increases in post exercise resting HR (27±2 versus 4±2 beats·min⁻¹; $P<0.005$). Post-exercise T_{INT} and S_kBF increased only after HIIT ($P<0.05$). PEH after HIIT correlated with the reductions in SVR ($r=0.58$; $P<0.030$) the increases in Q ($r=-0.91$; $P<0.001$) systolic BP prior to exercise ($r=0.60$; $P<0.023$).

CONCLUSIONS: Our findings suggest that HIIT is a superior exercise mode than CE to transiently reduce hypertension in MSyn subjects. PEH seems to be enhanced by some factor positively related the elevations blood pressure during the previous exercise bout.

Supported by a Grant from the Spanish Ministry of Economy and Competitivity (DEP2014-52930-R)

303 Board #124 May 31 11:00 AM - 12:30 PM

Effects of Warm up and Cool Down on Wingate Anaerobic Power Test Hemodynamics

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The impact of warm-up (WU) and cool down (CD) on systemic vascular resistance (SVR[dyn.s/cm]) relative to high intensity exercise is limited. SVR (mean arterial pressure – central venous pressure ÷ cardiac output [CO]) is an index of change in vascular resistance of individual vascular beds and provides insight into local hemodynamic (H) function. **PURPOSE:** The purpose was to examine the effects of a WU and CD on power output and the cardiovascular (CV)/H response to the Wingate Anaerobic Power Test (WAPT). **METHODS:** Following familiarization with impedance cardiography and the WAPT, 20 subjects (21.9 ± 2.7 yr, 170.7 ± 10 cm, body mass 70.5 ± 10.9 kg, 7 ♂) were randomly assigned in a crossover design to the following trials: WU & CD (C1), WU & no CD (C2), no WU, but CD (C3), and no WU & no CD (C4) with 48 hours between trials. Both WU and CD were 3 min cycling @ 50 rpm @ 50 watts. No WU or no CD required 3 minutes of seated rest. All measures were monitored continuously until 5 min post-test. Blood pressure was measured immediately post exercise. **RESULTS:** Statistical analysis by ANOVA with repeated measures ($p<.05$) of combined data of WU trials (C1 & C2) vs no WU trials (C3 & C4) reveals a significant difference ($p<.05$) pre-WAPT between HR 102 vs 84 b/min, SV 95 vs 83 mL/b, CO 9.8 vs 7.0 L/min, and SVR 681 vs 950 dyn.s/cm, respectively. Combined data of CD trials (C1 & C3) vs no CD (C2 & C4) post-WAPT reveals significant differences ($p<.05$) in HR 141 vs 130 b/min, CO 16.0 vs 14.4 L/min, and SVR 415 vs 469 dyn.s/cm. SV of 114 vs 111 mL/b was not significantly different. No differences were found between trials performing the same type of WU or CD. Peak power and average power of all trials were 1131 ± 308 W and 583 ± 120 W with NSD among trials. **CONCLUSION:** Our data indicate that WU had no impact on Wingate Anaerobic Power Test performance. The differences in SV and HR were anticipated because of the protocol used with active and passive WU and CDs. The marked reduction in SVR of 39% from WU prior to WAPT substantiates improved local peripheral hemodynamic function and confirms the opportunity for improved metabolic exchange for a highly demanding anaerobic activity. The benefit of CD following intense exercise is demonstrated with a prolonged attenuation of SVR, which may enhance recovery.

304 Board #125 May 31 11:00 AM - 12:30 PM

The Hypotensive Effects of Isometric Training are Associated with Decreasing Daytime Sleepiness in Young Women

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(No relationships reported)

Isometric exercise training (IET) has been conducted to reduce resting blood pressure; however, the underlying mechanisms are not fully understood. Sleep and sleepiness have been shown to be associated with cardiac risk factors including hypertension. In addition, although some studies indicate that exercise can improve sleep and sleepiness, it remains unknown whether IET can influence sleep, sleepiness, and their relationship with hypotensive effects. **PURPOSE:** To investigate whether IET influences sleep, sleepiness, and to determine their relationship with reduced resting blood pressure (BP). **METHODS:** Twenty-two normotensive young women were assigned to either control (n=11) or training (n=11) group. The training group

performed unilateral isometric handgrip (IHG) sessions three times per week for 8 weeks (wks). The training protocol consisted of four 2-min bouts of IHG exercise at 25 % of maximal voluntary contraction, separated by 3-min rest periods. Sleep and sleepiness were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS). Resting blood pressure was measured pre and post 8 wks of training. PSQI and ESS were measured at pre (0 wk), middle (4 wk), and post (8 wk) training. BP was compared between pre and post training, using paired T-test in each group. PSQI and ESS were analyzed by two-way analysis of variance (time x group), using post hoc Tukey HSD test. A Pearson correlation was determined between resting BP change ratio and change ratio for PSQI and ESS from pre to post training period. **RESULTS:** Following 8 wks, IHG training significantly reduced systolic BP (-4.5±6.3 mmHg, $p<0.05$) and mean BP (-3.8±4.6 mmHg, $p<0.05$), but not diastolic BP (-3.4±5.3 mmHg, $p=0.058$); no BP changes were noted in the control group. The PSQI scores were not significantly different among groups. A significant interaction effect was observed in ESS, which indicated that ESS significantly decreased from pre to post training period in the training group (10.3±3.7 to 8.4±4.6, $p<0.05$). ESS change ratio was significantly associated with the resting mean BP change ratio ($r=-0.732$, $p=0.01$). **CONCLUSION:** This study indicates that isometric exercise training could reduce resting blood pressure and was associated with daytime sleepiness in young women.

A-45 Free Communication/Poster - Chronic Disease and Disability

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

305 Board #126 May 31 9:30 AM - 11:00 AM

Balance Confidence Predicts Fall Frequency but not Physical Activity in Individuals with Parkinson's Disease.

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(No relationships reported)

Parkinson's disease (PD) is a neurodegenerative movement disorder that affects approximately one million Americans. Physical activity has been shown to be beneficial in the management of PD, however, motor symptoms associated with the disease may create a barrier to participating in exercise. The activities balance confidence (ABC) scale is an index of an individual's confidence in their balance during activities of daily living and is predictive of fall risk but the association between ABC scores and physical activity behavior in individuals with PD has yet to be determined.

Purpose: To assess the relationship between balance confidence and fall frequency, disease severity and objectively-measured physical activity in individuals with PD. **Methods:** Ten participants diagnosed with PD (63.5 ± 11.2 years old, $n = 3$ females) completed the validated ABC scale and gave self-report of their fall frequency over the past 12 months. Disease severity was assessed via the Unified Parkinson's disease ratings scale (UPDRS) by trained personnel. Finally, participants were given a wrist-mounted, physical activity monitor (Movband 3) to measure physical activity behavior over a one-week period. Physical activity during all waking hours and was recorded as the number of steps taken per hour of activity monitor wear. **Results:** Pearson's correlation analyses revealed significant negative correlations ($r \geq -0.59$, $p \leq 0.05$) between the ABC scale score and both the number of falls reported over the previous 12 months and UPDRS scores. In other words, as balance confidence increased, the number of falls reported and disease severity decreased. However, ABC scores were not ($r = -0.06$, $p = 0.85$) associated with physical activity.

Conclusion: While individuals with Parkinson's disease who had poor balance confidence did have more frequent falls and greater disease severity, their physical activity behavior was not different than those with greater balance confidence. Therefore, poor balance confidence may not decrease physical activity behavior in individuals with Parkinson's disease.

306 Board #127 May 31 9:30 AM - 11:00 AM

Effectiveness Of Multi-component Exercise On Physiological Function Among Older Adults With Diabetes And Hypertension

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(No relationships reported)

The increasing prevalence of older adults with diabetes and hypertension has resulted in a major public health issue and seriously challenged healthcare professionals in China. **PURPOSE:** The purpose of this study is to design a multi-component exercise program (MEP) with a randomized controlled trial and examine the effectiveness of the MEP on fitness and physiological function among older adults with diabetes, hypertension or mixed at a community sitting in China. **METHODS:** Seventy older adults (34 men, 36 women; M age= 66±5.5 year old) randomly assigned for the MEP participated in 60 minutes of supervised exercise consisting of various activities related to flexibility, strength, balance, and endurance three times per week for 12 weeks. An experimental pretest-posttest design was employed measuring physical fitness: strength, endurance, flexibility, balance and VO₂ peak, and physiological function: a systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL), low-density lipoprotein (LDL), and fasting glucose (FG). Paired *t*-tests were utilized to analyze for within-group comparisons between baseline and the results after three months. **RESULTS:** The results revealed that fitness variables were improved significantly in strength (bench press, seated row, arm curl, knee extension, leg press), endurance (VO₂ peak), flexibility (hamstring flexion, knee flexion, shoulder flexion,) and balance (8 foot up and go and chair stand) ($P < 0.05$) after training, meanwhile, the results showed greater decrease in DBP ($t = 3.34 P = 0.00$) SBP ($t = 3.49 P = 0.00$). Biomarkers further demonstrated that the MEP had a significant effect on physiological function: TC ($t = 3.89 P = 0.00$), LDL ($t = 3.20 P = 0.00$), FG ($t = 2.85 P = 0.01$), but no significant effect emerged on TG ($t = -1.01 P = 0.34$), HDL ($t = -0.73 P = 0.56$) in pretest-posttest. **CONCLUSIONS:** The findings from this intervention indicated that this MEP has significant effects on physical fitness, aerobic capacity, blood pressure and biomarkers among older adults with diabetes and hypertension. Such intervention should be expanded to a larger older population.

307 Board #128 May 31 9:30 AM - 11:00 AM

Muscle Weakness and Diabetes Jointly Exacerbate the Rate of Functional Disability among Older Mexican Americans

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PURPOSE: Preserving muscle strength and avoiding chronic diseases such as diabetes may reduce the rate of developing a functional disability at an older age, especially among at risk populations. The purpose of this study was to determine the independent and joint contributions of muscle weakness and diabetes on the incidence of activities of daily living (ADL) disability in an older Mexican American cohort. **METHODS:** A subsample of 2,378 Mexican American males and females aged 65 years and older at baseline were followed for 17 years. Muscle strength was assessed with a handheld dynamometer and was normalized to body weight (normalized grip strength [NGS]). Male and female participants were considered weak if their NGS was ≤ 0.46 and ≤ 0.30 , respectively. The presence of diabetes, ADL disability, and the age of each diagnosis was self-reported by participants. Males and females were classified into four separate groups depending on their muscle strength and diabetes status. Sex-stratified Cox proportional hazard models were used to examine the independent and joint effects of muscle weakness and diabetes on incident ADL disability after adjusting for relevant covariates. **RESULTS:** Males and females that were weak and had diabetes at baseline had a 2.36 (95% confidence interval [CI]: 2.29-2.43; $p < 0.0001$) and 1.96 times higher rate (CI: 1.92-2.20; $p < 0.0001$) of ADL disability compared to males and females that were strong and did not have diabetes at baseline, respectively. Strong male and female participants that had diabetes at baseline had a 1.84 (CI: 1.76-1.93; $p < 0.0001$) and 1.36 times higher rate (CI: 1.33-1.40; $p < 0.0001$) of ADL disability than males and females that were strong and did not have diabetes, respectively. Weak males and females that did not have diabetes at baseline had a 1.36 (CI: 1.32-1.39; $p < 0.0001$) and 1.11 times higher rate (CI: 1.09-1.12; $p < 0.0001$) of ADL disability than males and females that

were strong and did not have diabetes, respectively. **CONCLUSION:** Preserving muscle strength and avoiding diabetes reduces the rate of incident ADL disability in older Mexican Americans. Older Mexican Americans should engage in behaviors and activities that are conducive to healthy aging in order to reduce future declines in physical functioning.

308 Board #129 May 31 9:30 AM - 11:00 AM

Prevalence Of Leisure Time Physical Activity In Adults With Seizure Disorders: 2013 And 2015 Nhis

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PURPOSE: Examine the prevalence of self-reported leisure time physical activity (LTPA) participation by intensity using a representative sample of U.S. adults (18-64 years old) with a seizure disorder or epilepsy. **METHODS:** Data from the 2013 (n=587) and 2015 (n=647) National Health Interview Survey cycles were utilized to examine the prevalence of meeting the 2008 Physical Activity Recommendations for U.S. adults. **RESULTS:** In the 2013 NHIS, the prevalence of adults with a seizure disorder or epilepsy reporting insufficient (< 150 min), sufficient (150-300 min [meets rec]), or high volumes of LTPA (> 300 min [meets rec]) were 92.5%, 6.6%, and 0.9%, respectively. In the 2015 NHIS, the prevalence of adults with a seizure disorder or epilepsy reporting insufficient (< 150 min), sufficient (150-300 min [meets rec]), or high volumes of LTPA (> 300 min [meets rec]) were 92.4%, 7.1%, and 0.5%, respectively. An estimated 19.6% and 15.8% of those with a seizure disorder or epilepsy reported meeting the MSA recommendation during 2013 and 2015, respectively. **CONCLUSIONS:** Adults reporting a seizure disorder or epilepsy may not be impeded by their condition to participate in LTPA or MSA.

309 Board #130 May 31 9:30 AM - 11:00 AM

Patterns of Sedentary Behavior in The First Month After Acute Coronary Syndrome

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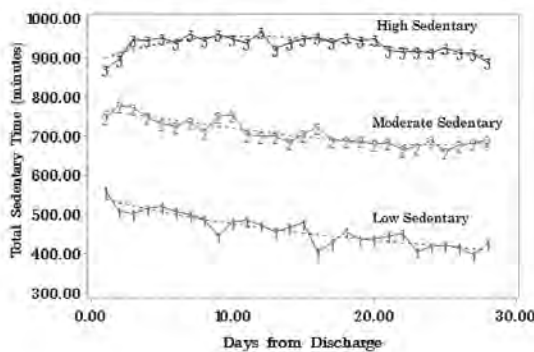
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(No relationships reported)

Sedentary behavior (SED) is a key contributor to cardiovascular disease in the general population. Few data exist on objectively measured SED patterns in acute coronary syndrome (ACS) patients in the first month after an ACS event; a critical period when lifestyle behaviors are reformed.

PURPOSE: To characterize SED patterns and their correlates in ACS patients over the first month post-discharge. **METHODS:** Participants (n=177) with confirmed ACS (myocardial infarction or unstable angina) from a university hospital in Upper Manhattan were examined. SED was objectively measured for 28-days post-discharge via Actical wrist accelerometry. Group-based modeling at the day-level was used to characterize SED patterns (trajectories) over the 28-days. Logistic regression was used to determine correlates of SED trajectories. Correlates included sociodemographic, hospitalization, physical and psychosocial factors. Models were adjusted for age, sex, race and ethnicity. **RESULTS:** Participants spent a mean (SD) of 12.3±3.2 hrs/day in SED the first month post-discharge. Three distinct SED trajectory groups were identified (Fig 1). The high SED group (38%) spent a mean (SD) of 15.6±1.3 hrs/day in SED with no change in day-level SED. The moderate SED group (41%) spent a mean (SD) of 11.8±1.2 hrs/day in SED with little change in day-level SED. The low SED group (21%) spent a mean (SD) of 7.6±1.5 hrs/day in SED, with a gradual decline in SED from immediately post-discharge (~9 hrs/day) to 28-days post-discharge (~7 hrs/day). In multivariable models, left ventricular ejection fraction < 40 , length of hospital stay and coronary artery bypass grafting were identified as significant correlates of the high SED group ($p < 0.05$ for all). **CONCLUSION:** ACS survivors accrued alarmingly high volumes of SED during the first month post-discharge, with little to no change in day-level SED over time. ACS survivors with greater disease severity were more likely to accrue higher volumes of SED.

Figure 1. Trajectories of sedentary time post-discharge in ACS patients.



310 Board #131 May 31 9:30 AM - 11:00 AM
Association of Sedentary Behavior with Cardiovascular Disease Risk Factors in Osteoarthritis Patients.
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INTRODUCTION: Cardiovascular disease has been a significant public health concern among US adults. Recently, great attention has been given to the sedentary behavior (SB) in relation to health indicators such as CD risk factors (CDRF); however, the relationship between sedentary behavior (SB) and CDRF has been little known in patients with osteoarthritis.

PURPOSE: The aim of this study was to investigate the association between leisure-related SB (LSB) time and CDRF among US adults suffering with osteoarthritis.

METHODS: Data from the 2004-2005 Osteoarthritis Initiative Database were analyzed for this study. 4,796 adults (male = 1,992; average age 61.16 ± 9.2 years), currently experiencing or at risk of developing severe osteoarthritis, were included in this analysis. LSB time was defined as leisure time sitting hours per day for past 7 days, categorized into less than 1 hour, 1 hour to less than 2 hours, 2-4 hours and more than 4 hours. Patients with CDRF were operationally defined as presence of any one of hyperlipidemia (blood cholesterol ≥240 mg/dl), obesity (BMI ≥30 kg/m²), hypertension (BP ≥140/90 mmHg), and diabetes (blood glucose ≥200 mg/dl). Logistic regression analysis was used to examine the association between LSB and CDRF with controlling covariates (i.e., age, sex, race, education, and marital status). Statistical analyses were conducted using SPSS (v.22). Significance level was set at 0.05.

RESULTS: 57.1% of participants had CDRF. 79.4% of the participants had leisure time sitting for more than 2 hours per day. The adjusted odds ratios (OR) were statistically significant between LSB time and CDRF for less than 1 hour (reference) vs 2-4 sitting hours (OR = 1.47, 95% CI: 1.01 - 2.13) and less than 1 sitting hour vs more than 4 sitting hours (OR = 1.80, 95% CI: 1.24 - 2.62). Sitting time for 1 hour but less than 2 hours was not significant.

CONCLUSIONS: The results of this study indicate that LSB time associates significantly with CDRF among osteoarthritis patients. This finding suggests that avoiding LSB may be beneficial for lowering the risk of CD in US adults with osteoarthritis.

311 Board #132 May 31 9:30 AM - 11:00 AM
Prevalence of Physical Activity and Sitting in People with Inflammatory Bowel Disease and Healthy Individuals
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Inflammatory bowel disease (IBD) is an autoimmune disease characterized by the cyclical nature of flare and remission periods, with little known about the prevalence of physical activity and sedentary behaviors, such as sitting, in this population.

PURPOSE: To determine the prevalence of physical activity and sitting in people with IBD (in remission and disease flare) compared to healthy individuals. **METHODS:** Participants with IBD (n=242; 96 in disease flare [IBD-flare] and 146 in disease remission [IBD-remission]), and healthy controls (n=265) participated in an online survey. Self-reported walking, moderate-to-vigorous physical activity (MVPA) and

sitting were collected using the International Physical Activity Questionnaire. Data were analyzed using analysis of covariance with age, sex, education status, disease history, and smoking habits as covariates. **RESULTS:** People with IBD reported lower levels of walking (329±422 minutes/week, p=0.03) and MVPA (279±412 minutes/week, p<0.01) than healthy individuals (477±536 min and 481±529 minutes/week, respectively). There were no differences between IBD-flare and IBD-remission participants for levels of walking (301±466 vs. 335±368 minutes/week, respectively) or MVPA (227±315 vs. 330±481 minutes/week, respectively, p>0.05 for both). Physical activity guidelines were met in 45% of people with IBD and 73% of healthy individuals (p<0.05). Although sitting was not different between groups, there was a trend for higher sitting in those with IBD (424±196 minutes/day) compared to healthy individuals (395±182 minutes/day, p=0.07). **CONCLUSION:** Our findings indicate that people with IBD report lower levels of physical activity than healthy individuals but report no differences in weekday sitting. Furthermore, there were no negative consequences of a disease flare on physical activity. Our findings suggest that people with IBD are able to participate in varying levels physical activity despite there being no guidelines for this population. Future research should aim to develop physical activity recommendations to benefit people with IBD and reduce the amount of time spent sitting.

312 Board #133 May 31 9:30 AM - 11:00 AM
Seasonal Variation in Physical Activity of Children with Disabilities during Physical Education
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Children with disabilities are less physically active than their typically developing peers. Physical education (PE) is a primary school setting where children can accumulate health promoting physical activity (PA). Little is known about seasonal variation in PA of children with disabilities during PE in Hong Kong.

PURPOSE: To examine seasonal difference in PA of children with different types of disabilities in the context of PE in special schools.

METHODS: Nine schools designed for children with four disability types (i.e., sensory impairments, physical disabilities (PD), mild-to-moderate intellectual disabilities, and severe intellectual disabilities) in Hong Kong were recruited. Trained observers used SOFIT (System for Observing Fitness Instruction Time) to code PA levels (i.e., lying down, sitting, standing, walking, vigorous) of students during PE. Moderate-to-Vigorous PA (MVPA) was calculated by summing walking and vigorous codes. Observations were conducted on three normal school days in winter (December, mean 18°C) and summer (June, mean 28°C) respectively. Total session energy expenditure (TEE) and energy expenditure rate (EER) were calculated using standard formulae. Linear mixed models were used to determine difference in percentage of time spent in MVPA, TEE, and EER across disability types in two seasons, after adjusting for gender, grade level, duration of PE, and school-level clustering. Interactions among season, disability type, and gender were also examined.

RESULTS: A total of 179 PE classes (94 winter, 85 summer; mean length 38.5 minutes) were observed. Only main effects of *season* were significant for %MVPA (F=4.2, p=.042) and TEE (F=5.1, p=.026), with lower scores in winter (b=-5.1, 95% confidence interval [CI], -10.0 to -0.2 for %MVPA; b=-17.4, 95% CI, -32.7 to -2.1 for TEE) compared to summer.

CONCLUSIONS: PA of children with disabilities during PE varies with seasonality. Adaptation of the setting and program content is needed to promote year-round PA for children with disabilities.

Supported by General Research Fund (752712), University Grant Committee of Hong Kong SAR

313 Board #134 May 31 9:30 AM - 11:00 AM
Physical Activity Levels among Children with Physical Disabilities in Home and School Settings
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Children with physical disabilities (PD) are less physically active than their peers with other types of disabilities. Homes and schools are important settings where children can accrue physical activity (PA).

PURPOSE: To examine PA levels of children with PD in school and home settings.

METHODS: Participants were 147 children with PD recruited from three special schools in Hong Kong. *Behaviors of Eating and Activity for Children's Health: Evaluation System* was used to document PA levels in four settings at school (before-class, recess, lunch break, after-class) and one home setting (before dinner) on four normal school days. Linear mixed models with repeated measures (four measurement days) were used to examine the percentage of time spent in moderate-to-vigorous PA (%MVPA) in the five settings across gender, grade level (4-6, 7-9, and 10-12), and mobility level (walking with or without assistance) after adjusting for school as random effects.

RESULTS: In the before-class setting, significant main effects were found for gender ($F = 5.5, p < .05$) and grade level ($F = 3.8, p < .05$), with boys having less %MVPA than girls ($b = -6.2, 95\% \text{ CI} = [-11.4, -0.9]$), and children in Grades 4-6 and 7-9 having higher %MVPA than those in Grade 10-12 ($b = 7.8, 95\% \text{ CI} = [1.7, 13.9]$; $b = 7.0, 95\% \text{ CI} = [0.4, 13.6]$). A significant main effect of mobility was found separately for recess, lunch break, and after-class settings ($F = 48.6, p < .001$; $F = 34.1, p < .001$; $F = 12.1, p < .01$), with children walking without assistance accruing higher %MVPA ($b = 16.9, 95\% \text{ CI} = [12.1, 21.7]$; $b = 12.7, 95\% \text{ CI} = [8.4, 17.0]$; $b = 47.8, 95\% \text{ CI} = [22.9, 72.7]$). Additionally, a significant *grade by mobility* interaction effect was found in %MVPA during the after-class period ($F = 3.8, p < .05$), whereby the %MVPA of Grade 10-12 children who walked without assistance was greater than counterparts needing assistance. No significant effects of gender, grade level, and mobility on %MVPA were found at home setting.

CONCLUSIONS: Children have low levels of PA across settings, with the most inactive pattern at home and slightly more PA accrual at recess and after-class setting. Future research should pay more attention to their low activity level at home. A multifaceted intervention that considers the contextual and personal factors may help promote PA in children with PD. Supported by GRF 14409514.

314 Board #135 May 31 9:30 AM - 11:00 AM
The Epidemiology of Injuries in Turkish Athletes at Rio Paralympics

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Purpose: The aim of the study was to determine the characteristics and incidence of medical condition or injuries of Turkish team participated to Rio Paralympics. **Methods:** Medical condition information was collected from assessment forms which recorded by 6 team physiotherapists and one doctor. The assessments included demographic characteristics of athletes (sport type, age, gender), injury related questions (time-type and region of injury). **Results:** 81 Turkish athlete (35 female/45 male) participated to Rio Paralympics. A total of 148 application (75 female/73 male application) in 50 athletes were documented during the Paralympic Games. Of the application 63% was musculoskeletal system disorders, 12.8% was urinary system disorders, 2.7% was ophtalmologic problems, 6.8% was gastro intestinal, 2% was ear and 2.1% was allergic problems. Of these injuries 37.1% occurred before the games started. 31 athletes injured more than one time. The most commonly injured region was shoulder and neck (17.6%, 16.9% respectively). Of the athlete 41.9% received medical treatment alone, 43.2% received physiotherapy alone, 14.9% received both physiotherapy and medical treatment. **Conclusion:** This is the first comprehensive epidemiologic report of Turkish paralympic team. It is important to determine the injury prevalence and develop prevention strategies in paralympic sports.

315 Board #136 May 31 9:30 AM - 11:00 AM
Identifying Predictors of Health in Adults with an Intellectual Disability

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Body mass index (BMI) and age are well-known predictors of an individual's health (Peter et al., 2015). However, many studies recently suggest that there should be additional factors between BMI and health to strengthen the relationship (McAuley et al., 2014). This complicated process might apply to adults with an intellectual disability (ID), but there have been limited understanding on what other factors influence health over BMI and age in this underserved population. **PURPOSE:** To identify health predictors in adults with ID, controlling for BMI and age. **METHODS:**

We employed secondary data analysis using 6814 adults with ID (age 18-96 years; 56% men) from the 2013-14 Adult Consumer Survey by National Core Indicators to reveal the potential predictors. Tested variables included personal, health, residence, employment, daytime activities, home, friends/family/staff support, service satisfaction, community participation, and choice-related variables. Considering a type of the outcome variable (i.e., four health categories from poor to excellent), a forward model selection method based on ordinal multiple regression was employed to find out the best model explaining health in adults with ID. **RESULTS:** Mobility, moderate physical activity (PA) engagement, tobacco use, staff support, having a job, eating out in the past month, and having a vacation in the past year were all significant predictors of health in this population ($p < .001$), and the model containing those predictors explained 17% of variance on health of adults with ID, after accounting for BMI and age. Those who moved without mobility aids, engaged in PA, didn't smoke, had a job, received less staff support, ate out, and had vacation were significantly healthier than their counterparts. For instance, the ordered logit for adults with ID who didn't routinely engage in moderate PA being a less healthy category is .49 more than their counterparts. The goodness-of-fit test (Pearson $\chi^2 = 20241.5, p > .05$) revealed that this model fits well. **CONCLUSION:** Apart from BMI and age, we have to consider various personal, social and environmental predictors to better explain health of adults with ID. Interestingly, the health predictors found in this study are closely aligned with the International Classification of Functioning, Disability and Health (WHO, 2001).

316 Board #137 May 31 9:30 AM - 11:00 AM
Associations Among Residential Settings, Physical Activity And Health Outcomes In Adults With Intellectual Disabilities

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(No relationships reported)

The impact of different forms of residential settings on the quality of life of people with intellectual disabilities (ID) has received considerable attention. Previous studies indicate positive effects of deinstitutionalization on social network, adaptive behavior, and many other behavioral outcomes. However, the relationship between residential settings and health-related outcomes in people with ID has not been adequately studied, despite the significance of health and health risk factors such as physical activity (PA). **PURPOSE:** To examine the relationships between perceived general health, PA engagement, body mass index (BMI), and types of residential settings in adults with ID. **METHODS:** We analyzed data from the 2013-2014 Adult Consumer Survey by National Core Indicators. Data were available from 13991 cases of adults with ID (8069 men; 5922 women) aged 18 to 96 years ($M = 43.35 \pm 14.97$ yrs). Perceived health, height, weight, BMI, mobility, engagement in moderate PA, age, and residential settings were extracted for secondary data analyses. Binary logistic regression, multinomial logistic regression, and univariate one-way ANOVA were used to answer the research questions. **RESULTS:** There were significant differences in BMI between adults with ID residing in different settings ($p < .001$). Individuals with ID who live in institutions have the lowest BMI, whereas those who live independently have the highest BMI. However, there are different results on perceived health and PA engagement. There are significant differences on PA engagement among adults with ID in different residential setting. People with ID living in institutions have approximately 38% of lower engagement in PA than those living with parents ($OR = .61; CI: .50 - .75$), after controlling for mobility. Individuals with ID who live in institutions are 4 times more likely to rate their health as poor than those who live with parents ($OR = 4.19; CI: 2.54 - 3.88$), after controlling for age. There are no significant differences on perceived health between those living independently and those living with parents. **CONCLUSION:** Although individuals with ID who reside in institutions have the lowest BMI, they are less likely to engage in moderate PA and to have lower perceived health than individuals who live independently or with their parents.

317 Board #138 May 31 9:30 AM - 11:00 AM
BMI Across Age-groups In Adults With Down Syndrome And Adults With Intellectual Disability

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The age-associated response of body mass index (BMI) in adults with Down syndrome (DS) has not been thoroughly examined. DS is associated with faster biological aging; thus, BMI may change differently in response to age between adults with DS and adults with other intellectual disabilities (ID). Differences between these groups in the age-associated response of BMI may reflect differences in how weight and height change as these people age. **PURPOSE:** To examine if BMI, weight, and height differ

across age-groups between adults with DS and adults with ID. **METHODS:** We conducted secondary analyses of data from the 2013-2014 National Core Indicators Adult Consumer Survey, containing 14,237 cases (age 18-96 y; 8208 men). Of these cases, 1,343 persons had DS (age 41 ± 13 y) and 11,289 persons (age 44 ± 15 y) had ID, but not DS. We extracted weight, height, BMI, sex, and age, and generated age groups: 18-29; 30-39; 40-49; 50-59; 60-69; 70-79; 80-89; 90-99 y. There were no DS cases in the 70-79, 80-89, and 90-99 y age groups. We used 2-way ANOVA and follow-up tests to examine differences in BMI, height, and weight across age groups. Height and weight were analyzed by sex. **RESULTS:** The BMI age-associated response was different between adults with DS and adults with ID ($p < 0.001$ for interaction). Adults with DS had higher BMI than adults with ID ($p < 0.001$) at ages 18-29 (30 vs. 27 kg·m⁻²), 30-39 (32 vs. 28 kg·m⁻²), and 40-49 y (31 vs. 29 kg·m⁻²). BMI did not differ between groups at 50-59, 60-69, and 70-79 y. For adults with DS, BMI was not significantly different between the 3rd, 4th and 5th decades of life and decreased after age 49 y (from 31 kg·m⁻² at age 40-49 y to 26 kg·m⁻² at age 60-69 y; $p < 0.001$). For adults with ID, BMI increased between the 3rd and 4th decade of life and decreased after age 59 y (from 28 kg·m⁻² at age 50-59 to 25 kg·m⁻² at age 80-89 y; $p = 0.015$). For both sexes, weight declined at earlier ages in those with DS than those with ID ($p \leq 0.019$ for interactions). Height was lower across all ages for both women and men with DS than their sex counterparts with ID ($p < 0.001$); however, the age-associated response in height did not differ between those with DS and those with ID. **CONCLUSION:** The age-associated changes in BMI and weight are different between adults with DS and adults with ID, but no DS. The results indicate earlier onset of weight loss in adults with DS.

318 Board #139 May 31 9:30 AM - 11:00 AM
Effect Of A Physical Education Program On Motor Performance In Down's Syndrome Children By Mabcb2
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PURPOSE: Previous studies suggest that children with Down's Syndrome, a genetically based neurodevelopmental disorder, demonstrate motor problems and cognitive deficits. Thus, the aim of study was to analyze the effect of an intervention based on a special physical education program on motor performance in children with Down's Syndrome. **METHODS:** A total of 16 participants (7 girls and 9 boys) from Riobamba (Ecuador) with Down's Syndrome aged between 7 and 10 years (7.00±1.47) participated in this study. A special physical education program was implemented during 6 month (3 time-week; 2 hour per session). Motor performance was assessed at baseline and post-intervention through the Movement Assessment Battery Children-2 (MABC2-checklist) evaluating the following variables: manual dexterity, accuracy and catches, and balance. A pair sample t-test was conducted to compare the differences between baseline and post-intervention on motor performance variables means. **RESULTS:** Time to perform the test of Manual Dexterity significantly decreased post-intervention (baseline=155.82±94.06-seconds vs post-intervention=149.29±90.19-seconds; $p < 0.001$). The number of successful attempts in the test of accuracy and catches significantly improve post-intervention (baseline=3.17±1.98 vs post-intervention=8.29±4.62; $p < 0.001$). In the balance test, children significantly increased the time in balance state post-intervention (baseline=11.23±10.18 seconds vs post-intervention=15.58 ±7.50 seconds; $p < 0.001$). **CONCLUSION:** 6-month physical education program could improve motor performance (manual dexterity, accuracy and catches, and balance) in children with Down's Syndrome.

319 Board #140 May 31 9:30 AM - 11:00 AM
Physical Activity and Shoulder Muscle Strength in Spinal Cord Injured Individuals
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The participation in sport activities is important in individuals with spinal cord injury, namely to counteract their sedentary lifestyle and the loss of hand and upper limb function. However, there is a lack of knowledge regarding the effects of sport in moderate-to-vigorous physical activity levels and shoulder muscle strength. **PURPOSE:** To compare shoulder muscle strength and physical activity levels in sportive and non-sportive individuals with spinal cord injury. **METHODS:** This is a cross-sectional study encompassing 14 sportive (41.07 ± 9.99 yrs.) and 4 non-sportive men (32.0 ± 6.97 yrs.) with spinal cord injury (between T5 and L1). Sports

participation was determined by questionnaire. Physical activity was measured with triaxial accelerometry worn on wrist during 7 consecutive days. Data was expressed as average of minutes per day in moderate-to-vigorous physical activity. Shoulder strength was assessed in an isokinetic dynamometer at 60°/second. Shoulder movements considered were flexion/extension (range 0 - 50°), external/internal rotation (range 0 - 45°), and abduction/adduction (range 25 - 75°). Non-parametric statistics (Mann-Whitney) was used to compare differences between sportive and non-sportive men. **RESULTS:** Total moderate-to-vigorous physical activity of sportive compared to non-sportive individuals was significantly higher (126.50 ± 53.26 and 61.82 ± 28.8 min/day, respectively; U=52.00; $p=0.008$), and the same pattern was observed when considering only weekday moderate-to-vigorous physical activity (131.81 ± 58.66 and 62.47 ± 30.29 min/day, respectively; U=52.00; $p=0.008$). Regarding to isokinetic strength, the peak torque of the right and left shoulder extension was significantly higher (U=49.00; $p=0.025$) in sportive (72.45 ± 11.8 Nm and 73.95 ± 12.0 Nm, respectively) compared to non-sportive men (59.97 ± 7.46 Nm and 62.90 ± 12.42 Nm, respectively). **CONCLUSIONS:** In men with spinal cord injury, the participation in sport activities can lead to an increment in moderate-to-vigorous physical activity and shoulder extension strength that might be important for independency in daily activities. Supported by the CNPQ under grant number 206862/2014-8; CAPES under grant number 6099/13-0; CIAFEL under grant number UID/DTP/00617/2013.

320 Board #141 May 31 9:30 AM - 11:00 AM
Workplace Wellness Exercises For Individuals Who Use Wheelchairs
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Individuals who use wheelchairs for mobility face various barriers to physical activity during the workday. Worksite wellness exercises can be conducted during the workday to increase energy expenditure during sedentary time sitting at a desk. Research in the general population shows promising results for worksite wellness exercises conducted at specific intervals and intensities throughout the day increasing daily energy expenditure, which over an extended time period could have a significant impact on weight management. **Purpose:** To pilot test worksite wellness exercises for individuals who use wheelchairs for mobility. **Method:** Five worksite wellness exercises were chosen from surveys including: air punches, arm circles, chair push-ups, forward/lateral raises, and desk push-ups. The five exercises were pilot tested using the COSMED K4 portable metabolic cart in individuals who use wheelchairs of working age. Participants first rested for five minutes to measure resting energy expenditure. Exercises were performed for intervals of 60 seconds of work and 60 seconds of rest in a randomized order. Feasibility of worksite wellness exercise movement performance and trends in changes in energy expenditure were analyzed across the entire sample. **Results:** Participants included 14 individuals who use wheelchairs for mobility between 18 and 60. On average resting energy expenditure equaled 1.33(SD=0.35) Mets and 1.64(SD=0.39) Kcal/min and exercise energy expenditure equaled 2.38(SD=0.81) Mets and 3.08(SD=1.06) Kcal/min. Greatest increases shown in chair push-ups and desk push-ups. Three participants were unable to perform chair push-ups due to injuries or strength. Therefore, performing worksite wellness exercises for 13 minutes per workday could result in an extra 100 Kcal/week expended per week. **Conclusions:** Worksite wellness exercises are a feasible option for energy expenditure in the workplace for individuals in wheelchairs. Specific worksite wellness exercises are needed to suit their needs that could also be performed outside the workplace as an exercise regimen. This was a small, feasibility pilot study and larger studies need to be done to show reliability and validity of these exercises across diverse populations of individuals who use wheelchairs for mobility.

321 Board #142 May 31 9:30 AM - 11:00 AM
Using a Self Regulation Physical Activity Intervention to Improve Physical Function
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Limitations in physical function are risk factors for subsequent disability, institutionalization, and loss of independence for older adults and are directly caused or exacerbated by physical inactivity. Getting older adults to adopt and maintain physical activity (PA) is a challenge. Use of self-regulation (SR) strategies may be useful, especially for overweight and obese older adults. **PURPOSE:** To examine the effect of a 10-week group exercise and lifestyle behavior change program on physical function in older community-dwelling adults. **METHODS:** Fifty two older adults (mean age=72.34 yrs ± 8.0, mean BMI=31.68 ± 6.53) completed the 10-week Physical Activity

for Life for Seniors (PALS) group exercise and lifestyle behavior change program. Ten exercises were performed in a circuit in 1 minute intervals over 40 minutes 3 days/week. The 30 minute lifestyle behavior change class included self-regulation problem solving strategies for staying active. Physical function was measured via the Physical Function Questionnaire (PFQ, 0=unable to do to 100=no difficulty in performing 6 functional tasks), Timed Up and Go (TUG, time in seconds to rise from a chair, walk 3 meters, return to chair and sit), 6 Minute Walk (6MW, feet) and Usual Gait Speed (UGS, meters/second to walk 6 m distance); PA via the CHAMPS questionnaire and SR via the Self-Regulation for Exercise Scale (1=never to 5=very often). Paired t-tests were used to examine mean differences in the variables pre and post intervention.

RESULTS: In this population of overweight and obese older adults, significant improvements ($p<.000$) were noted in physical function (PFQ: 72.85 ± 21.12 vs 79.31 ± 18.47 ; TUG: 10.89 sec ± 2.67 vs 9.45 sec ± 2.52 ; UGS: 1.19 m/s $\pm .22$ vs 1.26 m/s $\pm .22$; 6MW: 1112.06 ft ± 410.21 vs 1337.92 ft ± 361.04); PA (total PA: 2143.31 ± 2153.24 vs 4092.99 ± 2635.78 ; moderate PA: 742.84 ± 1476.00 vs 2366.96 ± 2112.94); and SR ($1.55 \pm .61$ vs $2.67 \pm .62$). **CONCLUSIONS:** These results suggest that a 10-week group exercise intervention that includes a SR behavior change component was effective in improving physical function and moderate intensity and total PA in this population of older adults. Participants indicated they liked the socialization the group format provided.

322 Board #143 May 31 9:30 AM - 11:00 AM
Determinants of Leisure-Time Physical Activity Participation in University Students with Physical Disabilities: A Multi-University Study

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Purpose: The purpose of this study was to investigate the participation rates and determinants of physical activity (PA) participation of university students with physical disabilities (SWD).

Methods: 40 SWD from 16 U.S. universities completed a mixed-methods online survey regarding their LTPA practices and influences to participation on their campus. Surveys used to measure variables of interest included LTPAQ-SCI and PASIPD (PA), WHO QOL-BREF (quality of life), ESES (exercise self-efficacy), SCOPE (social inclusion opportunities), B-PEDS (barriers to exercise), and Self-Regulation (SR) questions (intent to exercise). Short answer questions were included to allow participants to expand on answers and provide more detailed information. Kruskal-Wallis tests were used to examine differences in survey outcomes between gender and sport participation. Spearman's rho and multiple regressions analysis were used to examine the extent of the relationships between variables of interest and participant PA levels. Short answer responses were analyzed using thematic analysis strategies.

Results: A strong correlation was found between PA and all variables of interest ($p<.05$). Variables found to have the strongest correlation with PA included ESES ($r_s=0.63$, $p<.01$), SR ($r_s=0.74$, $p<.01$), WHO QOL-BREF ($r_s=0.45$, $p<.01$), and perceived opportunities for LTPA on campus ($r_s=0.51$, $p<.01$). Multiple regressions analysis revealed gender, SR, and perceived social inclusion on campus were significant predictors of PA level ($F=19.43$, $p<.01$, adj. $R^2=0.61$). Short answer responses reflected quantitative findings and provided rich elaboration on these constructs.

Conclusions: Results indicated SWD may be more active than previously thought, yet still critically low relative to physical activity guidelines for aerobic health. Although all external and internal variables examined had significant relationships to PA level, internal variables had the strongest correlations to PA level. It was also found that significant internal variables had strong correlations to external variables, indicating a complex relationship between SWD external-environmental influences, internal-personal influences, and PA levels.

323 Board #144 May 31 9:30 AM - 11:00 AM
Cognitive Benefits Of A Dance Movement Therapy Program In Adults With Intellectual Disabilities

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INTRODUCTION: There is a constant connection between mind and body in Dance/Movement Therapy (DMT). This connection promotes the integration of the emotional, cognitive and physical dimensions of a person.

PURPOSE: to evaluate the cognitive improvement after a DMT program in adults with intellectual disability (ID)

METHODS: 28 adults with moderate-severe ID (16 men, 40-66 yr), recruited from a workshop center, participated in the study after obtaining their legal/tutors and their own informed consent. They were divided into Intervention group (IG; n=15) and Control group (CG; n=13). The IG followed a DMT program of 26 sessions of 1 hour 2 day/w plus their regular work, meanwhile the CG continued with their regular activities. The sessions were structured as proposed by Chace (1953). Human Figure drawing test, Illinois test for Psycholinguistic aptitudes and Pictures memory test were applied before and after the DMT program. Descriptive for all variables were obtained. T-test was applied to study within-group differences. ANCOVA was applied to study between-groups differences.

RESULTS: Significant deterioration for evolutionary indicator (EI), word verbal expression fluency (WVEF) and body part expression fluency (BPEF) were found in the CG. The IG significantly improves EI and picture's memory (PM). When controlling for age, gender, ID level and baseline values, a significant difference ($p<.05$) between IG and CG in the EI was found.

CONCLUSIONS: Even only EI showed between-groups significant differences, there is a cognitive improvement in persons with ID after following a DMT program. More research is needed with a larger sample and/or a longer DMT program.

Partially supported by: MEC (Ref: DEP2012-35335) & AGAUR (Ref: 2013FI_B2 00091)

Table 1. Characteristics of the participants

Variables	Control group (n=13)	Intervention group (n=15)
Age (years)	53 (9)	52 (7)
Gender (M/F)	9/4	7/8
ID level (%)	66.5 (11.0)	71.2 (7.7)

Table 2. Cognitive values for participants by Pre-Posttests

Variables	Control group (n=13)		P_1	Intervention group (n=15)		P_2	P_3
	T_1 Mean (SD)	T_2 Mean (SD)		T_1 Mean (SD)	T_2 Mean (SD)		
Evolutionary Indicator	17.1 (3.8)	14.9 (3.9)	.014	12.6 (5.5)	14.67 (4.9)	.014	.000
Picture's Memory	3.4 (2.2)	4.9 (2.3)	.621	2.6 (1.6)	3.8 (2.2)	.033	.554
Word verbal expression fluency	34.2 (13.09)	33.5 (14.1)	.007	28.3 (11.6)	31.3 (11.0)	.169	.812
Body part verbal expression fluency	10.0 (5.5)	8.9 (4.1)	.008	7.3 (4.1)	8.7 (3.8)	.068	.105

Abbreviations: T_1 , pre-test; T_2 , Post-test

P_1 : within-group differences for CG.

P_2 : within-group differences for IG.

P_3 : ANCOVA between-groups differences, controlling for baseline values, age, gender and Intellectual Disability level.

324 Board #145 May 31 9:30 AM - 11:00 AM
Validity Of The Maps Score As A Functional Measure In Adults With Incomplete Spinal Cord Injury

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Current functional measures for adults with spinal cord injury are limited in their ability to assess person-environment interaction as defined by the World Health Organization. The Movement and Activity in Physical Space (MAPS) score, an objective functional measure encompassing physical activity and person-environment interaction, has been successfully applied to measure various patient populations. However, the validity of the MAPS score in adults with incomplete spinal cord injury (iSCI) has not been evaluated.

PURPOSE: To validate the MAPS score in adults with iSCI using evidence of convergent and known-group difference validity.

METHODS: 9 adults (48.1 ± 16.4 yrs) with iSCI wore a GT3X accelerometer and carried a LandAirSea model Tracking Key GPS receiver when outside of their residence to measure free-living physical activity and record location (latitude/longitude), respectively. In this analysis, participants who wore an accelerometer and GPS for at least 3 days were included ($n=9$; 5.8 ± 1.5 days). MAPS scores were calculated by combining data from the accelerometer and GPS to assess patient function. Functional ambulation measures included walking speed, 6-minute walk distance (6MWD), and Walking Index for Spinal Cord Injury (WISCI - II).

Convergent validity evidence was obtained by quantifying the relationship between MAPS score and the three functional ambulation measures using Pearson product moment correlations, and known-group difference validity evidence was assessed using an independent t-test to compare participants who displayed greater (n=7; ASIA Impairment Scale: B) and lesser (n=2; ASIA Impairment Scale: C and D) severity of functional impairment (GSFI vs LSF1).

RESULTS: The MAPS score was moderately correlated with walking index (r=.74), walking speed (r=.64) and 6MWD (r=.56). A significant difference in MAPS score was also observed between GSFI (5.27±7.12) and LSF1 (35.65±23.55) groups, t(6.47)=-2.97, p=.023.

CONCLUSIONS: Our findings provide support for using the MAPS score as a functional outcome measure in adults with incomplete spinal cord injury.

325 Board #146 May 31 9:30 AM - 11:00 AM
Sex Differences in Resting Heart Rate and Heart Rate Recovery in Low Back Pain Subjects

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Resting heart rate (RHR) and heart rate recovery (HRR) are two easy to obtain measures providing a quick estimate of cardiovascular health (CVH). There is conflicting and inconclusive evidence regarding the association of CVH and low back pain (LBP), although it is known that deconditioning is prevalent in this population. **PURPOSE:** To examine sex differences in RHR and HRR, and the relationship between RHR and HRR in subjects with LBP. **METHODS:** RHR and 1 minute HRR were assessed via Polar heart rate monitoring in 31 patients (18 females) seeking therapy for chronic non-specific LBP. HRR was assessed after repeatedly lifting a 25-pound weight from a 1 foot stool to chest height in an erect posture (Rep Lift) for 1 minute at a self-selected cadence, using self-selected biomechanics, as well as after 15 minutes of steady state treadmill walking (TMW) at a self-selected brisk pace. **RESULTS:** Males and females were similar in age (55.4±14 years), BMI (28.6 ± 5.4 kg/m²), resting blood pressure (127/78 mmHg), pain intensity (2.8 ± 2.5), and self-reported disability (Oswestry score of 35.8 ± 17.1). Additionally, there were no significant differences between males and females in RHR (72.3±1.9 bpm), peak heart rate of Rep Lift and TMW (107.0 ± 20.0 and 96.0 ± 13.7 bpm respectively), and HRR after Rep Lift and TMW (18.0 ± 10.3 and 15.8 ± 6.4 beats, respectively). However, RHR predicted HRR after Rep Lift and TMW in males (p<.01, R²=.55 and .46 respectively) but not in females (R²=.05, p=.11 and R²=.03, p=.48 respectively). **CONCLUSIONS:** RHR is often measured and interpreted as a sign of CVH, or rather deconditioning, in patients with LBP. However, it appears that RHR predicts cardiac recovery after activity in males but not females with LBP. Thus, assumptions of exercise tolerance and CVH in females with LBP should not be based on RHR, but rather on HRR. The reason for the above findings in women compared to men is unclear and warrants further investigation. This study also highlights the potential value of HRR after functional tasks such as repetitive lifting and steady state walking.

326 Board #147 May 31 9:30 AM - 11:00 AM
The Success Rate of iCan Bike Participants with Multiple Diagnoses

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Individuals with cognitive and physical disabilities must endure daily challenges that may decrease overall well-being. The iCan Bike program, a subdivision of the iCan Shine organization, utilizes an individualized intervention for teaching mentally and physically challenged individuals how to ride a two-wheeled bicycle as a means to increasing well-being and self-confidence. **PURPOSE:** The purpose of this study was to investigate the relationship between the learning success rate in the iCan Bike program and the quantity of participant diagnoses. **METHODS:** Participants were 2,652 boys (n = 1,705) and girls (n = 947) with varying diagnoses. The amount of diagnoses per rider were as followed: one (n = 1896), two (n = 639), three (n = 100), and four (n = 17). Each participant attended a five day camp, 75 minutes per day. During the week, participants progressed through a series of interventions, adapted equipment, and typical two-wheeled bicycles. Successfully riding a two-wheeled bicycle was defined as riding unassisted for 75 feet. Descriptive statistics were conducted using IBM SPSS (v23). **RESULTS:** Overall, participants achieved a 67.7% rate of success (males = 70.2%; females = 60.4%) for learning to independently ride a two-wheeled bike. The participants' success rate per amount of diagnoses were as follows: one diagnosis = 67.9% (males = 70.3%; females = 63.5%), two diagnoses =

67.0% (males = 68.2%; females = 64.7%), three diagnoses = 71.0% (males = 81.4%; females = 56.1%), and four diagnoses = 58.9% (males = 63.6%; females = 50.0%). **CONCLUSIONS:** These findings support past research, indicating this teaching style is an effective way for individuals with any amount of diagnoses to learn how to ride a two-wheeled bicycle. Interestingly, participants with three diagnoses saw a higher success rate (primarily due to a higher male success rate) when compared to the participants that had one, two, or four diagnoses. More research needs to be conducted to better define the relationship between success rate, quantity/combination of diagnoses, and gender differences among iCan Bike participants.

327 Board #148 May 31 9:30 AM - 11:00 AM
Exercise Results in Physiological Improvements in Individuals Living with Disabilities

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PURPOSE: Individuals who have a disability are at risk for becoming overweight or obese which has been associated with secondary health conditions including heart disease, stroke, diabetes, and cancer. In fact, individuals who have a disability triple their risk for these aforementioned conditions compared to adults without disabilities. This population is likely to become overweight due to physical inactivity or inadequate physical activity. Reasons cited for exercise barriers include residual physical impairments related to their health condition, or a lack of access to programs that provide appropriate accommodations. This study aimed to determine the effects of an exercise intervention on physical functioning, which may ultimately be linked to chronic disease development, in individuals with disabilities. **METHODS:** Participants were recruited from a group home through convenience sampling. At baseline and following the 6-week exercise intervention, participants underwent a battery of physiological and functional tests including body weight, resting heart rate (RHR), resting blood pressure, cardiorespiratory fitness, fall risk, muscular strength and endurance. The exercise intervention consisted of three 60 minute supervised sessions per week with two sessions held at the Miracle Field and one held at the group home. **RESULTS:** Participants included 12 group home residents, (n = 8 males) with an average age of 46 years old with varying degrees of cognitive impairments. Significant improvements were found in balance and muscular endurance. Fall risk scores improved from 37.42 ± 4.47 to 55.98 ± 6.82 (p = 0.02) and the number of repetitions performed on the lateral raise improved from 5.60 ± 0.93 to 8.10 ± 0.60 (p = 0.01) from pre- to post-intervention. Additional improvements, although not statistically significant, were found in RHR, systolic blood pressure, cardiorespiratory fitness, muscular strength, and number of push-ups performed. **CONCLUSIONS:** A supervised exercise intervention seems to be a safe and effective way to improve functional outcomes in individuals with disabilities living in a group home.

328 Board #149 May 31 9:30 AM - 11:00 AM
Sedentary Patterns In People with Intellectual Disability

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Introduction: Adults and older adults with intellectual disabilities (ID) have low physical activity levels (PALs) and very little is known about the patterns of sedentary time (ST) among them. **Purpose:** To analyze ST patterns of adults and older adults with ID. **Methods:** A group of 42 adults and 42 older adults with mild to severe ID were recruited. A health screening questionnaire was completed by each participant and/or legal guardian. Height and weight were obtained to calculate BMI. ST patterns were assessed with ActiGraph accelerometers for 7 consecutive days. **Results:** Non-significant differences in ST throughout the week were observed. Non-significant differences between gender groups were found for ST. A significant difference was found for age groups where adults present a higher number of breaks per sedentary hour than older adults (P = 0.048) and the obese participants spent more time on SB than those participants with a normal BMI (P = 0.042). We also found that the number of bouts in SB per day increased in those participants with higher BMI values (P = 0.005). **Conclusions:** These groups of subjects with ID showed a high prevalence of ST (79.4% of monitoring time). Interestingly, when comparing age and/or gender groups, no differences were observed for ST. Our findings provide novel and valuable information to be considered in future interventions aiming to increase PAL and reduce ST. Well-designed interventions and preventive health strategies in this specific population are recommended.

Partially supported by: MEC (Ref: DEP2012-35335) & AGAUR (Ref: 2013FI_B2 00091)

Table 1. Descriptive characteristics of the participants.

Variable	All n = 84	Males n = 49	Females n = 35	P_1	Adults n = 42	Older adults n = 42	P_2
Age (yr)	44 (12)	45 (11)	43 (13)	0.499	35 (7)	54 (6)	< 0.001
Height (cm)	160.5 (11.3)	165.5 (9.7)	153.5 (9.5)	< 0.001	161.0 (12.8)	159.9 (9.7)	0.642
Weight (kg)	73.5 (14.4)	72.4 (12.0)	75.2 (17.3)	0.385	70.3 (14.0)	76.8 (14.3)	0.037
BMI (kg·m ⁻²)	28.8 (6.5)	26.5 (4.1)	32.1 (7.9)	< 0.001	27.1 (4.6)	30.5 (7.7)	0.016

Note: data are expressed as mean (SD). Abbreviations: BMI, body mass index.
 P_1 Difference between genders based on t-tests. P_2 Difference between age groups based on t-tests.
 BMI, body mass index; WC, waist circumference.

Table 2. Time in sedentary, percentage of sedentary behavior·day⁻¹, number of sedentary bouts·day⁻¹, and number of breaks per sedentary hour.

Variable	Sedentary behavior (min·day ⁻¹)	P_1	Percentage of wear time in sedentary behavior·day ⁻¹	P_2	Number of bouts in sedentary behavior·day ⁻¹	P_3	Number of breaks per sedentary hour	P_4
All	612.9 (80.1)		79.4 (6.5)		64.8 (11.7)		6.2 (0.7)	
Age group [†]		0.155		0.654		0.553		0.048
Adults	599.7 (76.8)		79.1 (5.6)		64.1 (9.5)		6.4 (0.6)	
Older Adults	626.0 (82.2)		79.7 (7.3)		65.5 (13.7)		6.1 (0.7)	
Gender [†]		0.369		0.431		0.491		0.593
Males	607.7 (86.0)		78.9 (7.4)		64.1 (12.1)		6.3 (0.6)	
Females	620.2 (71.6)		80.1 (4.9)		65.8 (11.4)		6.2 (0.7)	
BMI (kg·m ⁻²)		0.039		0.111		0.005		0.138
Normal	577.2 (90.8)		77.0 (8.1)		57.9 (11.1)		6.5 (0.6)	
Over-weight	619.4 (74.1)		79.9 (5.5)		66.7 (10.4) [§]		6.2 (0.6)	
Obese	634.0 (71.1) [§]		80.7 (5.8)		68.0 (11.9) [§]		6.1 (0.7)	

Note: data are expressed as mean (SD). Abbreviations: BMI, body mass index; WC, waist circumference.
 P_1 Between age groups, gender, BMI category and WC category difference in sedentary behavior (min·day⁻¹).
 P_2 Between age groups, gender, BMI category and WC category difference in sedentary behavior·day⁻¹ (%).
 P_3 Between age groups, gender, BMI category and WC category difference in the number of bouts in sedentary behavior·day⁻¹.
 P_4 Between age groups, gender, BMI category and WC category difference in the number of breaks per sedentary hour.
[†] Differences between age groups based on linear models adjusted for gender; differences between genders based on linear models adjusted for age group. [§] Significant difference ($p < 0.05$) when compared to Normal BMI.

and body composition in people with DS. **METHODS:** The design of the study was an experimental type. Twenty two children participated with DS. Thirteen in the experimental group (EG) and nine in the control group (CG), that did not present any history of heart diseases and which didn't practice any type of physical activity or sport. The isometric strength (manual hydraulic dynamometer model SH5001), the height (stadiometer SECA 213), weight (Tanite Scale Bc533) were measured and BMI was calculated. Also the triceps and the medial calf skinfolds (Slimguide Caliper) were measured. Later a physical activity program was implemented with a frequency of five times per week with sessions of 55 minutes of duration for a period of 16 weeks. **RESULTS:** In the EG the age was 12.3 + 2.06 years, while in the CG was 11.4 + 1.94 years. The height was 134.6 + 6.4 cm and 132.7 + 4.8 cm for the GE and GC respectively. The BMI in the EG was 22.2 + 2.5 kg/m² and 20.7 + 2.5 kg/m² at the beginning and at the end of the intervention, respectively ($p=0.0001$). Meanwhile in the CG the BMI was 23.29 + 4.9 kg/m² and 21.9 + 4.6 kg/m² during the pretest and posttest respectively ($p=0.001$). In regards to the calf skinfold in the EG was 14.9 + 5.5 mm at the beginning and 14.55 + 3.2 mm at the end ($p=0.008$), while in the CG no significant difference were found ($p = 0.39$). No significant differences for the triceps skinfold were found. Isometric strength in EG at baseline was 2.4 ± 4 kg and 9.2 ± 2 kg at the end ($p=0.0001$), while in the CG no significant difference were observed ($p = 0.1$). **CONCLUSION:** A physical conditioning program can improve the body composition and the isometric strength in people with DS. People with DS need to engage in physical activity because of their tendency to be overweight and obese, this would significantly improve their quality of life.

330 Board #151 May 31 9:30 AM - 11:00 AM
Ballroom Dance Improves Heart Rate Variability and Depression in Persons with Multiple Sclerosis
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Multiple Sclerosis is a neurodegenerative disease of the central nervous system. Symptoms include fatigue, depression, gait disturbances, and cognitive changes, all which affect quality of life (QOL). Heart Rate Variability (HRV), an indication of cardiac autonomic balance, can be altered in persons with Multiple Sclerosis (PwMS) and has been associated with depression and other health risks in other populations. In turn, depression as well as HRV, can be improved with aerobic exercise. The relationships between depression, QOL, and other self-reported measures to HRV in PwMS are largely unknown. We previously showed that ballroom dance (BD) may improve physical fitness, cognition, fatigue, depression and QOL in PwMS. **PURPOSE:** The purpose of this study was to investigate the relationship of depression with HRV in PwMS and test whether BD can improve HRV concurrent with depression. **METHODS:** Thirteen PwMS participated in an 8-week BD program (MSD). Twelve PwMS served as a control group (C). BD classes were 1 hour/day, 2x/week and taught by a professional BD instructor. Each MSD subject was paired with a non-MS partner. All subjects were ambulatory, independent to modified independent. Patient Determined Disease Steps (PDDS) did not differ between groups (MSD=2.0(1.9), C=1.4(1.8)). Pre- and post- measures included QOL (PROMIS Global Well Being), Fatigue Impact Scale (FIS), Beck Depression Inventory (BDI), Heart Rate Variability (HRV), and 6-minute walk test (6MWT). Nonparametric and parametric statistics were used with $p \leq 0.05$. Data are mean (SD) or md (Q1,Q3) for self-report measures. **RESULTS:** In both MSD and C groups prior to BD, QOL correlated with FIS ($r_s = -0.63$) and BDI ($r_s = -0.70$). FIS correlated with BDI ($r_s = 0.72$). HRV correlated with QOL ($r_s = 0.47$) and BDI ($r_s = -0.56$) but not with FIS. ($r_s = -0.32$). No variables correlated with 6MWT. For the MSD group, HRV (pre = 31 (19) post = 38 (19) ms, $p = 0.03$) and 6MWT (pre = 432 (114) post = 462 (126) m, $p = 0.03$) increased. Of the self-report outcomes, BDI improved (pre= 9 (5,15) post = 4 (0,10), $p = 0.04$). There were no changes in any measured outcome for the C group. **CONCLUSION:** BD can lead to significant improvements in HRV and depression. Further, HRV but not 6MWT might mediate improvements in QOL through depression in pwMS. This study was supported by the Greater Milwaukee Foundation.

329 Board #150 May 31 9:30 AM - 11:00 AM
Physical Conditioning Program To Improve Isometric Strength And Body Composition In People With Down Syndrome.
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It is calculated that in Mexico there exists about 250,000 people with Down Syndrome (DS). However due to the lack of activities that stimulate an optimum development causes a poor quality of life than the rest of the population. **PURPOSE:** To determine the effect of a physical conditioning program on isometric strength

331 Board #152 May 31 9:30 AM - 11:00 AM
The Effect of Step Count Increase on Role Limitations for People Living with HIV/AIDS
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Individuals living with HIV/AIDS experience many daily struggles beyond the complications associated with physical illness. These could include psychological stress, mood disorders, and depression, all of which can greatly impact an individual's

daily life. This secondary data analysis was conducted to examine a potential relationship between increase in physical activity and health-related quality of life for people living with HIV/AIDS (PLWHA).

Methods: Participants were recruited as part of a home-based PA intervention aimed to reduce risk factors of cardiovascular disease for PLWHA taking ART. A secondary data analysis was conducted by separating participants into groups according to increases in step count. Clinical and psychological assessments were conducted at baseline and 18 week follow-up. Self-reported mental health was measured using the SF-36 and its specific subscales were used. This analysis focuses on the subscale role limitations due to emotional wellbeing (RE). PA levels were measured via accelerometer. Accelerometer data was considered compliant if the participant had a total on-body time of at least 10 hours a day for 4 days. PA was determined by using the average step count per day. The comparison group consisted of those who increased daily steps by 10% or more.

Results: 34 females and 28 males with valid armband data were used for final data analysis. No significant differences were observed between groups at baseline. Those who increased their PA from baseline to follow-up had an average increase of 1502 steps/day and showed a significant increase in their self-reported RE score from 18.18 ± 6.84 at baseline to 40.91 ± 7.89 at 18 weeks on the SF-36 form ($p = 0.03$), whereas those with no changes in and/or who decreased daily PA by an average of 1195 steps/day showed no change.

In conclusion, people living with HIV/AIDs who increased their step count by 10% after 18 weeks showed a significant increase in RE. A relationship between physical activity and emotional well-being could provide a foundation for further study aimed to increase health-related quality of life for people with chronic disease, especially considering the impact it can have on activities or daily living. This project was supported by funding through the NIH/NINR R21 Grant 1R21NRO11281 and Theraband@

332 Board #153 May 31 9:30 AM - 11:00 AM

Exploring The Impact Of A Pilot Physical Activity Intervention On Youths With Type 1 Diabetes.

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Purpose: Type 1 Diabetes (T1D) is rising globally. Youths with T1D have poorer health and lower levels of physical activity (PA) than those without diabetes. The ActivPals study aimed to support youths with T1D to increase PA levels. The intervention incorporated a PA consultation, key behaviour change techniques and a wearable PA self-monitoring device. The aim of this study was to qualitatively explore the impact of the ActivPals pilot PA intervention on youths with T1D.

Methods: Semi-structured interviews with participants and one of their parents (N=16) were carried out between May and July 2016. Participants were recruited after delivery of the ActivPals 4- week intervention. Interviews were recorded, transcribed verbatim and analysed thematically using a six-stage iterative process. Codes were applied to data extracts in an inductive manner as recurring ideas, events or beliefs were identified.

Results: Factors contributing to intervention effectiveness are presented as three main themes. Each main theme had two sub-themes. The themes were: 1) Intervention impact (sub themes: new ways to exercise and sustained exercise); 2) Intervention components (sub themes: behaviour change techniques and one to one consultation); and 3) Intervention technology (sub theme: barriers/issues and recommendations for future interventions). The ActivPals intervention had a positive impact on young people with Type 1 diabetes. Most notably, the PA consultation and behaviour change techniques were important for increasing PA levels. The intervention technology was seen as both a facilitator and a barrier to PA. Participants provided important feedback on the intervention. For example, role modelling and self-monitoring were seen as critical to the intervention and the wearable activity monitors were problematic and should be redesigned or an alternative used, for future work with this population.

Conclusion: This research will contribute to the development of evidence based, user informed and pragmatic interventions leading to healthier lifestyles in youths with T1D.

This study was funded by Yorkhill Children's Charity.

333 Board #154 May 31 9:30 AM - 11:00 AM

Increases In Physical Activity Improves HDL Cholesterol In People Living With HIV/AIDS Taking Antiretroviral Therapy

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(No relationships reported)

People living with HIV/AIDS (PLWHA) and taking antiretroviral therapy (ART) medications are at increased risk for cardiovascular disease (CVD) and metabolic disorders once they begin therapy. The presence of metabolic disorders, such as increased blood lipids, make it difficult to manage CVD. Physical activity (PA) has been shown to reduce modifiable risk factors of CVD. The purpose of this analysis was to compare the blood lipid profiles of PLWHA while being treated with ART who increased their daily step count compared to those who did not.

Methods/design: Participants were recruited as part of a home-based PA intervention aimed to reduce risk factors of cardiovascular disease for PLWHA taking ART. A secondary data analysis was conducted by separating participants into groups according to changes in step count. The comparison group consisted of those who increased daily steps by 10% or more, with the remaining participants serving as the reference group. Assessments conducted at baseline and 18 week follow-up included waist circumference and fasting blood lipids including total cholesterol and triglycerides, HDL-C, LDL-c, and glucose. Height, weight, and PA levels via accelerometer were also collected. Accelerometer data was considered compliant if the participant had a total on-body time of at least 10 hours a day for 4 days. PA was determined by using the average step count per day. Groups were determined by changes in step count from baseline to follow-up with an increase in PA by 10% or more as group 1.

Results: A total of 34 females and 28 males with valid armband data were used for final data analysis. No significant differences were observed between groups at baseline. Those who increased their PA at 18-weeks had an average increase of 1502 steps/day and showed a significant increase in HDL cholesterol from 44.10 ± 2.79 pre to 49.01 ± 3.51 post ($p = 0.03$), whereas those with no changes and/or decreased daily PA by an average of 1195 steps/day showed no change.

Conclusion: These data show that a small increase in daily step count of 10% or more increased HDL levels compared to those who did not. In conclusion, something as simple as increasing step count can improve blood lipid profile for PLWHA while being treated with ART.

This project was supported by funding through the NIH/NINR R21 Grant 1R21NRO11281 and Theraband@

A-46 Free Communication/Poster - Ergogenic Aids I

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

334 Board #155 May 31 11:00 AM - 12:30 PM

10-Week Guanidinoacetic Acid Supplementation Affects Inflammatory Markers in Healthy Men and Women

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(No relationships reported)

Cellular bioenergetics largely depends on guanidinoacetic acid (GAA, also known as glycoylamine or betacyamine), a natural metabolic precursor of creatine, and an investigational dietary supplement. Previous animal studies have shown that supplemental GAA could induce inflammatory responses yet no human studies so far evaluated possible pro-inflammatory effects of this compound. **PURPOSE:** To examine the effects of 10-week supplementation with 3 grams per day of GAA on serum and urinary inflammatory markers in apparently healthy men and women. **METHODS:** Twenty healthy volunteers (10 men and 10 women; age 22.0 ± 2.3 years, weight 75.5 ± 22.9 kg, height 173.3 ± 10.5 cm) participated in this open-label, repeated-measure interventional study. All participants were assigned to receive GAA for 10 weeks, and were evaluated at baseline, and following 10-weeks of ingestion. The primary endpoint was the change in serum levels of high-sensitivity C-reactive protein (hsCRP) assessed at baseline and at 10 weeks follow-up. Secondary outcomes included change from baseline to end of treatment in values for serum ferritin, white blood cell (WBC) count and differential, and urinary inflammation markers. **RESULTS:** Serum hsCRP levels increased non-significantly during GAA intervention (1.6 ± 1.0 mg/L at baseline vs. 1.8 ± 2.1 mg/L at 10-week follow-up; $P = 0.72$). Supplementation with GAA yielded a statistically significant increase (7.5%

corresponding to 4.1 g/L; $P = 0.012$) of the mean serum ferritin levels. In addition, WBC count tended to increase at post administration ($6.7 \pm 0.9 \cdot 10^9$ vs. $7.3 \pm 1.5 \cdot 10^9$; $P = 0.09$), while urinary markers were not affected by GAA intervention ($P > 0.05$).

CONCLUSION: It appears that dietary GAA might have a pro-inflammatory effect during medium-term intake in healthy humans. GAA-driven elevation in serum ferritin should be considered as a possible adverse effect of the intervention. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (Grant no. 175037), the Provincial Secretariat for Higher Education and Scientific Research (Grant No. 114-451-710/2016-03) and the Faculty of Sport and Physical Education, University of Novi Sad (2016 Annual Award).

335 Board #156 May 31 11:00 AM - 12:30 PM

Sprint Cycling Performance Improvement Post-Creatine Supplementation is Associated with Increase in Lean Body Mass

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Reported Relationships: D.L. Crisafulli: *Contracted Research - Including Principle Investigator; Albion Laboratories, Inc., Clearfield, UT.*

Creatine supplementation is recommended as an ergogenic aid to improve repeated cycling sprint performance. Creatine absorption is increased in the presence of electrolytes. Research examining the effect of a creatine-electrolyte (CE) supplement on repeated sprint cycling performance failed to show post-supplementation improvement. These results can be attributed to inadequate recovery periods between repeated sprints. A recovery of 2-minutes is adequate for phosphocreatine resynthesis and may allow for maximal performance during repeated cycling sprints.

PURPOSE: To investigate the effect of a 6-week CE supplementation intervention on peak power and average work performed during repeated cycling sprints interspersed with 2-minute recovery periods.

METHODS: Peak power and average work performed by 38 recreational cyclists (CE group: $n = 17$; 23.4 ± 4.0 years; placebo (P) group: $n = 18$; 23.4 ± 4.0 years) were measured on a Velotron ergometer as they completed five, 15-s cycling sprints, with two minutes of recovery between sprints, pre- and post-supplementation. Peak power was the highest overall power measured across the sprints. Average work was the mean of total work performed across the five sprints. Participants' body composition was estimated using three site skinfold measurements. Mixed-model ANOVAs were used for statistical analyses.

RESULTS: For almost all participants, the peak power was generated during the first sprint. A supplement-time interaction showed a 4% increase in peak power (27 W; $p < 0.001$) and a 5% increase in average work (376 J; $p < 0.001$) from pre- to post-supplementation for the CE group. For the P group, no differences were observed in these variables from pre- to post-testing. Similarly, the lean body mass increased by 2% (1.4 kg; $p = 0.001$) from pre- to post-testing for the CE group, whereas no differences were found for the P group (supplement-time interaction; $p = 0.001$). For the CE group, a modest association ($r = 0.626$; $p = 0.007$) was observed between the increases in peak power and lean body mass from pre- to post-supplementation.

CONCLUSION: A CE supplement improves repeated short duration cycling sprint performance when sprints are interspersed with adequate recovery periods. Additionally, the ergogenic effect of CE supplement is associated with an increase in lean body mass.

336 Board #157 May 31 11:00 AM - 12:30 PM

The Effect of Bacillus Coagulans and HMB On Muscle Integrity and Inflammation During Military Training

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BACKGROUND: β -Hydroxy- β -methylbutyrate (HMB) is a derivative of the branched chain amino acid leucine, and has been demonstrated to enhance recovery and attenuate muscle damage from high intensity exercise. Recent evidence has suggested that the use of a probiotic may enhance protein absorption, as such the combination of a probiotic with HMB ingestion may be more beneficial during

field operations. **PURPOSE:** To compare the co-administration of the probiotic *Bacillus coagulans* (BC30) with HMB calcium (CaHMB) to CaHMB alone on the inflammatory response and muscle integrity during 40-days of intense military training. **METHODS:** Soldiers from the same unit were randomly assigned to one of two groups: CaHMB with BC30 (CaHMBBC30; $n=9$) or CaHMB with placebo (CaHMBPL, $n=9$). A third group of participants from the same unit served as a control (CTL; $n=8$). During the 40-day study, all participants performed the same daily protocol. During the first 28 days soldiers were garrisoned on base and participated in the same training tasks. During the final 2-weeks soldiers navigated 25-30 km per night in difficult terrain carrying ~35 kg of equipment. All assessments (blood draws and diffusion tensor imaging to assess muscle integrity) were conducted prior to and approximately 12-hours following final supplement consumption. Analysis of covariance was used to analyze all blood and muscle measures. **RESULTS:** Significant attenuations were noted in IL-1 β , IL-2, IL-6, CX3CL1, and TNF- α for both CaHMBBC30 and CaHMBPL compared to CTL. The response of plasma IL-10 concentrations was significantly attenuated for CaHMBBC30 compared to CTL only. A significant decrease in apparent diffusion coefficients was also observed for CaHMBBC30 compared to CaHMBPL. **CONCLUSION:** Results of this study provide further evidence that HMB supplementation may attenuate the inflammatory response to intense training, and that the combination of the probiotic *Bacillus coagulans* with CaHMB may be more beneficial than CaHMB alone in maintaining muscle integrity during intense military training.

337 Board #158 May 31 11:00 AM - 12:30 PM

The Physiological And Psychological Effects Of A Pre Exercise Amino Acid Supplement

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(No relationships reported)

Purpose: The research literature suggests that amino acid supplementation may be beneficial for many different modes of exercise. Thus, the purpose of this study is to determine if a pre-exercise amino acid supplement improves performance of a 5 mile time trial test and to assess whether there are changes in cognition.

Methods: Eight recreationally active male college students were recruited for this repeated measures design study. Participants consumed either a commercially available BCAA supplement (BCAA) or placebo (CON) 15 minutes prior to performing a Wingate test, followed by a brief break and then a 5 mile time trial test. Blood samples were collected before, during and after exercise to measure glucose, lactate and insulin levels. The Go/No Go and Stroop tests were used to assess cognition before and after exercise.

Results: There were no significant performance differences between BCAA and CON treatments for the Wingate test (Pre-Exercise: BCAA 10.7 ± 0.5 W/kg vs. CON 11.1 ± 1.2 W/kg, Post-Exercise: BCAA 11.4 ± 1.1 W/kg vs. CON 10.8 ± 1.5 W/kg; $p < 0.05$). Also there were no significant difference in performance for the time trial test (BCAA 26.7 ± 0.9 min vs. CON 25.9 ± 1.4 min; $p < 0.05$). Furthermore, blood glucose, lactate and plasma insulin levels were similar at each time point for both treatments. Lastly, participants performed equally well on the cognitive tests both before and after exercise (Go/No Pre-Exercise: BCAA 93.2 ± 1.6 % correct vs. CON 93.6 ± 2.0 % correct, Post-Exercise: BCAA 92.8 ± 1.9 % correct vs. CON 93.0 ± 0.9 % correct; Stroop Pre-Exercise: BCAA 83.9 ± 4.5 % correct vs. CON 85.3 ± 4.6 % correct, Post-Exercise: BCAA 86.3 ± 2.7 % correct vs. CON 85.5 ± 3.2 % correct; $p < 0.05$).

Conclusion: Under these testing conditions BCAA supplementation does not appear beneficial for 5 mile time trial performance, on physiological markers or cognition. However, the effects of BCAA supplements under different conditions is warranted. Grant Funding:

- Research, Scholarship, and Creative Activities Grant, awarded to Dr. Jeffrey Bernard.

338 Board #159 May 31 11:00 AM - 12:30 PM

Effects Of Branched-chain Amino Acids On Resting Metabolic Rate, Body Composition, And Satiety In Females

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(No relationships reported)

Branched-chain amino acid (BCAA) supplementation may have beneficial effects by raising amino acids in the blood, however, nearly all of the research has examined effects only in males. **PURPOSE:** To examine the effects of BCAAs on resting metabolism, body composition, and satiety in females. **METHODS:** Twenty four females (mean \pm SD; Age: 22.6 ± 5.3 y; Height: 166.4 ± 7.3 cm; Weight: 66.0 ± 11.4 kg) completed baseline testing, which assessed body composition, resting

energy expenditure (REE) and respiratory exchange ratio (RER). REE and RER were measured through indirect calorimetry for 20 minutes while participants laid in a supine position. Body composition was measured by seven site skinfolds and bioelectric impedance analysis to determine body fat percentage (%BF). Questionnaires using Likert scales were completed to evaluate hunger and satiety. Participants were then randomly stratified to either the treatment group of BCAAs (28.5 g/day) or placebo group (4 g/day non-caloric sweetener), and consumed the supplement three times daily mixed with 12 oz. of water, between meals (between breakfast and mid-day meal, between mid-day meal and evening meal, and between evening meal and sleep) for 21 days. After supplementation, participants repeated baseline testing. Prior to the first testing visit and during the last week of consuming the supplement, participants completed two separate 3-day diet logs. **RESULTS:** There were no significant differences pre- to post-testing in weight, %BF, or RER for either group ($p < 0.05$). There was no main effect for treatment ($p = 0.65$) or time ($p = 0.84$) for REE. There was a significant interaction between groups for REE ($p = 0.025$) with REE increasing after BCAA supplementation ($\Delta 85.5 \pm 142.2$ kcal) and REE decreasing after placebo consumption ($\Delta -74.5 \pm 139.5$ kcal). Confidence intervals (95% CI) demonstrated a significant increase in REE after BCAA supplementation ($p < 0.05$). The BCAA group reported feeling more satiated in the evening, according to 95% CI ($p < 0.05$). **CONCLUSIONS:** Supplementing with BCAAs between meals resulted in a higher resting metabolic rate and greater feelings of satiety in women. Initial results suggests consuming BCAAs between meals may have positive implications for weight maintenance or loss in women, due to increases in resting energy expenditure and satiety.

339 Board #160 May 31 11:00 AM - 12:30 PM
Effects Of A Combined Protein And Antioxidant Supplement On Muscle Recovery In College - Aged Males

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Eccentric contractions (ECC) result in muscle fiber damage from mechanical stress and a pro-inflammatory, pro-oxidant response, leading to a decline in muscle function and rise in muscle soreness. Individually, protein (PRO) and antioxidant (AO) supplements have been shown to improve recovery after eccentric exercise-induced muscle damage, though have yet to be combined. **PURPOSE:** Determine if a combined protein and antioxidant supplement (PRO+AO) improves muscle soreness (MS) and muscle function (MF) following fatiguing eccentric contractions over PRO alone or a control. **METHODS:** 60 sedentary college-aged males participated in a randomized, single-blind, parallel design study. Peak isometric torque (PIT), peak isokinetic torque (PIKT), thigh circumference (TC), and muscle soreness (MS) were measured prior to 100 maximal ECC of the knee extensor muscles, immediately after the ECC, as well as at 1, 2, 6, and 24h post ECC. Immediately post ECC, 6h post ECC, and 2h prior to the 24h assessment, participants consumed one of three isocaloric supplements (~30 g, 120 kcal ea.) of either a carbohydrate control (CHO; $n = 14$), PRO ($n = 16$), or PRO+AO (dehydrated berry-mixture; $n = 17$). **RESULTS:** All groups had similar baseline MS, TC, MF, macro and micronutrient intakes, and performed a similar amount of total work during the ECC (all, $p > 0.05$). There was a significant effect for time ($p < 0.05$) for PIT (~25% decrease), PIKT (~25% decrease), TC and MS (~1 and 35% increase, respectively). There was an effect of group over time for PIKT (PRO and PRO+AO > CHO, $p < 0.05$). At the 24h time point, there was a trend towards improved relative MF for PRO and PRO+AO compared to CHO (~11% difference for PIT, ~17% difference for PIKT). For MS there was a group x time interaction indicating PRO+AO having the lowest MS ($p < 0.05$). **CONCLUSION:** These results suggest PRO facilitates recovery of muscle function and soreness within 24h following fatiguing ECC, however addition of AO ameliorates MS more than PRO alone. As eccentric contractions are a component of many types of physical activity, under circumstances requiring a short turn around to a subsequent bout (e.g. occupational, military, or sport), combined PRO+AO supplementation may better mitigate ECC-induced muscle soreness with equal restoration of performance. Support: Connelly Research Foundation.

340 Board #161 May 31 11:00 AM - 12:30 PM
Effect of Creatine Supplementation on Exercise Performance following a Short-term Low Carbohydrate Diet

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 (No relationships reported)

Consumption of a low carbohydrate (low-CHO) diet typically leads to fatigue and decreases in exercise performance. **Purpose:** This study determined if a creatine supplement (CS) prevents the decrease in exercise performance associated with consuming a low-CHO diet. Compared to the placebo (PL) group, we hypothesized that CS would prevent the decline in performance as demonstrated by an equal or improved time to task failure (completed intervals). **Methods:** Fourteen healthy subjects (5 males, 9 females; 25.7 ± 5.4 yrs, (\pm SD)) were randomly assigned to either CS or PL group. Each subject performed 2 high intensity interval exercise sessions at 90% peak work rate. The test sessions were separated by a 10 day low-CHO diet and either CS or PL supplementation. Peak work rate was determined using a 25 W/min ramp test to volitional fatigue. Baseline aerobic fitness (as peak oxygen uptake (VO_{2peak})) was determined as the highest 10 s average obtained during the ramp test. The high intensity interval session (i.e. performance trial) consisted of a 1:1 ratio of 30 s exercise at 90% peak work rate followed by 30 s of loadless cycling. Heart rate was collected at baseline and during each interval of the performance trial using a standard electrocardiogram. Subjects consumed a loading dose of creatine monohydrate (20 g/day) or placebo, while adhering to a low-CHO diet of <25% CHO total daily consumption. Subjects kept detailed food and exercise logs for the duration of the study. **Results:** Results of the preliminary exercise test indicated that the baseline fitness of the CS group (36.1 ± 5.3 ml/kg/min) was similar ($p > 0.05$) to the PL group (36.9 ± 5.8 ml/kg/min). There was a significant improvement in the CS group compared to the PL group for the high intensity interval exercise performance pre- and post-diet ($p < 0.001$). On average, the CS group improved $20.8 \pm 27.7\%$ for the total number of exercise bouts performed, whereas the PL group demonstrated a $35.9 \pm 14.5\%$ decrease in the total number of bouts performed post-diet. No change in body composition (% body fat) was observed between groups (CS; $1.4 \pm 1.5\%$ vs PL; $1.3 \pm 0.8\%$, $p > 0.05$). **Conclusion:** Results of the present study suggest that creatine loading may effectively attenuate the fatigue associated with a low-carbohydrate diet, and may, in fact, improve high-intensity interval exercise performance.

341 Board #162 May 31 11:00 AM - 12:30 PM
Beta-hydroxy-beta-methylbutyrate Supplementation On Low-frequency Fatigue Following Fatiguing Exercise

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 (No relationships reported)

Participation in any strenuous form of physical activity will result in a decline in skeletal muscle performance during and following the activity, this decline is commonly called fatigue. Low-frequency fatigue (LFF), a form of fatigue, is characterized by a loss of force at low frequencies of stimulation, a slow recovery of force and is reported following eccentric contractions. β -Hydroxy- β -Methylbutyrate (HMB) is a nutritional supplement that claims to prevent and improve skeletal muscle recovery following muscle damage producing contractions. **PURPOSE:** To determine if three weeks of HMB supplementation could attenuate the effects of LFF caused by eccentric muscle contractions in young healthy adults. **METHODS:** 33 participants (18 males, 15 females; 23.2 ± 4.3 yr.) completed the study. Participants performed 4 sets of 25 eccentric (ECC) contractions of the tibialis anterior muscle. Outcome measures were recorded prior, following, throughout a 20-minute recovery period, and at 48 and 96 hours following an ECC fatiguing protocol. Outcome measures included: isometric peak torque, 10 and 50 Hz peak torque, and 10/50 Hz peak torque ratio. Participants served as their own control and lower limbs were randomly assigned as control (CTL) or supplement (SUP). Following the pre-supplement test-day, participants completed 3 weeks of 3g/day of HMB supplementation. Post-supplementation, the ECC fatiguing protocol was completed and outcome measures were obtained. **RESULTS:** The ECC fatiguing protocol reduced isometric peak torque in both the CTL and SUP limbs by 49.3% and 48.4%, respectively ($p < 0.01$). Ten Hz peak torque (pre-ECC fatigue: 4.8 ± 2.2 Nm vs. 96-hr post-ECC fatigue: 4.2 ± 2.4 Nm) and the 10/50 Hz peak torque ratio (pre-ECC fatigue: 0.51 ± 0.14 vs. 96-hr post-ECC fatigue: 0.44 ± 0.14) in the CTL limb were reduced at the 96-hour time point ($p < 0.01$), indicative of LFF. The SUP limb displayed no LFF (pre-ECC fatigue: 0.49 ± 0.11 vs. 48-hr post-ECC fatigue: 0.47 ± 0.11) at the 48-hour time point ($p > 0.05$), suggestive of a faster recovery. The CTL limb showed a 19.2% reduction in isometric peak torque at the 48-hour recovery time point ($p < 0.01$); whereas, the SUP limb displayed only a 6.4% reduction in isometric peak torque. **CONCLUSIONS:** Three weeks of HMB supplementation attenuated LFF and force loss after an ECC fatigue protocol.

342 Board #163 May 31 11:00 AM - 12:30 PM
The Acute Effect of a Four-Main Ingredient Pre-workout Supplement on Lower Body Muscular Endurance
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 (No relationships reported)

Most pre-workout supplements have various ingredients that when ingested together claim to have positive ergogenic effects. However, many supplements lack scientific evidence from independent research. **PURPOSE:** To determine the acute effect of a pre-workout supplement on lower body muscular endurance in college aged males. **METHODS:** This study was a double-blind, crossover design. Twenty-five participants (23.8 ± 1.3 years) visited the University Fitness Center on two separate occasions. Each visit was one week apart. During both visits participants completed the same warm up and maximal repetition seated leg press test at 75% of their body weight. Treatment order for each participant was randomized prior to testing. The control treatment consisted of a placebo supplement and the experimental treatment included a pre-workout supplement. Both treatments consisted of consuming eight fluid ounces, 15 minutes prior to testing, as recommended by the manufacturer. The treatment supplement included four main ingredients comprising beta alanine, creatine nitrate, N-Acetyl L-tyrosine, and caffeine. **RESULTS:** No significant difference in maximum repetitions was observed between the control treatment supplement (56.56 ± 24.74) and the experimental pre-workout supplement (60.56 ± 26.20), $F(1,24) = 1.481, p=0.235$. **CONCLUSION:** Despite popularity for pre-workout supplements while weight training, acute positive effects may not be realized. Recommendations for future research may evaluate timing of consumption and long term effects of particular pre-workout supplements.

343 Board #164 May 31 11:00 AM - 12:30 PM
Effects of a Pre-Workout Supplement on Hyperemia Following Leg Extension Resistance Exercise at Different Intensities
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 (No relationships reported)

PURPOSE: We sought to determine if a multi-ingredient pre-workout supplement (PWS) given prior to resistance exercise was effective in increasing post-workout reactive hyperemia compared to placebo (PBO). **METHODS:** Thirty, recreationally trained males participated in this double-blinded, PBO controlled study. All participants reported for two visits, separated by one week. At visit 1, participants consumed a multi-ingredient PWS with seventeen active ingredients (including citrulline, norvaline, caffeine, creatine and anti-oxidant blends) or PBO. 45-min after consumption of PWS/PBO, participants performed four sets of leg extension resistance exercise to failure at 30 or 80% of their 1-RM. At visit 2, subjects consumed the same supplement as in visit 1, but exercised at the alternate intensity. Heart rate (HR), blood pressures, and femoral artery blood flow were assessed at baseline (BL), 45-min following PWS/PBO consumption (PRE), and at 5-min following the last set of resistance exercise (POST). Repeated measures ANOVA was performed with time, supplement, and training intensity as the independent variables. Data are reported as mean \pm sem. **RESULTS:** Significant main effects of time ($P < 0.01$), but no interactions were observed for blood pressures, femoral artery diameter, and retrograde femoral artery blood flow. A significant time*supplement interaction ($P < 0.05$) was observed for HR and antegrade and mean femoral artery blood flow. Change in HR from BL and PRE to the POST time point was significantly greater in the PWS group compared to the PBO group ($+27.3 \pm 2.5$ vs. $+19.8 \pm 2.2$ bpm and $+34.6 \pm 2.1$ vs. $+25.0 \pm 2.3$ bpm for change from BL and PRE, respectively; $P < 0.03$). Similarly, change in mean femoral artery blood flow from BL and PRE to the POST time point was significantly greater in the PWS group compared to the PBO group ($+590 \pm 56$ vs. $+404 \pm 52$ mL/min and $+687 \pm 60$ vs. $+484 \pm 50$ mL/min for change from BL and PRE, respectively; $P < 0.02$). **CONCLUSIONS:** The PWS did increase the reactive hyperemia response observed following resistance exercise though no specific interactions with the intensity of the resistance exercise were observed.
Funding was provided through a gift-in-kind to M.D.R. from FutureCeuticals, Inc. (Mokenca, IL, USA) and through a contract to J.S.M. through Maximum Human Performance (West Caldwell, NJ, USA).

344 Board #165 May 31 11:00 AM - 12:30 PM
Nighttime Consumption of Whey and Casein Protein: Effects on Morning Metabolism and Resistance Exercise Performance
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Whey protein (WP) and casein protein (CP) consumed at night before sleep has been shown to have positive satiating and metabolic effects the next morning. No data exist regarding the effect of nighttime consumption of WP and CP on the ability to perform resistance exercise (RE) the following morning. **PURPOSE:** To determine the effect of WP and CP at two different doses, when consumed before sleep on next morning appetite, resting metabolic rate (RMR), and RE volume compared to a non-caloric placebo (PLA). **METHODS:** Eleven physically active men and women (age, 24 ± 5 yrs; body fat, $18.8 \pm 4.9\%$) participated in this randomized, double blind, crossover study. One-repetition maximums (1-RM) were performed on six exercise machines to determine RE intensity. A single dose of 24g WP, 48g WP, 24g CP, 48g CP, or PLA was consumed 30 minutes prior to sleep and each trial was separated by 48-72 hours. Measurements of appetite (visual analogue scales (VAS) for satiety, hunger, and desire to eat), RMR (indirect calorimetry), and RE volume were performed the next morning (0600-0900 hours). Appetite was assessed immediately before and after RMR measurements, and immediately after RE. RMR measurements were collected for 30 minutes and the last 25 minutes were analyzed. Outcome variables were oxygen consumption (VO_2), RMR, and respiratory quotient (RQ). RE was performed for 2 sets of 10 repetitions and a 3rd set to failure at 60% of 1-RM. Statistical analyses were conducted using 5×3 (group by time) repeated-measures ANOVA for appetite variables and one way ANOVA for metabolic variables and RE volume. All significance was accepted at $p < 0.05$. **RESULTS:** There were no time effects and no group \times time interactions in satiety, hunger, and desire to eat. There were no significant differences in VO_2 , RMR (24g WP: 1795 ± 517 kcal/d; 48g WP: 1810 ± 371 kcal; 24g CP: 1691 ± 351 ; 48g CP: 1858 ± 416 ; PLA 1775 ± 346 kcal; $p > 0.05$) and RQ. In addition, there was no significant difference in RE volume (24g WP: 11812 ± 2972 kg; 48g WP: 11913 ± 2575 kg; 24g CP: 12646 ± 3759 kg; 48g CP: 11753 ± 2456 kg; PLA: 11680 ± 2654 kg; $p > 0.05$). **CONCLUSION:** Varying doses of WP and CP prior to sleep did not have an effect on morning appetite, RMR, and RE volume. Nighttime consumption of WP and CP can be consumed without impeding next morning metabolism and training volume, but does not improve exercise performance.

345 Board #166 May 31 11:00 AM - 12:30 PM
Promoting Training Gains And Recovery With Nutrition: Beneficial Effects Of A Native Whey Supplementation
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Reported Relationships: V. Martin: Contracted Research - Including Principle Investigator; Study funded by Lactalis.

PURPOSE: Electrostimulation (ES) training can trigger muscular and nervous adaptations, leading to an improvement of muscular strength and power. However, this training modality generates a high fatigue level, that translates into training and recovery issues. However, it has been shown that a supplementation with native whey (NWH) can decrease neuromuscular fatigue during a strength-training session. Therefore, the purpose of this study was to assess if NWH supplementation could promote recovery and training gains after an ES training program. **METHODS:** This pilot, randomized, double-blinded trial, involved 50 moderately active men (21.5 ± 3.2 y). They were allocated into 3 groups, supplemented 5d/week, either with 15 g of NWH, or whey (WH), or placebo (PLA). All the groups underwent a 12-week ES training program. Maximal concentric power (Pmax) was evaluated before, immediately after, as well as 30', 60', 24h et 48h after the 1st, 4th and last ES training session. In addition, the maximal voluntary contraction force (CMV), the evoked twitch amplitude (Pt), anatomical cross-sectional area (CSA) and the maximal voluntary activation level (VA) of the knee extensors were measured before (T0), and after 6 (T1) and 12 weeks of training (T2). **RESULTS:** Pmax recovery kinetics differed between groups ($P < 0.01$). Pmax started to recover at 30' in NWH, 24h in WH and 48h in PLA. Training gains also differed between groups. CMV increased between T0 and T2 in NWH ($+11.8\%$, $P < 0.001$) and WH ($+7.1\%$, $P < 0.05$), but not PLA. Nevertheless, the adaptations kinetics differed: CMV increased in NWH and WH between T0 and T1, but a additional gain was only observed between T1 and T2 in NWH. In addition, VA was depressed at T1 and T2 in PLA (-3.9% , $P < 0.05$), at T2

in WH (-3.5%, $P < 0.05$), and was unchanged in NWH. Finally, Pt and CSA improved with training, but did not differ between groups. **CONCLUSIONS:** These results suggest that NWH initiate the power recovery process earlier than WH or PLA after an ES-training session. This quicker recovery seems associated with strength gains along the entire training period, that are accounted for by hypertrophy and VA preservation. Conversely, the VA decreases in WH and PLA could be indicative of overtraining. Thus, as compared to WH, NWH could promote recovery and neuromuscular adaptations after training.

346 Board #167 May 31 11:00 AM - 12:30 PM
Differently Formulated Creatine Effects On Fatigue, Work, And Power In Resistance-trained Subjects

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Reported Relationships: D.R. Miller: *Contracted Research - Including Principle Investigator; Partially supported by Albion Laboratories, Inc.*

Creatine is an effective supplement for improving strength, power, and reducing fatigue, especially in high intensity, repeated activities. Various nutritional strategies have been utilized to enhance creatine efficacy, including concurrent intake of carbohydrates, electrolytes, and nutrients with alkaline quality, such as magnesium. **Purpose:** This study examined the effects of two differently formulated creatine supplements, creatine monohydrate (CM) or creatine-magnesium chelate (CC), compared to placebo (P) on fatigue, work, and power during knee extensions. **Methods:** The study evaluated effects in resistance-trained participants, repeating measures after six-weeks of supplementation. Subjects ($n=23$; 21.9 ± 1.8 years) maintained their regular resistance training program and had not supplemented creatine in the previous 6 months. Supplementation was 4 g creatine daily for CM and CC, plus 400 mg magnesium in CC. Maximum torque and fatigue of knee extensors at $180^\circ \text{ sec}^{-1}$ were determined using an isokinetic dynamometer for 2 sets of 30 repetitions each, with 2 minutes rest between sets. Fatigue was calculated by the ratio between the first 1/3 and the last 1/3 of work for each set. Body composition was determined with the three-site skin folds test. Statistical analyses were performed using mixed ANOVA. **Results:** Fatigue results demonstrated no significant differences ($p > 0.05$). For work and average power, there were no significant interaction effects ($p > 0.05$) in either set 1 or 2. However, there was a significant group effect for work (P: 1987.49 ± 617.65 J, CM: 1978.55 ± 723.21 J, CC: 2485.57 ± 677.58 J; $p < 0.05$; partial $\eta^2 = 0.371$) and average power (P: 165.4 ± 70.33 W, CM: 160.59 ± 56.28 W, CC: 186 ± 66.71 W; $p < 0.05$; partial $\eta^2 = 0.407$) in set 1; with no significant differences in set 2 ($p > 0.05$). There were no significant effects of time or group from pre- to post-test for body composition ($p > 0.05$). **Conclusion:** There were no significant differences for fatigue in either set. In the first set, CC demonstrated greater total work performed and greater average power. There were no significant differences in these variables for the second set in any group. The small improvement observed in work and power for CC indicates that the magnesium may enhance creatine's effects.

347 Board #168 May 31 11:00 AM - 12:30 PM
 β -alanine Supplementation To Improve Exercise Capacity And Performance: A Systematic Review And Meta-analysis

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(No relationships reported)

PURPOSE: To conduct a systematic review and meta-analysis of the evidence on the effects of β -alanine supplementation on exercise capacity and performance. **METHODS:** This study was designed in accordance with PRISMA guidelines. A three level mixed effects model was used to model effect sizes, along with the influence of various moderators including participant training status, duration and type of exercise (capacity and performance). Three databases (PubMed, Google Scholar, Web of Science) were searched using a number of terms (" β -alanine" and " β -alanine" combined with "supplementation", "exercise", "training", "athlete", "performance", and "carnosine"). Inclusion/exclusion criteria limited articles to double-blinded, placebo-controlled studies investigating the effects of chronic β -alanine supplementation on an exercise measure. All healthy participant populations were considered. A single outcome measure was extracted from each exercise test and converted to effect sizes for meta-analyses. **RESULTS:** Forty individual studies employing 65 different exercise protocols and totaling 70 exercise measures in 1461 participants were included in the analyses. A significant overall effect size of 0.18 (95%CI: 0.08, 0.28) was shown. Meta-regression demonstrated that exercise duration significantly moderated effect sizes ($P=0.004$).

Subgroup analyses also identified the type of exercise as a significant ($P=0.013$) moderator of effect sizes within an exercise time-frame of 0.5-10 min with greater effect sizes for exercise capacity [0.4998 (95%CI: 0.246, 0.753)] vs. performance [0.1078 (95%CI: -0.201, 0.416)] based tests. There was no moderating effect of training status ($P=0.559$), intermittent or continuous exercise ($P=0.436$) or total amount of β -alanine ingested ($P=0.438$). Co-supplementation with sodium bicarbonate resulted in the largest effect size when compared to placebo [0.43 (95%CI: 0.22, 0.64)]. **CONCLUSIONS:** β -alanine supplementation had a significant overall effect while sub-group analyses revealed a number of modifying factors, including exercise duration and type. These data allow individuals to make informed decisions as to the likelihood of an ergogenic effect with β -alanine supplementation based upon their chosen exercise modality.

348 Board #169 May 31 11:00 AM - 12:30 PM
The Effects of Beta-Alanine and Sodium Bicarbonate Supplementation on Anaerobic Performance in Trained Males

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 (No relationships reported)

PURPOSE: The study was designed to examine the effects of chronic beta-alanine supplementation and acute sodium bicarbonate supplementation on anaerobic performance using a cycle ergometer protocol. **METHODS:** Ten trained males (O_{2peak} $52.14 \pm 4.24 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) performed an 8 minute anaerobic exercise cycling protocol before, after chronic beta-alanine supplementation, and after the combination of chronic beta-alanine and acute sodium bicarbonate supplementation. Subjects were instructed to take 6.4 grams of beta-alanine in 4 doses spread throughout the day at the same time each day for 4 weeks. At the completion of the beta-alanine experimental session each subject was given a sodium bicarbonate supplement to take acutely for 24 hours prior to the combination of chronic beta-alanine and acute sodium bicarbonate supplementation experimental session. Each subject took 0.5 grams of sodium bicarbonate per kilogram of bodyweight ingested in 4 doses evenly spread throughout the 24 hours prior to the final session. The 8 min intermittent cycling protocol used for each session included 30 seconds of maximum effort followed by 30 seconds of active recovery for 8 rounds. The performance variables measured every minute included lactate, RTW (relative total work), RAAP (relative average anaerobic power), TREPS (total repetitions), RPE, O_2 and RER. **RESULTS:** Significant interactions were found for RTW, RAAP, TREPS and RPE. RTW was significantly greater post supplement 2 ($M_{PS2} = 131.68 \pm 4.44$) compared to control ($M_C = 116.86 \pm 3.25$) at time point 3:30. RAAP was significantly greater post supplement 1 ($M_{PS1} = 4.42 \pm .19$) compared to control ($M_C = 4.05 \pm .21$) for time point 3:30. Although RTW and RAAP were only significant at one time point (3:30), a trend toward an increase in RTW and RAAP was found. **CONCLUSION:** A trend toward higher RTW and RAAP during the 8 min intermittent cycling protocol may indicate the benefit of chronic beta-alanine combined with acute sodium bicarbonate supplementation outside the widely studied exercise length of 60-240 seconds.

349 Board #170 May 31 11:00 AM - 12:30 PM
Twenty-four Weeks Of Beta-alanine Supplementation Increases Muscle Carnosine Content Despite Downregulation Of Beta-alanine Transporter Expression

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 (No relationships reported)

Skeletal muscle carnosine content can be increased via chronic beta-alanine ingestion, but the maximum increase achievable with supplementation is unknown. Additionally, the effects of prolonged supplementation on carnosine-related gene expression in humans are not known. Since athletes are likely to supplement for extended periods of time, determination of the long-term effects of beta-alanine supplementation is warranted. **PURPOSE:** To investigate the effects of 24-weeks of beta-alanine supplementation on muscle carnosine content and expression of genes related to carnosine metabolism. **METHODS:** Twenty-four males were supplemented with 6.4 g day⁻¹ of sustained release beta-alanine (BA; N=15) or placebo (PL; N=9) for 24 weeks. Every 4 weeks participants provided a muscle biopsy from the *m. vastus lateralis*, which was subsequently analysed for muscle carnosine content and gene

expression (*CARNS*, *TauT*, *ABAT*, *CNDP2*, *PHT1*, *PEPT2*, *PAT1*). **RESULTS:** Carnosine content was increased from baseline at every time point in BA (all $P < 0.0001$; Week 4: $+11.4 \pm 7.0$ mmol·kg⁻¹·dm, Week 8: $+13.9 \pm 7.8$ mmol·kg⁻¹·dm, Week 12: $+17.0 \pm 8.6$ mmol·kg⁻¹·dm, Week 16: $+17.6 \pm 8.4$ mmol·kg⁻¹·dm, Week 20: $+21.2 \pm 7.9$ mmol·kg⁻¹·dm, Week 24: $+20.2 \pm 7.6$ mmol·kg⁻¹·dm), but not PL (all $P > 0.05$). Maximal changes ranged from $+17.1$ to $+41.3$ mmol·kg⁻¹·dm, and absolute maximal content ranged from 31.8 to 63.9 mmol·kg⁻¹·dm. There was an effect of supplement ($P = 0.002$) on *TauT* with lower expression in BA (-36%, -39%, -27%, -57%, -46% and -35% at Weeks 4, 8, 12, 16, 20 and 24); no further differences in gene expression were shown. **CONCLUSION:** Twenty-four weeks of beta-alanine supplementation increased muscle carnosine content in all individuals at all time points, although absolute maximal changes were variable. Downregulation of the beta-alanine transporter *TauT* suggests it plays an important role in muscle carnosine accumulation with beta-alanine supplementation. These data demonstrate that individuals who supplement with beta-alanine for prolonged periods can maintain elevated muscle content throughout supplementation, despite downregulation of beta-alanine transporter expression.

350 Board #171 May 31 11:00 AM - 12:30 PM

The Effect of Six Weeks of Beta-Alanine Supplementation on Incremental Exercise Performance

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(No relationships reported)

Beta-alanine supplementation has been proposed as a means to improve exercise performance by increasing intramuscular buffering capacity. By increasing buffering capacity, exercise performance should improve by delaying the onset of fatigue. **PURPOSE:** The purpose of this study was to determine if beta-alanine supplementation is able to reduce fatigue associated with incremental exercise to exhaustion among males and females. **METHODS:** 25 (12 male and 13 female) healthy, recreationally active volunteers completed this study. Subjects were age 22.6 ± 3.5 years with a BMI of 24.4 ± 3.9 . A double blind study was conducted over a 6-week period. Each subject completed an incremental exercise bout on an electromagnetically braked cycle ergometer once every 2 weeks for 6 weeks. Timing of data collection was as follows: week 0 (no supplementation/ baseline measure), end of week 2, 4, and 6. Supplementation consisted of either a 400mg capsule of beta-alanine (treatment) or 400mg capsule of dextrose (placebo) taken 4 times per day for 6 weeks. **RESULTS:** Performance and physiological measures collected included time to exhaustion (TTE), maximum power output (PO max), VO_2 peak, Ventilatory Threshold (VT), and peak heart rate (HR peak). Results were analyzed using repeated measures ANOVA with significance set *a priori* at $p < 0.05$. There were no significant differences over time or within sex, therefore data is collapsed and is presented as treatment vs. placebo (mean \pm SE). TTE (seconds) 1051.1 ± 39.1 vs. 976.4 ± 37.6 ; PO max (Watts) 206.7 ± 6.7 vs. 195.5 ± 6.5 ; VO_2 peak (ml/kg/min) 34.1 ± 1.4 vs. 35.9 ± 1.3 ; VT (L/min) $1.84 \pm .08$ vs. $1.83 \pm .07$; and HR peak (beats/min) 180.3 ± 3.4 vs. 178.2 ± 3.3 . **CONCLUSIONS:** Assessed variables showed no significant differences ($p > 0.05$) between treatment and placebo at time points 2, 4, and 6 weeks. This finding was also found when isolating assessment to males and females. These results suggest that beta-alanine supplementation was not effective in improving exercise performance as used in this study.

351 Board #172 May 31 11:00 AM - 12:30 PM

Glutamine and Alanine Supplementation Improves Cytoprotective Parameters in Rats Submitted to Progressive Resistance Exercise

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(No relationships reported)

Excessive exercise can lead to an inflammatory process and, recently described, liver dysfunction. Heat shock proteins, especially HSP70, have important anti-inflammatory properties by blocking the activation of the NF- κ B pathway, which is also suppressed by Sirtuin 1 (SIRT1). Glutamine availability is critical for the optimal regulation of HSP response and SIRT1 concentration, and its metabolism is compromised under catabolic situations, such as intense exercise. Glutamine and alanine supplementation, in their free form or as dipeptide, can increase the HSP70 response in heavy aerobic training. However, less is known about these cytoprotective effects in resistance exercise (RE). **PURPOSE:** Evaluate the effect of chronic oral supplementation with glutamine and alanine, in their free form or as dipeptide, on SIRT1 and HSP70 concentration and NF- κ B activation in liver of rats submitted to progressive RE. **METHODS:** Adult male Wistar rats (n 8/ group) were submitted to 8-week RE and

supplemented with L-alanine and L-glutamine, in their free form or as dipeptide (ALA, GLN+ALA and DIP groups, respectively), or water (SED and CTRL group). RE consisted to climb a ladder for 3 to 6 sets with progressive loads (25 to 100% of body weight). In the last 21 days of training, supplements were given in a 4% solution dissolved in drinking water. SIRT1 and HSP70 concentration and DNA binding activity of NF- κ B were determined in liver. **RESULTS:** RE slightly decreased HSP70 concentration in liver of CTRL group. However, all supplementations promoted a 3-fold increase in HSP70 levels ($P < 0.05$ v. CTRL group), denoting liver protection. Trained groups exhibited significantly increased level of SIRT1, consistent with the reduction of NF- κ B activation. Interestingly, DIP supplementation induced higher level of SIRT1 (by 280%, $p < 0.05$ when compared with trained groups), as well as greater cytoprotection demonstrated by suppression of NF- κ B activation (by 52%, compared with GLN+ALA and ALA groups) in liver of trained rats. **CONCLUSIONS:** Chronic oral supplementation with L-glutamine, given with L-alanine or as dipeptide, induced cytoprotective effects mediated by increased HSP70 and SIRT1 concentrations, which may have attenuated NF- κ B activation in liver of rats submitted to progressive RE. Financial support: FAPESP, CAPES and CNPQ.

A-47 Free Communication/Poster - Genetics

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM

Room: Hall F

352 Board #173 May 31 9:30 AM - 11:00 AM

CYP19A1 Gene Polymorphism of Aromatase is Associated with Arterial Stiffness in Healthy Japanese People

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INTRODUCTION: CYP19A1, the aromatase enzyme gene, is responsible for the biosynthesis of estrogens that have anti-arteriosclerotic effects. Previous studies have shown that the rs10046 genotype of CYP19A1 is associated with increased incidence of coronary artery disease. However, no studies have investigated whether this genotype is correlated with arterial stiffness. Additionally, it is unknown whether the rs10046 genotype is associated with a relationship between arterial stiffness and cardiorespiratory fitness. **PURPOSE:** To determine the effects of CYP19A1 gene polymorphism (rs10046) on arterial stiffness, and their associations with cardiorespiratory fitness in healthy Japanese people. **METHODS:** Nine hundred forty-seven healthy Japanese adults (Men: N=280, 43 \pm 17 years; Women: N=667, 46 \pm 17 years, Mean \pm SD) participated in a cross-sectional study. The rs10046 (C>T; transposition in the 3' untranslated region) genotype was determined by real-time PCR with Taqman probe. Arterial stiffness was measured by brachial-ankle pulse wave velocity (baPWV). Cardiorespiratory fitness was evaluated by peak oxygen uptake. Subjects were divided into high- or low-cardiorespiratory fitness groups based on the median value of peak oxygen uptake in each sex and decade of life. **RESULTS:** One-way ANOVA revealed that there were significant differences in age, weight, blood triglyceride level, and systolic blood pressure among the genotypes. After adjusting for these covariates, baPWV of individuals with the TT genotype of rs10046 were significantly lower than those of other genotypes (TT; 1211 \pm 195, TC; 1253 \pm 250, CC; 1251 \pm 257 cm/sec). For both sexes, the same pattern was observed, but these findings were not significant. The rs10046 genotype had no impact on differences of arterial stiffness associated with cardiorespiratory fitness level. **CONCLUSION:** CYP19A1 gene polymorphism (rs10046) of aromatase is related to arterial stiffness in healthy Japanese people but has no impact on the relationship between arterial stiffness and cardiorespiratory fitness.

353 Board #174 May 31 9:30 AM - 11:00 AM
Genes' Polymorphisms Related To Athletic Physical Performance: A Descriptive Study In Estonian Elite Athletes
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 (No relationships reported)

Genetic predisposition has a substantial role in the development of athletic physical performance and is characterized by a large number of gene polymorphisms and the interaction of these variations.

PURPOSE: (1) to examine the prevalence of genotypes of 6 genes related to physical performance (*ACE1/D*, *ACTN3 R577X*, *PPARGC1A Gly482Ser*, *AGT Met235Thr*, *AMPD1 Gln12Ter*, *NOS3 786C/T*) in Estonian elite athletes; (2) to compare the distribution of gene variations between representatives of 2 sports groups (predominantly endurance-oriented and mostly for speed and/or power-oriented sports groups).

METHODS: the study group consisted of 130 elite athletes (23 females and 107 males); current and former Estonian national team members; in age range 28.3±5.6 years; involved in 19 different sports disciplines. There were 77 representatives of endurance-oriented sports (17 females and 60 males) and 53 representatives of speed and power-oriented sports (6 females and 47 males). 26 athletes of the study group were medallists or finalists in the Olympic Games, World or European championships. Peripheral venous blood samples were collected for DNA extraction and genotyping (6 candidate genes) from all study subjects. For statistical analysis, a descriptive analysis and χ^2 test were used to determine significant differences between the frequencies of gene variations. P-values of ≤ 0.05 were set as statistically significant.

RESULTS: the higher prevalence of the RR genotype of the *ACTN3* gene among athletes of endurance-oriented sports compared to athletes of speed and power-oriented sports was statistically significant ($p=0.025$). We did not find any significance in the distribution of other gene variations between the two sports groups. We observed the trend of a higher prevalence of the *NOS3* TT genotype ($p=0.076$) and a lower prevalence of the *AMPD1* TT genotype ($p=0.09$) in the endurance-oriented sports group compared to the speed and power-oriented sports group, but it was not statistically significant.

CONCLUSIONS: our study results reveal a significantly higher prevalence of the *ACTN3* RR genotype in athletes of the endurance-oriented sports group, which is in accordance with our previous study among young skiers and this may be an advantage for the explosive speed and power capacity in endurance sports.

354 Board #175 May 31 9:30 AM - 11:00 AM
Novel Genes Associated with Elite Athlete Performance Via Inflammatory Pathways
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 (No relationships reported)

There is a known relationship between inflammation and its alteration in exercise performance. In addition, a number of inflammatory processes are linked to the major histocompatibility complex (MHC) on the short arm of chromosome 6. As our understanding of genetics expands, over 140 genes have been linked with exercise performance; however, the role of inflammatory pathways remains unclear. **PURPOSE:** The purpose of this study was to investigate whether 3 genes, unique to the elite athletes, and located on the short arm of chromosome 6 are connected to the immune/inflammation MHC genes cluster. **METHODS:** Eleven elite runners (VO₂max: 70-88.3 mL/kg, included Olympic Trial qualifiers and Olympic athletes) and eleven control athletes (VO₂max: 54-57 mL/kg, locally competitive cyclists and runners) had their genome sequenced. Exome reads were mapped to the hg19 using CLC Genomics ver. 8.5 with respective amino acid variants called and annotated. Variants shared by at least 75% of the respective groups (elites vs. controls) were further investigated using the Database for Annotation, Visualization, and Integrated Discovery (DAVID) v6.7. The top 3 functional groups of genes in each category were analyzed further and certain genes identified for further research. **RESULTS:** *GABBR1/OR2H2* (6p21.31), *OR14J1* (6p22.1), and *SLC17A4* (6p22-p21.3) were identified as genes, unique to the elite athletes, located close to an important immune cascade pathway on chromosome 6. The hypothesis is that the close proximity of these genes to the MHC cluster (6p21.2) is likely related to the inflammation pathways in the elites that influences their exercise performance ability.

CONCLUSIONS: These results indicate that there may be underlying genetic traits that are unique to elite athletes that allow for their extraordinary athletic performance and that are related to inflammatory markers.

355 Board #176 May 31 9:30 AM - 11:00 AM
Genome-wide Association For Exercise Tolerance In The TIGER Study
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 (No relationships reported)

PURPOSE: The genetic basis of physical activity has been firmly established through both animal and human studies. The purpose of this study was to examine genetic variation across the genome for association to quantitative measures of exercise dose, intensity, duration, and adherence.

METHODS: Young adults (18-35 y) underwent 15 weeks of aerobic exercise training while wearing computerized heart rate monitors. Exercise intensity was defined as age- and gender-specific percent heart rate reserve, and exercise dose was calculated as session duration adjusted for exercise intensity, summed over all exercise sessions. A total of 1,012 non-Hispanic white, 700 African American, and 332 Hispanic subjects were genotyped for ~200K genetic markers using the Illumina Metabochip, and genome-wide association analysis was performed using PLINK. Principal component analysis was used to control for racial/ethnic background and population substructure.

RESULTS: SNPs in 10 genes exceeded a genome-wide significance of $p < 10^{-4.5}$, including *FN3KRP*, *FAM148A*, *CUX2*, *RIPK2*, *ABC11*, *B3GNTL1*, *BRE*, *BDNF*, *ZHX3*, *IDE*, and *TBCD*. Pathways contributing to lipid metabolism, neural signaling, muscle contraction, and adiposity were significantly represented by SNPs with a nominal $p < 0.0001$. The brain-derived neurotrophic factor (BDNF) signaling pathway emerged as a central factor linking multiple other pathways, highlighting neural signaling as a target for exercise tolerance. Two SNPs in the *CEP112* gene were significantly associated with exercise adherence ($p < 10^{-6}$); this gene has previously been implicated in smoking cessation, suggesting a common genetic pathway for persistent behavior.

CONCLUSIONS: This study represents the first genome-wide analysis of exercise tolerance and adherence in a multi-racial sample of young adults; neural signaling pathways appear to be important in both outcomes.

356 Board #177 May 31 9:30 AM - 11:00 AM
Osteoarthritic Extracellular RNA Biomarkers in Synovial Fluid
 Anthony J. Griswold, Jose Perez, Karen Nuytemans, Thomas Strong, Liyong Wang, Hayley Ennis, Marvin Smith, Jeffery Vance, Margaret A. Pericak-Vance, Lee D. Kaplan. University of Miami, Miami, FL. (Sponsor: Thomas Best, FACSM)
 (No relationships reported)

The molecular mechanisms influencing the initiation and progression of osteoarthritis (OA) are unclear. Therefore, current clinical management of predominately involves symptomatic treatment of end-stage diagnosed OA. Understanding the pathogenesis of OA at the pre-clinical stage may aid in both diagnostic and preventative modalities in the management of this chronic disease. **PURPOSE:** To determine the synovial extracellular RNA (exRNA) changes associated with OA. **METHODS:** Synovial fluid was collected from the injured knee of a cohort of 14 individuals (ages 15-47, 10 males and 4 females) undergoing surgical repair following ACL and/or meniscus injuries. Each knee had arthroscopically graded OA and divided the cohort into 5 individuals in the OA group (OA in >1 knee compartment) and 9 individuals in the non-OA group (OA in ≤ 1 knee compartment). Total exRNA was extracted from the synovial fluid collected at the time of surgery, >30 million reads generated per sample using massively parallel sequencing, and differential abundance of RNA was calculated between the two groups. **RESULTS:** A total of 19 protein coding exRNAs were significantly different ($FDR \leq 0.05$) between the two groups: 13 increased in the OA group, 6 decreased. While no specific pathways were enriched, these genes included several genes known to influence OA pathways including *ADAM12* (metalloprotease-disintegrin 12) and *BMPRIA* (bone morphogenetic protein receptor type 1A). In addition, 3 miRNAs were different: 2 increased, 1 decreased. One of these increased miRNAs was mir30a which has a known role in promotion of extracellular matrix degradation. **CONCLUSIONS:** These data suggest that the profile of extracellular RNA molecules are dysregulated arthroscopically diagnosed OA. While the specific intercellular signaling role of these exRNA are yet to be elucidated, they offer intriguing biomarkers and suggestions of dysregulated molecular pathways in OA. Changes in the genes *ADAM12*, *BMPRIA*, and mir30a suggest that exRNA markers of extracellular matrix degradation are biomarkers for the initiation and/or progression of OA. These findings have the potential clinical utility to differentiate patients at risk for the development of OA, introducing the possibility for intervention at pre-symptomatic stages.

357 Board #178 May 31 9:30 AM - 11:00 AM

Acute Exercise Induced Changes of Gene-Specific DNA Methylation in Natural Killer Cells

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As part of the innate immune system, natural killer cells (NK cells) have the ability to detect and eliminate virus-infected and neoplastic cells. The amount of tumor infiltrating NK cells is connected with the prognosis of various tumor diseases. Acute physical exercise influences the mobilization of NK cells and increases their cytotoxicity. Previous studies indicate that a load-dependent variation of the NK cells is induced by epigenetic modifications.

Purpose: The aim of this investigation was to examine to what extent has the promoter methylation of activating (KIR2DS4) and inhibiting (KIR3DL1) NK cell receptors changed after acute exhaustive exercise.

Methods: A total of 18 healthy female subjects (age of 55, 2 ± 5, 7) were asked to perform a spirometry on a cycle ergometer. The spirometry protocol was a step test of 1 min rest measurement at the beginning, followed by a 3 min warm-up phase with 50 watts of power output and an increase of 25 watts for every 2 minutes of the test until exhaustion. Before (T0) and after (T1) spirometry test, venous blood was collected from which NK cells were isolated and DNA was extracted. Accordingly, the KIR2DS4 and KIR3DL1 NK cell receptors were examined through Targeted Deep Amplicon Sequencing.

Results: The promoter methylation of the activating KIR2DS4 receptor reduced after single exercise load (T0 vs T1). The significant changes were observed in two close (distance of 4 base pairs), identified CpGs (p=.007 and p=.008). No effects found on the inhibiting KIR3DL1 receptor. There was no correlation found between the promoter methylation and the maximum oxygen uptake of the subjects. However, the data showed a positive correlation of the promoter methylation between both genes at T0 and T1.

Conclusions: Acute exercise reduces the promoter methylation of the activating NK cell receptor KIR2DS4. This finding may be related to reduced KIR2DS4 gene expression by natural killer cells. The correlation between the methylation of both genes indicates that reduced methylation of the activating receptor proves to be reduced for the inhibiting receptor as well. However, only the activating receptor is sensitive to epigenetic modulations after exhaustive exercise. Therefore, high-load acute exercise represents a promising positive influence for the innate immune system.

358 Board #179 May 31 9:30 AM - 11:00 AM

Exercise Induced Natural Killer (NK) Cell Genomic Response in Pediatric Acute Lymphoblastic Leukemia (ALL) Survivors

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(No relationships reported)

Despite remarkable success in achieving remission, pediatric ALL survivors face increased risk of physical activity related metabolic, cardiovascular, and bone disease. The mechanisms of these threats to the healthspan are unknown. NK cells play a role in therapy and immune surveillance in ALL and along with other immune cells, are also involved in the molecular pathways by which exercise benefits health. NK cells increase in the circulation in response to brief exercise to a greater degree than any other leukocyte. **PURPOSE:** To examine the effect of brief exercise on NK cell gene expression (RNA seq), in children and adolescents who have survived ALL. **METHODS:** 9 ALL survivors and 9 sex and age-matched controls (14.8±0.7 & 15.0±0.9 y/o) performed 8, 2-min bouts of cycle ergometer exercise interspersed with 1-min rest at a constant work equivalent to 65±1% of peak $\dot{V}O_2$. RNA Seq was performed using standard techniques. The trimmed reads were aligned to Human hg19 reference genome. Differential analysis was performed using DESeq (v.1.18.0). Paired design was used to account for samples from same patient (FDR<0.05). Differential expression genes were classified into pathways using the Kyoto Encyclopedia of Genes and Genomes (KEGG) database (EASE score<0.05). **RESULTS:** 17 annotated genes were expressed significantly different from controls in ALL survivors at baseline (before exercise) and were enriched in MicroRNAs in Cancer KEGG pathway. Brief exercise significantly altered 4407 genes in control and 4126 genes in ALL. 220 genes were altered differently in response to exercise in ALL survivors compared to controls. Those genes were enriched in KEGG Pathways involved in immune surveillance; e.g., hematopoietic cell lineage, central carbon metabolism in cancer, HIF-1 signaling pathway, pathways in cancer and antigen processing and presentation which included 3 killer-cell immunoglobulin-like receptors (regulate the killing function of NK cells)

that had reduced response in ALL. **CONCLUSION:** Exercise altered the expression of thousands of NK cell genes in both ALL and controls with a distinct pattern in ALL. Among several possible health effects, exercise may improve NK cell function in immune surveillance in ALL survivors. Supported by UCI SOM Faculty Research Grant, PERC System Biology Fund, and NIH Grant P01HD-048721

A-48 Free Communication/Poster - Hypoxic Exercise

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

359 Board #180 May 31 9:30 AM - 11:00 AM
FGF21 is Produced By Active Skeletal Muscle during Intense Exercise in Humans: Influence Of P_iO₂

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Fibroblast growth factor 21 (FGF21) is a peptide produced mostly by the liver and other tissues as skeletal muscle. Recent work supports that the main source of circulating FGF21 during exercise is the hepato-splanchnic circulation. Nevertheless, increased FGF21 mRNA has been reported in human skeletal muscle after prolonged exercise. Given the great increase of skeletal muscle blood flow during exercise, a small amount of FGF21 released by active skeletal muscles could have escaped detection by a-v differences.

PURPOSE: to determine whether skeletal muscle produces FGF21 in response to exercise and the influence of muscle metabolism and oxygenation on this process. **METHODS:** Eleven volunteers performed incremental exercise (IE) to exhaustion in normoxia (Nx, P_iO₂:143 mmHg) and hypoxia (Hyp, P_iO₂:73 mmHg) while muscle metabolites and FGF21 protein expression (Western Blot) were measured before (control) and immediately after IE in Nx and Hyp. Immediately after IE, the circulation of one leg was instantaneously occluded (300 mmHg) and vastus lateralis muscle biopsies obtained after 10s from the occluded leg, and simultaneously from both legs at 60s.

RESULTS: At 10s muscle lactate ([La]) was increased and phosphocreatine (PCr) and ATP reduced in Nx and Hyp, without differences between conditions. Muscle [La] was increased by 25% from 10 to 60s in the occluded leg (P<0.05) and unchanged in the non-occluded leg (+5% P=0.71). After 60s, PCr was reduced by 94 and 48%, in the occluded and non-occluded leg, respectively (P<0.05). Compared to pre-exercise, FGF21 protein expression was increased in the occluded leg by 55 and 57% at 10s and 60s, respectively (time effect P=0.02) and by 10% (P=0.42) in the non-occluded leg at 60s, without influence of P_iO₂. No association was observed between metabolite accumulation and FGF21 expression.

CONCLUSIONS: FGF21 is produced during intense exercise in human skeletal muscle. The fact that FGF21 was not increased 60s after the end of exercise in the leg recovering with free circulation highlights the utility of total occlusion of the circulation to trap in the muscle myokines released in small amounts by the muscle during contractile activity.

Funding: MINECO Ref.: DEP2015-71171-R

360 Board #181 May 31 9:30 AM - 11:00 AM

The Effect Of Normobaric Hypoxic Endurance Training On Forearm Muscle Blood Flow

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(No relationships reported)

The effects of intermittent hypoxic exposure (live low train high) on skeletal muscle oxygenation kinetics remain poorly understood. However, recent developments in technology have meant that the monitoring of skeletal muscle blood flow in response

to training is possible. **PURPOSE:** The aim of the current study was to determine whether handgrip dynamometry (HGD) training in normobaric hypoxia (14% FiO₂) altered blood flow in the non-dominant flexor digitorum profundus (FDP) at rest and during exercise.

METHODS: Following institutional ethical approval, 7 healthy males who were not forearm trained (mean age: 20.7 ± 1.1 years; stature: 1.77 ± 0.08 m; body mass: 84.0 ± 14.2 kg) volunteered to take part in the study. In a randomized, crossover design participants completed four weeks of progressive HGD endurance training (0.3Hz in week one increasing to 1.2Hz in week 4) in both normoxia and hypoxia. There were four training sessions per week and each consisted of 30 min intermittent handgrip exercise at 30% of maximal voluntary contraction (MVC), followed by a 60s maximal 'sprint'. A six week washout period separated normoxic and hypoxic training. Before and after the training intervention, forearm muscle blood flow was determined at rest and during exercise (25% MVC) using near-infrared spectroscopy and the venous occlusion method. Forearm blood flow was calculated by evaluating the rate of increase in total haemoglobin (thb) during the first few seconds of venous occlusion (60 mmHg).

RESULTS: Two-way repeated measures ANOVA revealed a significant interaction (time x condition; *p* = 0.028) in blood flow during exercise at 25% MVC, but not during rest (*p* = 0.114); further there was no significant main effect for condition (*p* = 0.059) or time (*p* = 0.077). Follow up paired samples *t*-tests revealed that forearm muscle blood flow during exercise was greater than baseline following normobaric hypoxic training (*p* = 0.049, MD = 1.59, 95% CI = 0.24 - 3.21 ml·min⁻¹·100ml⁻¹), but not following normoxic training (MD = 0.05, 95% CI = -0.45 - 0.54 ml·min⁻¹·100ml⁻¹).

CONCLUSIONS: Thirty minutes of handgrip dynamometry training a day for 4-weeks in normobaric hypoxia has the potential to increase forearm muscle blood flow. Future studies should seek to determine whether these hypoxia induced changes translate to an enhanced endurance performance.

361 Board #182 May 31 9:30 AM - 11:00 AM

The Effect of Hypoxia on PGC-1α

Roksana Zak, Robert Shute, Dustin Slivka, FACSM. *University of Nebraska-Omaha, Omaha, NE.* (Sponsor: Dustin Slivka, FACSM)

(No relationships reported)

Markers for mitochondrial function in the skeletal muscle appear to be reduced after extended exposure to altitude. However, short term training at altitude enhances aerobic capacity. Further investigation is needed to determine the skeletal muscle response to altitude.

PURPOSE: The purpose of this study was to determine the impact of exposure to normobaric hypoxia after exercise on the gene expression and subcellular location of PGC-1α protein compared to a normoxic environment.

METHODS: Six male participants (age 25 ± 2, height 180 ± 4 cm, weight 82 ± 2 kg) completed two 90 min cycling trials in laboratory conditions followed by a 6 h recovery in either ambient conditions (975 m) or in a hypoxic environment (5000 m). Biopsies were taken from the *vastus lateralis* before exercise, after exercise, and following 6 h recovery. Samples were analyzed for PGC1-α gene expression using RT-qPCR and subcellular location using western blot on cytosolic and nuclear fractions.

RESULTS: Exposure to hypoxia following exercise resulted in significantly lower expression of PGC-1α (*p* = 0.014) but no significant differences were found in protein translocation between the cytosolic (*p* = 0.225) and nuclear (*p* = 0.211) fractions.

CONCLUSIONS: It appears that the post-translational events of PGC-1α are not altered by acute hypoxia after exercise, despite a reduced transcriptional response of PGC-1α. It is unclear if these cellular events would account for the deficit in mitochondrial function observed with extended exposure to a hypoxic environment. This project was funded by grants from the Department of Defense (W8IXWH-10-Z-0120) and NASA Nebraska Space Grant.

362 Board #183 May 31 9:30 AM - 11:00 AM

Exercise Induced Oxidative Stress During Normobaric And Hypobaric Hypoxic Exercise Recovery

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(No relationships reported)

PURPOSE: Altitude exposure and exercise provoke an acute oxidative stress response in muscle and blood tissues. Prior work indicates that redox-sensitive exercise recovery responses are attenuated above 1500m, although the independent impact of hypobaric and hypoxia on these responses are unknown. Moreover, given that the wealth of existing exercise and altitude data are conducted primarily in males, the current study

was designed to understand exercise recovery responses in males and females exposed to various hypoxia and hypobaric conditions following a common bout of aerobic exercise.

METHODS: Sixteen active males (n=8) and females (n=8) between the ages of 18-40 performed cycle ergometer exercise for 60 minutes at 70% watts max at a base elevation of 975m. In a randomized counter-balanced crossover design subjects recovered in an environmental chamber for 4 hours in three conditions; 1000m normobaric normoxia (NN, 675mmHg, 18.8% FiO₂), a simulated 4400m normobaric hypoxia (NH, 675mmHg, 12% FiO₂), or a simulated 4400m hypobaric hypoxia (HH, 440mmHg, 12% FiO₂). Pulse oximetry was used to measure O₂ saturation throughout the exercise trials and to confirm hypoxia during recovery. Six muscle biopsies obtained from the vastus lateralis at baseline and following each exercise recovery were examined for hypoxia and redox sensitive transcripts including endothelial PAS domain protein-1 (EPAS-1), hemoxygenase-1 (HMOX1), superoxide dismutase-2 (SOD2), and nuclear factor erythroid-derived 2-like 2 (NFE2L2).

RESULTS: No sex-dependent differences in gene transcripts were observed for any markers examined (*p*>0.05). No differences were observed for EPAS-1 (variable 2 fold increase, *p*>0.05) or NFE2L2 (1.29 fold increase, *p*>0.05). Time-, but not trial-, dependent differences existed for HMOX1 (8.4 fold increase, *p*<0.000) and SOD2 (1.4 fold increase, *p*=0.017) and indicate a similar redox stimulus was present 4 hours post exercise in all three recovery condition.

CONCLUSIONS: These data suggest exercise recovery in simulated conditions of NH and HH do not impact EPAS-1, HMOX1, SOD2 or NFE2L2. Additional redox-sensitive markers in blood and muscle should be examined to determine whether additional adaptive responses are impacted by NH and HH recovery conditions.

363 Board #184 May 31 9:30 AM - 11:00 AM

Hypoxic Training Promotes Apelin Expression In Skeletal Muscles Of High Fat Diet-induced Obese Mice

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(No relationships reported)

PURPOSE: To investigate the effects of hypoxia, exercise, and hypoxic exercise training on the expression of apelin and APJ in skeletal muscle of obese mice.

METHODS: 60two-month oldC57BL/6Jmice were randomly divided into two groups: 10 in normal diet group(N) and 50 in the high fat diet (HFD) groups. After two months of feeding, the HFD mice whose body weight 20% higher than the average weight of N group were selected as obese mice and were further allocated into four groups: Control (C), Exercise (E), Hypoxia (H), and Exercise plus Hypoxia (E+H), at 8-9 mice/group. Besides body weight, measured variables in skeletal muscle were protein/mRNA levels of apelin/APJ, AMPKα-Thr172 phosphorylation, hypoxia inducible factor-1α(HIF-1α),mRNA levels ofperoxisome proliferator-activated receptorα (PPARα), estrogen-related receptor (ERRα),and nuclear respiratory factor1 (NRF1).

RESULTS: Obese mice had significantly lower mRNA and protein expressions of apelin/APJ in skeletal muscles than the normal body weight mice. After four weeks of interventions, hypoxic exercise training decreasedbody weight andincreased mRNA and protein expressions of apelin and APJ, mRNA expression of ERRα, and protein expression of HIF-1α.

CONCLUSIONS: These results indicate that changes of body weight may be associated with the levels of apelin/APJ expressions in skeletal muscle.

364 Board #185 May 31 9:30 AM - 11:00 AM

Metabolomic Analysis Of Skeletal Muscle In Horses Trained In Hypoxia.

Hajime Ohmura¹, Kazutaka Mukai¹, Yuji Takahashi¹, Toshiyuki Takahashi¹, James H. Jones². ¹Japan Racing Association, Shimotsuke-shi, Japan. ²University of California, Davis, Davis, CA.

(No relationships reported)

Hypoxic training is effective for improving athletic performance. In horses, hypoxic training increases maximal oxygen consumption (VO₂max) more than normoxic training. However, the effects of hypoxic training on well-trained horses is unclear, and its effects on muscle metabolism have not been investigated. We hypothesized that VO₂max of well-trained horses would increase and muscle metabolomics would differ before and after hypoxic training. **PURPOSE:** To determine the effects of hypoxic training on VO₂max and muscle metabolomics of well-trained horses.

METHODS: We studied 5 well-trained horses in which VO₂max had not increased over 3 consecutive weeks of supramaximal treadmill training in normoxia twice a week. Horses trained with hypoxia (15% O₂) twice a week. Before and after 3 weeks of hypoxic training, VO₂max was measured on the treadmill and biopsy samples for metabolomics analyses were taken from the gluteus medius muscle at rest. Data were analyzed with Welch's t-test. **RESULTS:** VO₂max increased after 3 weeks of hypoxic training (176 vs. 194 ml/(kg×min), *p* < .05) even though all-out training in normoxia had not increased VO₂max. From metabolomic analysis, Acetyl CoA (0.150 vs.0.048

nmol/g, $p < .05$), ATP (8.3 vs. 7.6 $\mu\text{mol/g}$, $p < .05$), and pyruvic acid (141 vs. 116 nmol/g, $p < .05$) decreased after hypoxic training. However, BCAAs (302 vs. 407 nmol/g, $p < .05$) and methionine (33 vs. 41 nmol/g, $p < .05$) increased after hypoxic training. **CONCLUSION:** Hypoxic training may increase $\text{VO}_{2\text{max}}$ even though it is not increased by normoxic training. Finding changes in muscle metabolomics in hypoxia may suggest a mechanism for potentially increasing racing performance by increasing $\text{VO}_{2\text{max}}$.

A-49 Free Communication/Poster - Military Physiology

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

365 Board #186 May 31 9:30 AM - 11:00 AM Physical Discomfort And Relationship To Performance During A 12-mile March In US Army Soldiers

Stephen A. Foulis, Jan E. Redmond, Peter N. Frykman, Edward J. Zambraski, Marilyn A. Sharp. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*
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(No relationships reported)

Long road marches carrying heavy loads are a common military task. While it is anecdotally accepted that discomfort related to physical pain and soreness increases during long marches, there is little data available which has quantified this discomfort or determined its effect on march performance. **PURPOSE:** To quantify pain and soreness (P&S) during a 12-mile march and determine how it affects pacing. **METHODS:** While carrying a load weighing ~46.4 kg, 46 male and 26 female Soldiers performed a 12 mile foot march. A mandatory rest break of 10 minutes was enforced at the 3 and 9 mile marks, and a 30 minute break was enforced at the 6 mile mark. Time splits were taken every 3 miles. At the start, each rest point, and finish, soldiers rated their P&S from 0 (No Discomfort) to 3 (Extremely Uncomfortable) using an image of the body mapped into 21 regions (scale adapted from Dimov et al, *AIHAJ*, 2000). Increases in P&S over time were assessed using rmANOVA. Correlations were examined between changes in P&S (finish-start) for each site and load carried per body mass and with changes in pace (time for last 3 miles – time for first 3 miles). **RESULTS:** Total march time was 244 ± 35 minutes (mean \pm SD). Average overall P&S of the 21 body regions increased during the march from 0.13 ± 0.11 prior to the march to 0.46 ± 0.24 at the end ($p < 0.01$ for trend), and did not significantly differ by sex ($p = 0.24$). Of the 71 soldiers, 64 (90%) reported a P&S of 2 or 3 for at least one body region, with 36 (51%) reporting a P&S of 3. The sites of the greatest soreness were the shoulders (End P&S 1.99 ± 0.96) and the feet (End P&S 1.36 ± 1.20) ($p < 0.05$ for both). Significant increases in P&S were observed in the neck, shoulders, mid-to-lower back, hips/waist, thighs, legs/feet, and ankles ($p \leq 0.05$ for trends). Load carried per body mass correlated with changes in neck P&S ($r = 0.24$, $p = 0.04$). Increases in P&S of the hips/waist were associated with decreasing their pace ($r = 0.32$, $p = 0.01$). **DISCUSSION:** Due to the high load over a long distance, P&S increased over the march and may have interfered with performance. These data provide quantitative evidence of the changes in reported physical discomfort during long marches. To minimize soldier discomfort and improve performance, improvements in road march policy, equipment ergonomics, and training of proper gear fitting should target these body regions.

366 Board #187 May 31 9:30 AM - 11:00 AM Relationship Between Soldier Performance on the Two-Mile Run and Beep Test: Ability to Predict $\text{VO}_{2\text{max}}$

Maria C. Canino, Stephen A. Foulis, Jan E. Redmond, Edward J. Zambraski, Marilyn A. Sharp. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*
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(No relationships reported)

Aerobic fitness is vital for military personnel to perform their physically demanding job tasks. The Army currently uses a two-mile run (TMR) as part of the Army Physical Fitness Test to measure aerobic fitness levels. The Beep Test (BT) is also currently being used by the Army as a pre-enlistment screening test. Both tests have been validated to predict an individual's aerobic capacity. An advantage of the BT is that it can be performed indoors, offering an alternative to the TMR when outdoor conditions could affect performance. A comparison of the results of these two tests has not been made. **PURPOSE:** To determine the relationship between the TMR and BT and to compare their $\text{VO}_{2\text{max}}$ estimations. **METHODS:** 404 male and 128 female soldiers participated in this study. The TMR results were self-reported from their most recent APFT. To screen for maximal effort, all soldiers included reached a post BT heart rate within 10 bpm of their age-predicted maximal heart rate (220-age). Correlations and

simple linear regression were used to analyze the relationship between TMR and BT. **RESULTS:** The regression model obtained for predicting TMR time (min) from BT shuttles (#) was $\text{TMR} = 19.101 - 0.067 * \text{BT}$, $R^2 = 0.53$ ($p < 0.001$), $\text{SEE} = 1.137$ min. For example, completing 60 and 30 shuttles would be similar to TMR times of 15.08- and 17.09 min, respectively. The mean TMR time was 15.01 min (range: 10.9-22.2 min). The mean BT score was 61 shuttles (range: 16-113 shuttles; test duration: 2.2-12.2 min). There is a significant moderate correlation between the TMR and BT estimated $\text{VO}_{2\text{max}}$ ($R^2 = 0.64$; $p < 0.001$), with mean $\text{VO}_{2\text{max}}$ values for TMR and BT 50.5 ± 5.1 and $39.4 \pm 6.1 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, respectively. **CONCLUSIONS:** A significant moderate relationships exist between both TMR times and BT shuttles and TMR and BT estimated $\text{VO}_{2\text{max}}$. Further, in the same individuals TMR estimated $\text{VO}_{2\text{max}}$ was 22% higher than what was predicted by BT performance. Reasons for this large discrepancy could include inflation of their performance on the TMR due to subject recall, motivational differences to perform to their maximum, and/or significant differences in the ability of these two tests to actually estimate $\text{VO}_{2\text{max}}$. Additional studies are needed to concurrently measure TMR, BT, and a laboratory measure of $\text{VO}_{2\text{max}}$ in the same individual.

367 Board #188 May 31 9:30 AM - 11:00 AM The Physiological Demands of a 16 km Loaded Patrol

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(No relationships reported)

The Royal Air Force (RAF) Regiment (Regt) is a close combat unit, their primary role is to secure the safety of an operational airfield. One of the critical tasks of the RAF Regt is a patrol, this can last approx. 4.5 hours, covering a distance of 16 km. **PURPOSE:** To determine the physical demand of a simulated 16 km loaded patrol in RAF Regiment Regt personnel, specifically if differences occurred between the first and fifteenth km. **METHODS:** 26 participants from the RAF Regt performed a 16 km loaded (31.50 kg) patrol over 4 hrs 28 min. Participants received 2 x 10 min breaks at 1 hr 25 min and 3 hrs 20 min and a 20 min break at 1 hr 54 min. Rating of Perceived Exertion (RPE) was recorded at the first and second break and on completion. Walking speed was paced at 4.20 km.h⁻¹ for the duration of the patrol. Heart rate (HR) was measured for the duration of the patrol. Oxygen consumption (O_2) was measured using Douglas bag collections of 1 min at 1 km, 3 km, 5 km, 10 km and 15 km. O_2 was calculated as $\text{mL} \cdot \text{kg}^{-1} \cdot \text{metre}^{-1}$ to allow for the variations in actual marching speed (3.80 km.h⁻¹ to 4.92 km.h⁻¹). **RESULTS:** No differences were reported in O_2 between the first, third, fifth or tenth km in comparison with 15 km. A meaningful significant increase in O_2 was observed at 10 km compared to the first km (0.24 ± 0.03 vs $0.22 \pm 0.02 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{metre}^{-1}$; $p = 0.002$; Cohen's d effect size (ES) 0.60; Post hoc power (PhP) = 0.92; $n = 25$) and 10 km compared to the third km (0.24 ± 0.03 vs $0.22 \pm 0.03 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{metre}^{-1}$; $p = 0.006$; ES 0.65; PhP = 0.85; $n = 19$). Significantly higher ($p \leq 0.0125$) O_2 was reported at 5 km compared to 3 km, however low ES and power were observed. During periods of work a linear cardiac drift was observed; mean \pm SD HR of $93 \pm 12.03 \text{ b} \cdot \text{min}^{-1}$ at 1 km to $110 \pm 14.98 \text{ b} \cdot \text{min}^{-1}$ at 16 km. RPE remained the same for the first and second breaks (median (range): 7 (6 to 13), increasing to 8 (6 to 14) on completion of the patrol. **CONCLUSION:** The metabolic, cardiovascular and perceived demands were low and remained low for the duration of the patrol. These data highlight that whilst the metabolic demand remained constant from the first to last km, HR increased linearly during the active element of the patrol. This suggests that HR should not be used to predict or estimate the metabolic workload of long duration activities such as the patrol.

368 Board #189 May 31 9:30 AM - 11:00 AM Neuromuscular Responses to Consecutive Day Military Load Carriage.

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(No relationships reported)

Previous research has shown that lower limb peak torque (PT) is reduced up to 72 hours after treadmill load carriage. PT can occur at a range of muscle lengths and as such are unable to define the changes in muscle function, which may occur because of load carriage. **PURPOSE:** To determine changes in lower limb neuromuscular output, in responses to consecutive day military load carriage on a treadmill compared to an unloaded control group. **METHODS:** 12 participants (10 males: $88.8 \text{ Kg} \pm 16.8 \text{ Kg}$, $188.72 \text{ cm} \pm 8.5 \text{ cm}$; 2 females: $63.4 \text{ kg} \pm 12 \text{ kg}$, $164.2 \text{ cm} \pm 8 \text{ cm}$) walked on a level treadmill carrying 32kg across webbing, backpack and rifle, at a speed of 5.4 km-h⁻¹ for two hours on two consecutive days. 8 participants (6 males: $92.8 \text{ Kg} \pm 11.8 \text{ Kg}$, $187.22 \text{ cm} \pm 8.5 \text{ cm}$; 2 females: $64.2 \text{ kg} \pm 12 \text{ kg}$, $154.1 \text{ cm} \pm 8 \text{ cm}$) completed the protocol without the military equipment. Neuromuscular output of the ankle and knee flexors and extensors were studied by observing changes in torque by isokinetic dynamometry.

Knee extensor and flexor muscles were studied at 0, 60, 180 °-s-1. Ankle dorsi and plantar flexors were observed at 0, 60, 120 °-s-1. Measurements were taken pre and post load carriage on day one and day two. Torque was recorded as PT and at 5° intervals during isokinetic contraction. **RESULTS:** Statistically significant reductions in PT were observed post load carriage on day one and two in the dorsiflexors at 60 and 180°-s-1 (P<0.05) and knee flexors and extensors at 60 and 0°-s-1 (P<0.05), these are supported by torque reductions throughout the movement (70° to 0°)(P<0.05). PT returned to baseline 24 hours post exercise while torque at serial muscle lengths remained reduced. No changes were observed between unloaded and loaded walking. **CONCLUSIONS:** Findings indicate that two hours of treadmill load carriage causes a bimodal change in neuromuscular function of the knee extensors and flexors and the ankle dorsiflexors, characterised by a reduction in the PT and torque over two days of repeated exercise. However, no significant difference was observed between loaded and unloaded groups. While temporal results find support in the previous literature, the inclusion of an exercising control group, that demonstrates no significant change, suggests that they fail to observe that load carriage causes no greater reduction in neuromuscular function than unloaded walking.

369 Board #190 May 31 9:30 AM - 11:00 AM
Optimal Number of Practice Sessions for Performance of Heavy Loading Tasks in Soldiers

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All U.S. Army soldiers must perform the physically demanding tasks of their job prior to graduation from initial entry training. Armored personnel are required to conduct a tank ammunition loading task (TAL), while Field Artillery (FA) personnel perform the FA Ammunition Supply Vehicle reloading task (FAR). As these are graduation requirements, it is important to determine the influence of practice on performance of the TAL and FAR to guide training. **PURPOSE:** To determine the number of practices needed to optimize performance and pass rates of the TAL and FAR in soldiers unfamiliar with the tasks. **METHODS:** A sample of 43 soldiers (22 men, 21 women) performed the TAL 4 times and 41 (23 men, 18 women) also performed the FAR 4 times. Tasks were performed on four different days over a two week period with ≥48 hours rest between trials (T). To perform the TAL a soldier lifted and carried 18, 25 kg rounds a distance of 5 m, and handed them to another crewmember standing on the deck of the tank (lift height=1.63 m). The rate of loading was calculated in rounds·min⁻¹ with a passing rate of ≥ 2.4 rounds·min⁻¹ (18 rounds in 10 min). To perform the FAR 30, 45 kg rounds were lifted from the vehicle tailgate, carried 3 m and loaded into a rack with openings from floor to shoulder height. Soldiers had 15 min (3 5-min bouts, with 2.5 min of rest between each bout) to load 30 rounds. A passing score for the FAR was ≥ 2 rounds·min⁻¹ (30 rounds in 15 min). Repeated measures ANOVA were used to examine the effects of repeated trials. The number of soldiers failing the standard at each T was determined. **RESULTS:** The scores were significantly improved (p<0.01) from T1 to T4 for TAL (T1= 3.54 and T4=5.36 rounds·min⁻¹) and from T1 to T3 for FAR (T1=2.45 and T3= 3.47 rounds·min⁻¹). FAR plateaued T3 to T4 at 3.64 rounds·min⁻¹. The number of failures decreased with each trial on the TAL (T1=17, T2=14, T3=10, T4=6) and on the FAR (T1=19, T2=16, T3=11, T4=10). **CONCLUSIONS:** For trainees, it is important to provide 2-3 trials on each of these tasks to maximize the number passing, while not utilizing an inordinate amount of training time. Soldiers who are unable to perform to standard after 3 practices may need remedial progressive resistance training to be successful.

370 Board #191 May 31 9:30 AM - 11:00 AM
Body Composition and Physical Determinants of Physiological and Musculoskeletal Readiness in Marines

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 (No relationships reported)

Combat arms are now open to women across all Armed Forces. Identifying physicality of men and women with enhanced, cumulative physiological and musculoskeletal fitness may optimize Force Readiness. **PURPOSE:** To assess body composition and physical characteristics of male and female Marines from the Marine Corps' Ground Combat Element Integrated Task Force classified by performance clusters. **METHODS:** 302 Marines (age=22.0±2.7 yrs, height=1.5±0.1 m, mass=76.1±12.2 kg) underwent body composition testing (air displacement plethysmography); arm span and leg length; and a battery of laboratory and field strength, aerobic/anaerobic,

balance, biomechanics, and flexibility tests. A k-means cluster analysis was performed to characterize Marines with similar lab and field characteristics, regardless of sex, body composition or physicality. Twenty-three clustering validity indices were calculated to determine the optimal cluster number using R. One-way ANOVA or Kruskal Wallis tests were utilized to test for group differences, as appropriate, followed by Bonferroni adjusted pair-wise comparisons (p<0.05, two-sided). **RESULTS:** Three clusters (C) were identified: C1 with the best strength and aerobic/anaerobic characteristics, C3 with the worst strength and aerobic/anaerobic characteristics, and C2 between C1 and C3; clusters were then stratified by sex (Men: C1M, C2M, C3M; Women: C2W, C3W). C1M, C2M, and C3M had significantly less BF% than C2W and C3W. Fat free mass was significantly different among all groups. C1M and C2W had significantly greater fat mass than C3M. C1M and C2M had significantly greater arm span and leg length than all other groups. (Table 1) **CONCLUSIONS:** Fat free mass may have a stronger association with performance on strength, aerobic, and anaerobic tests than BF% or fat mass. These results can assist in developing tools to identify Marines with enhanced physiological and musculoskeletal readiness.
 Supported by ONR Award #N00014-14-1-0021

Table 1. Body Composition and Physical Characteristics by Cluster and Sex.

	C1 (men: N=76)		C2 (men: N=132)		C2 (women: N=14)		C3 (men: N=10)		C3 (women: N=70)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Body Fat %	19.4	5.3*	18.9	6.3*	22.9	4.4	16.3	7.0*	24.7	5.0
Fat Free Mass (kg)	71.7	6.3***	82.3	5.2***	54.8	5.1***	53.2	3.5***	47.3	4.6***
Fat Mass (kg)	17.1	6.8**	14.4	7.1*	16.8	6.0*	8.9	6.5**	16.0	6.4
Arm Span (cm)	185.0	6.7***	179.9	7.3***	169.5	6.3**	172.6	6.7***	164.0	6.7***
Leg Length (mm)	958.9	37.2***	927.8	45.2***	892.9	46.7**	893.3	45.9**	857.9	36.4**

One-way ANOVA and post-hoc Bonferroni tests performed
 *Kruskal-Wallis and post-hoc Mann-Whitney U tests performed; Median and IQR presented instead of Mean and SD
 *Significantly different compared to C1 men (p<0.05)
 **Significantly different compared to C2 men (p<0.05)
 ***Significantly different compared to C2 women (p<0.05)
 *Significantly different compared to C3 men (p<0.05)
 **Significantly different compared to C3 women (p<0.05)

371 Board #192 May 31 9:30 AM - 11:00 AM
Distribution Of Cardiorespiratory Fitness Levels Of US Army Recruits From 2010-2013 By State

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PURPOSE: To characterize the cardiorespiratory fitness (CRF) levels of US Army recruits by state. **METHODS:** Data on US Army recruits from all 50 states and Washington, DC who entered basic combat training (BCT) between 2010-2013 were provided by the US Army Public Health Center. CRF was assessed in a subset of recruits from their first diagnostic Army Physical Fitness Test during BCT by two-mile run time (run time) in minutes. States were ranked into quartiles based on median run times of recruits from that state aged 17 - 35 yrs in the total sample and stratified by sex. **RESULTS:** A total of 168,160 recruits (79.46% male) were analyzed. Median age, BMI, and run time were 20.0±3.6 years, 24.4±3.6kg/m², and 16.2min (range of 8.1-60.0 min), respectively. There were significant (p<0.0001) differences in median run time between males (16.0±2.2 min) and females (19.3±2.8 min). The distribution of median run times across states, with states ranked into one of three groups: 1) top 25% (lowest run times/highest CRF), 2) middle 50%, and 3) bottom 25% (highest run times/lowest CRF); is shown for the overall sample and by sex in Figure 1. Of the 14 states in the bottom 25% of median CRF in the total sample (Figure 1A), 11 of them were from the southern/southeastern regions (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX). These 11 states remained in the bottom 25% of median CRF in models stratified by sex (Figure 1B-C), with the exception being KY replacing OK in models restricted to male recruits (Figure 1C). **CONCLUSION:** The CRF levels of US Army recruits entering BCT differ by state. Our results show that recruits from the southern and southeastern states tended to have lower CRF compared to recruits from the rest of the country. This is relevant given previously established associations between CRF and training-related injuries sustained during BCT. Investigating state level factors contributing to the fitness of Army recruits (and theoretically all state residents of a given age-range) is an important next step.

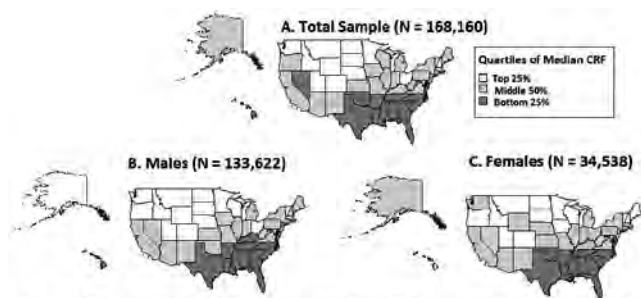


Figure 1. States ranked by quartiles of cardiorespiratory fitness based on median 2-mile run times of US Army recruits entering basic training from 2010-2013 (A-total sample), as well as separately in male (B) and female (C) recruits.

372 Board #193 May 31 9:30 AM - 11:00 AM
Dose Dependent Increases in Electrodermal Activity During Exercise in Military Men: Absolute Versus Relative Workloads

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Preliminary evidence suggests that electrodermal activity (EDA) is a prospective surrogate marker of sympathetic nervous system (SNS) activity during exercise. However, the validity of EDA in the context of aerobic exercise must be established before its translational potential can be realized. **PURPOSE:** To evaluate the validity of EDA as a measure of SNS activity during exercise and the moderating effects of aerobic fitness utilizing absolute (AW) and relative (RW) workloads. **METHODS:** Forty healthy, U.S. Navy active duty males (age: 36.2±6.9 yrs) completed a graded exercise test to assess maximal oxygen consumption (VO_{2max}). EDA was recorded at baseline, during exercise, and seated recovery. Relative changes were compared with baseline. A median split established the high-fit (AW: n=11, VO_{2max} 48.9±1.9; RW: n=20, VO_{2max} 50.5±4.3) and low-fit groups (AW: n=13, VO_{2max} 43.6±2.1; RW: n=20, VO_{2max} 41.1±2.7). A 2 (group) x 6 (stage) repeated measures ANOVA evaluated EDA changes across stages of exercise, as well as between fitness levels. To evaluate validity, EDA responses of high-fit and low-fit men measured by AW and RW were then compared to the established literature characterizing plasma catecholamine responses during exercise. **RESULTS:** Mean percent changes from baseline for AW were +71.1 to +107.4% from stages 1-4, with a decrease in seated recovery (+88.3%) ($p<0.001$, $\eta^2=0.38$), and for RW were +78.1 to +120.3% from 25% to 100% VO_{2max} , with a decline in seated recovery (+105.5%) ($p<0.001$, $\eta^2=0.24$). A significant interaction between fitness and workload was observed for RW ($p=0.003$, $\eta^2=0.11$). Specifically, high-fit showed a linear increase in EDA from 25 to 100% VO_{2max} , with a steady decrease into seated recovery. By contrast, low-fit maximal EDA response occurred at 75% VO_{2max} , followed by a blunted decline in seated recovery. This interaction did not prevail using AW ($p>0.05$). **CONCLUSION:** Similar dose dependent increases in EDA were observed utilizing AW and RW, although RW alone captured a rise in high-fit EDA above low-fit at maximal exertion. The noted differences between high-fit and low-fit men measured by AW and RW emulate the established literature characterizing plasma catecholamine responses during exercise. These findings imply that EDA is a potentially valid proxy of SNS activity during exercise.

373 Board #194 May 31 9:30 AM - 11:00 AM
Identifying The Critical Tasks Of The Raf Regiment
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The Royal Air Force Regiment (RAF Regt) delivers the ground close combat role for the RAF, protecting airfield assets and personnel. There is a requirement for a Physical Employment Standard for the RAF Regt and identifying the critical tasks is the essential first step in this process.

PURPOSE: To identify the critical tasks of the RAF Regt including the method of best practice (MOBP) and minimum acceptable standard (MAS) for undertaking these tasks. **METHOD:** Task Analysis Questionnaires (TAQ), were sent to 13% (n=530) of the RAF Regt. SME focus groups were conducted to describe the critical tasks in a realistic scenario and identify a MOBP and MAS. A Military Judgement Panel (MJP) was asked to review the proposed critical tasks. The authorised critical tasks were presented to a further focus group of SME to finalise the scenario for each task, the MOBP and MAS. **RESULTS:** 279 TAQ were returned providing 1849 task descriptions, allocated to 22 generic task categories. SME identified the most physically demanding critical tasks, which were presented to the MJP for endorsement. A final SME focus group provided the following description, including a MOBP and MAS, for each endorsed task as follows:

Tactical Advance to Battle: Carrying total weight 47.1 kg, walk over mixed terrain for 16 km at 2-4 km.h⁻¹ moving tactically including pausing to make observations and taking regular navigation checks.
 Point of Entry: climb over/through 1.2 m wall/window unaided.
 React to Effective Enemy Fire: assault and withdraw, conduct fire and movement over 200 m in 5-10 m bounds, zig-zag movement.
 Casualty Evacuation (CASEVAC) - One person drag under fire: sprint to casualty 15 m away then drag casualty (total weight 116.5 kg), for 15 m to a point of cover.
 CASEVAC - Fireman's carry: after removing casualty's daysack, lift with assistance a casualty weighing 107.9 kg, then fireman carry 100 m out of immediate danger area.
 CASEVAC by stretcher: in a team of 4, carry a casualty (total weight 107.9 kg) on a stretcher over difficult terrain for 1 km.
 Construct a defensive position: as part of a section, for 6 hr period construct a sangar on the second floor of a building, including lift, lift and carry sandbags.
CONCLUSION: The critical tasks of the RAF Regt have been established. The MOBP and MAS are currently being established for these tasks.

374 Board #195 May 31 9:30 AM - 11:00 AM
Identification and Verification of Critical Physically Demanding Tasks Undertaken by Royal Marines
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The first stage to develop role-related, gender-free Physical Employment Standards (PES) is to identify and describe the physically demanding tasks undertaken in a role. **Purpose:** To identify the essential physically demanding tasks undertaken by Royal Marines (RM). **Methods:** 158 male RM volunteered and data were collected in two parts. Part 1: A facilitated two-day focus group where subject matter experts (SMEs; from ranks of Private to Major) generated a list of essential physically demanding tasks undertaken in the RM role. Part 2: 149 participants (5% of each rank in the incumbent RM force) were presented the SME tasks list and identified if they had completed the task, the task importance (1-6 scale, not applicable - critical) and physical demands (1-6 scale, very light - maximum). **Results:** The focus group participants identified 23 tasks and the task completion rate, importance and physical demands were rated in the survey (Table 1).

Table 1 - RM tasks with survey data [data presented as mode (range)]

TASK DESCRIPTION	COMPLETED THE TASK? (%)	IMPORTANCE (1-6)	PHYSICAL DEMAND (1-6)
Battle Preparation – Moving Stores and Equipment	89	6 (5)	4 (5)
Establish a Company Defensive Position	89	5 (5)	5 (5)
Reconnaissance Patrol from a Harbour Area / Defensive Location	100	6 (2)	4 (6)
Establish an Observation Point (OP) Screen	81	6 (5)	5 (4)
Company Attack	96	6 (4)	5 (4)
Casualty Drag from Point of Wounding to Point of Cover	91	6 (3)	5 (5)
Casualty Evacuation – Fireman’s Carry	97	6 (4)	5 (3)
Casualty Evacuation by Light Weight Stretcher	95	6 (3)	5 (3)
Movement Through Ship With Load	79	5 (5)	4 (5)
Amphibious Transit by Small Craft	83	6 (5)	3 (5)
Re-embark an Offshore Raiding Craft from the beach	97	6 (5)	3 (5)
Vertical Assault	95	6 (5)	5 (5)
Ski March	37	5 (5)	5 (4)
Snow Shoe March	34	5 (5)	5 (3)
Ski-joring (on skis, pulled by vehicle)	30	5 (5)	4 (4)
Long Distance Insertion March	98	6 (5)	5 (5)
Boarding Operations – Surface to Vessel	41	5 (5)	4 (5)
Boarding Operations – HELO to Vessel	42	5 (5)	3 (4)
Barrel Change in a Jackal	30	6 (5)	4 (5)
Lift HMG on to Viking/ Jackal	37	5 (5)	3 (5)
River crossing	98	5 (5)	3 (5)
Ice Breaking	33	5 (5)	4 (5)
Urban Operations	98	6 (5)	4 (5)

Conclusion: The essential physically demanding tasks identified in this study can be used to select those most critical to the RM role, and underpin the development of future relevant role-related PES.

375 Board #196 May 31 9:30 AM - 11:00 AM
The Potential for Sex Bias in Physical Employment Test Design
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Physical employment tests often simulate job-related tasks. The implementation of such tests can be constrained by cost, ease, and simplicity, which may unintentionally create a sex bias. **PURPOSE:** To investigate potential sex bias in prototype UK Royal Navy (RN) physical employment tests. **METHODS:** One hundred and fifty RN personnel volunteered (men n=75, women n=75). Physical characteristics, mean ± SD were (men vs. women): age 32 ± 8 vs. 29 ± 6 years; stature 1.77 ± 0.06 vs. 1.65 ± 0.05 m; body mass 81.0 ± 10.7 vs. 67.5 ± 9.8 kg. Five tests were developed with cylindrical, sand-filled Powerbags that simulated manual handling tasks performed onboard RN warships. Tests included two variants of an Aft Casualty Carry (35.0 kg and 41.5 kg, 10 m), Fore Casualty Carry (27.0 kg, 10 m), Foam Drum Carry (2 × 21.6 kg, 60 m), and Damage Control Timber Carry (28.4 kg, 50 m). Loads and distances were derived from equipment, infrastructure, Subject Matter Expert opinion, and anthropometric norms. Tests were performed as quickly as possible. A sub-sample

of women (n=19) also performed a modified Aft Casualty Carry test using a *Barbell* (circumference 0.08 m) instead of a *Powerbag* (circumference 0.91 m). Cut-scores were developed for all tests. **RESULTS:** All men (100%) passed all tests. Compared to men the pass rates of women were above 80% in three tests (Fore Casualty Carry (88%), Foam Drum Carry (92%), Damage Control Timber Carry (89%)), but lower than 80% in both Aft Casualty Carry tests (29% 35.0 kg test; 8% 41.5 kg test). The lifting phase accounted for the majority of Aft Casualty Carry failures (49% 35.0 kg test; 77% 41.5 kg test). Within the sub-sample (n=19), 100% of women successfully lifted the *Barbell* Aft Casualty Carry loads, but markedly less lifted the same loads in the *Powerbag* version of the test (58 % and 32 % in the 35.0 kg and 41.5 kg tests, respectively). **CONCLUSIONS:** The larger circumferential girth of the *Powerbag* in the Aft Casualty Carry test was not representative of the anthropometric dimensions of a casualty, and appeared to create a sex bias against women. This highlights the potential risk of sex bias if physical employment test implementation considerations are prioritised above the faithful replication of simulated job-based tasks.

376 Board #197 May 31 9:30 AM - 11:00 AM
Fitness Trumps Gender; Next Fit Soldier Up
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The full integration of women into combat arms & relatively limited force structure demands every Soldier be a premium physical performer. **PURPOSE:** Investigate the role of fitness & gender integration of unit Soldier Performance Index (SPI) scores of a “mock” Airborne unit. **METHODS:** 71 subjects; 69 Airborne men; 26 officers (Rock LT), 43 soldiers (Rock S), 2 selected U.S. Service Academy female cadets (FC); tested on the SPI: Strength: Cadence Pull-ups {CPU}; 155-lb Bench Press {155BP}; Muscular Endurance: 65-lb BP {65BP}; 45-lb Dumbbell Squat {45SQ}; Endurance/Mobility: 2 Mile Run {2MR}; 300-Meter Forward/Backward Run (300M). APFT: (2-Min. Push-ups, Sit-ups, 2MR). Composite scores tabulated SPI scoring, age-gender scoring (APFT). Ten member mock units were created with highest Officer & different combinations of 9 highest Soldiers (HOS), 8 highest soldiers & highest female (H8F) 7 highest soldiers & 2 highest female soldiers (72F), 9 lowest male soldiers (LOS). **RESULTS:** Using SPI as true indicator of robust fitness profile, group affiliations & mean performances revealed HOS as highest physical performance. No significance was found between 3 groups (HOS, H8F, 72F), LOS group was significantly lower (p = .001) versus all 3 former groups. APFT paralleled SPI measure (p = .002). Objectively examining a multitude of physical indices, LOS achieved 78% of HOS, H8F achieved 98.5% of HOS ability & 72F achieved 96.7% HOS ability. Importantly H8F & 72F had only mean 80.7% of strength ability of HOS group. FC were only 68.4 % of SPI ability of the mean Rock LT group yet 17.6% greater ability than Rock LT group on APFT. **DISCUSSION:** Universal indicators of fitness, (i.e. SPI) are more critical to predicting performance in ground combat units than gender as a single variable. SPI indicated 2 FC were 19.1% higher than 9 LOS, however related to strength (155BP), the fit 2 FC had 0 reps compared to mean of 5.2 reps for the LOS. APFT, devoid of a strength measure, indicates FC to be 29.4% greater than LOS. **CONCLUSIONS:** In physical performance of ground combat units, SPI is more illuminative than either gender or current APFT. Integration of Airborne units should be based on an index similar to the SPI; minimally, the index should include valid measures of endurance, mobility & perhaps most importantly a strength metric.

377 Board #198 May 31 9:30 AM - 11:00 AM
Gender Differences in British Army Infantry Representative Military Task Performance
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 (No relationships reported)

British Army Infantry personnel must currently pass three Representative Military Tasks (RMTs) at the of end training: (1) A Loaded March (LM; 12.8 km, carrying 25 kg, <2 h); (2) A Jerry Can Carry (JCC; two 20 kg jerry cans for 150 m); and a Single Lift (SL; 40 kg Powerbag™ from the floor on to a 1.45 m platform). Female personnel have not previously been permitted to serve in Infantry roles in the British Army. Therefore, differences in RMT performance between serving male and female British Army personnel to an Infantry standard have not been examined. **Purpose:** To evaluate differences in RMT performance between male and female British Army personnel to an Infantry standard. **Methods:** 135 participants [48 female (age; 27 ± 5 y; body mass; 66.5 ± 8.4 kg; 2.4 km run time 11:11 ± 01:01 min:s) and 87 male (age; 25 ± 4 y; body mass; 78.8 ± 10.1 kg; 2.4 km run time 09:43 ± 00:42 min:s)] completed two sessions separated by at least 7 days. Session 1: Height, body mass, and body composition measured using dual energy X-ray absorptiometry (DXA). Participants

also completed the SL and JCC RMTs and a 2.4 km run to an individual best effort. Session 2: Participants completed a 12.8 km LM carrying 25 kg (6.4 km paced in 60 min and 6.4 km individual best effort). Participants wore a heart rate monitor during all physical tests. Differences between genders were compared using independent sample t-tests. Data are presented as the mean \pm SD and significance set at $p < 0.05$. **Results:** Compared to female participants, male participants had faster 2.4 km run times ($p < 0.01$), greater body mass ($p < 0.01$), greater total lean body mass ($p < 0.01$), higher SL scores ($p < 0.01$), achieved greater JCC distances ($p < 0.01$) and faster LM times ($p < 0.01$). All male participants and 13 % of female participants achieved the Infantry standard across all three RMTs. A greater proportion of male compared to female participants achieved the Infantry RMT standards for the SL (97 vs 15 %), Carry (99 vs. 58 %) and LM (100 vs. 83 %). **Conclusion:** Male personnel had higher RMT performance scores than females, however some women outperformed the men. The greatest gender differences in meeting Infantry RMT pass standards was for the SL. Therefore, future physical training programmes to support female personnel to meet Infantry RMT standards should focus on developing muscle strength.

378 Board #199 May 31 9:30 AM - 11:00 AM
Sex Differences in Training Load During British Army Phase One Training

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The initial weeks of British Army Phase One training are characterised by unaccustomed exercise and rapid increases in training load. Quantifying training load can aid in managing fatigue and minimising the risk of developing illness and injury whilst maximising training adaptation. Women are at increased risk of musculoskeletal injury during British Army Phase One training compared to men, however the differences in absolute external and relative internal training loads between sexes during the first few weeks of training is unknown. **PURPOSE:** Quantify the sex differences in external (distance and speed) and internal (ratings of perceived exertion [RPE] and heart rate [HR]) training loads during the first two weeks of British Army Phase One training. **METHOD:** Following completion of an initial medical assessment, 26 female (21 ± 4 yrs, 61.8 ± 8.4 kg, 1.64 ± 0.05 m, $12:29 \pm 1:01$ min 1.5 mile run time) and 24 male recruits (22 ± 4 yrs, 77.6 ± 9.7 kg, 1.78 ± 0.08 m, $10:30 \pm 1:03$ min 1.5 mile run time) were fitted with a combined HR and GPS device (Polar Team Pro, Polar Electro Oy, Finland) and monitored during waking hours (06:00 – 22:00 hrs) for the first 10 days of training. Daily self-reported RPE, muscle soreness and fatigue (all 0-10) were recorded. Independent samples t-tests were conducted to examine sex differences. **RESULTS:** Male recruits covered significantly more distance per day than female recruits (13.31 ± 0.83 km vs. 10.85 ± 0.70 km, $P < .001$) and at a greater mean speed (0.88 ± 0.05 km·h⁻¹ vs. 0.74 ± 0.03 km·h⁻¹, $P < .001$). Mean % HR reserve (%HRR) and RPE were not significantly different between men and women (%HRR: men 31 ± 3 vs. women 32 ± 4 , RPE: men 4 ± 1 vs. women 4 ± 1). However, female recruits reported significantly greater physical fatigue (men: 4 ± 1 , women: 6 ± 2 , $P < .001$) and muscle soreness (men: 4 ± 1 , women: 5 ± 2 , $P < .05$). **CONCLUSION:** Despite a lower absolute external training load and similar internal training loads, women reported greater fatigue and muscle soreness, which could be linked to a higher injury risk. Future work should examine the links between fatigue and muscle soreness with injury risk during the first few weeks of initial military training.

This research has been sponsored by the UK MOD (Army).

379 Board #200 May 31 9:30 AM - 11:00 AM
Diurnal Pattern of Salivary C-Reactive Protein and Associations with Biobehavioral Correlates in Military Men

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C-reactive protein (CRP), a systemic inflammatory biomarker, is positively associated with the development of disease and inversely correlated with regular physical activity. CRP has been previously reported to have a diurnal rhythm with higher levels upon awakening and lower levels thereafter.

PURPOSE: To characterize the pattern of salivary CRP and evaluate associations with sedentary and active behaviors in U.S. Navy men. **METHODS:** Healthy, active duty men ($n = 17$; mean \pm SD age = 36.1 ± 6.0 yr) self-collected samples in a free-living setting using oral swabs on 2 consecutive workdays at Wake, Wake + 30 min, Wake + 60 min, 1600, and 2100 for a total of 10 samples. Following our prior published study, CRP variables and summary parameters were computed. Stability across both days was evaluated via Pearson product-moment correlational analyses. Stable measures

were then correlated to self-reported percent time (%time) spent sedentary, or active, in a typical workday for the previous week. Three non-responders, defined as having an absolute reactivity (AR) > 0 , were excluded from analyses. **RESULTS:** Stability was high between both days at all time points (r value range = $.75-.92$, all $p \leq .001$). CRP was highest at Wake, decreased on average by $42.8 \pm 5.7\%$ at Wake + 30, and then plateaued for the rest of the day. The stabilities of Wake mean ($r = .89$, $p < .001$) and AR [(Wake + 30) - Wake], a measure of CRP pattern ($r = .48$, $p = .053$), were determined. Mean \pm SE of Wake mean was $12,460 \pm 3968$ pg/mL and AR was -8298 ± 3123 pg/mL. Wake mean was strongly associated with %time walking ($r = -.57$, $p < .01$). Wake mean also showed an intuitive yet nonsignificant positive association with %time sitting, and a negative association with both %time standing and %time performing heavy labor. Hypothesized associations between %time and AR were not performed due to the borderline stability of AR. **CONCLUSIONS:** In a military population, the salivary CRP pattern was described as diurnal with robust stability across 2 consecutive days. The negative correlation between Wake mean and %time walking suggests that walking is a powerful modality to reduce systemic inflammation. Subsequent analyses will comprehensively characterize the CRP pattern (area under the curve and other summary parameters) and evaluate additional biobehavioral correlates.

380 Board #201 May 31 9:30 AM - 11:00 AM
The “Yin and Yang” of the Adrenal and Gonadal Systems in Elite Military Men

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 (No relationships reported)

We recently established daily, free-living profiles of the adrenal hormone cortisol (Cort), the (primarily adrenal) anabolic precursor dehydroepiandrosterone (DHEA), and the (primarily gonadal) anabolic hormone testosterone (Testo) in elite military men. A prevailing view is that adrenal and gonadal systems reciprocally modulate each other; however, recent paradigm shifts prompted the characterization of these systems as parallel, cooperative processes (i.e., the “positive coupling” hypothesis). **PURPOSE:** To test the positive coupling hypothesis in elite military men by evaluating associations between adrenal and gonadal biomarkers across the day. **METHODS:** Fifty-seven healthy, active duty men (mean \pm SE age = 33.4 ± 1.0 yr) self-collected salivary hormone samples in a nondeployed, free-living setting on two consecutive midweek workdays upon waking, +30 min, +60 min, 1600, and 2100 (10 samples total). Hypotheses were tested using correlational and linear regression models. **RESULTS:** DHEA was positively coupled with Cort (r range: $0.28 - 0.30$, all $p < .05$) as was Testo (r range: $0.43 - 0.59$, all $p < .01$). Anabolic processes (i.e., DHEA, Testo) were also positively and reliably coupled across the day (r range: $0.31 - 0.39$, all $p < .05$). In multivariate models, DHEA and Cort combined to account for 27 - 43% variance in Testo across the day, which was driven primarily by DHEA. DHEA and Testo modestly and less robustly predicted Cort concentrations; this was confined to the morning (area under the curve, ground $F(3,51) = 2.9$, $p < .05$), and Testo was the primary predictor ($\beta = 0.38$, $p < .05$). **CONCLUSION:** To our knowledge, this is an unprecedented test of the positive coupling hypothesis in elite military men, a group at an elevated risk for chronic stress exposure. This study showed that adrenal and gonadal systems were positively coupled. Altogether, top-down co-activation of adrenal and gonadal hormone secretion may complement bottom-up counter-regulatory functions to foster anabolic balance and neuronal survival; hence, the “yin and yang” of adrenal and gonadal systems. This may be an adaptive process that is amplified by stress, competition, and/or dominance hierarchy.

381 Board #202 May 31 9:30 AM - 11:00 AM
Vitamin D Supplementation Augments SigA Secretion Rates in Marine Corps Basic Trainees

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 (No relationships reported)

BACKGROUND: Vitamin D has been implicated in modulating innate immunity and may confer protection against upper respiratory tract infections (URTIs) during periods of arduous training. **PURPOSE:** Determine whether vitamin D status in Marine Corps basic training recruits is associated with URTIs, and whether daily vitamin D supplementation decreases the incidence of URTIs as a result of augmented innate immunity. **METHODS:** A double-blind RCT was conducted with male and female recruits entering Marine Corps basic training. Subjects were randomized to

either 1000 IU vitamin D₃-d¹ (n=73) or placebo (n=76) for 12-weeks. At baseline, weeks 4, 8 and 12 (post-training) subjects provided saliva samples (passive drool) to determine secretory immunoglobulin A secretion rates (SIgA-SR) by indirect ELISA. The incidence of URTIs was assessed by administering a survey at weeks 4, 8 and 12. Serum vitamin D status (25(OH)D) was measured by radioimmunoassay. Longitudinal linear models were created using a simple-effects model to estimate symptoms. To determine whether supplementation altered SIgA-SR during training, a two-way repeated measures ANOVA was used. **RESULTS:** The proportion of recruits reporting URTI symptoms at any time during training was 72%. Baseline SIgA-SR were similar between placebo (65.4 ± 52.0 µg·min⁻¹) and vitamin D groups (51.9 ± 41.9 µg·min⁻¹). The relative changes in SIgA-SR were significantly greater with vitamin D supplementation at weeks 4 (5.1 ± 29.8%) and 8 (12.3 ± 31.0%) compared to placebo at the same time points (week 4; -6.5 ± 22.9% and week 8; 1.3 ± 22.9%), *p* = 0.001. Baseline 25(OH)D was significantly lower during winter (59.2 ± 22.5 nmol·L⁻¹) compared to summer (80.4 ± 21.0 nmol·L⁻¹), *p* < 0.001. When accounting for treatment, season and sex, there was no association between 25(OH)D and reported URTIs. **CONCLUSION:** We report that a high proportion of Marine Corps recruits experience URTIs during 12-weeks of basic military training, and although daily vitamin D supplementation led to a modest increase in SIgA-SR, this did not result in a reduction in the incidence of reported URTIs. Supported by the Defense Health Program. The views expressed are those of the authors and do not reflect the official position of the Uniformed Services University, United States Army, or United States Department of Defense.

A-50 Free Communication/Poster - Muscle and Mitochondria

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

382 Board #203 May 31 11:00 AM - 12:30 PM Alterations of Mitochondrial Dynamics Proteins in Primary Human Myotubes Following Roux-en-Y Gastric Bypass Surgery

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Mitochondrial dynamics including mitochondrial fission (e.g., Dynamin-related protein 1 (Drp1) and Fission 1 (Fis1)) and fusion (e.g., Mitofusin 2) regulates mitochondrial homeostasis. Defects in mitochondrial dynamics are suggested to contribute to skeletal muscle mitochondrial dysfunction and insulin resistance associated with obesity and Type 2 Diabetes. Roux-en-Y gastric bypass (RYGB) surgery markedly improves metabolic health as indicated by enhanced substrate oxidation and insulin action in skeletal muscle. However, the underlying cellular mechanisms responsible for these improvements are not clear and could possibly be due to the improvement of mitochondrial dynamics. **PURPOSE:** The purpose of this study was to determine whether RYGB surgery improves mitochondrial dynamics proteins in primary human myotubes derived from severely obese humans. **METHODS:** Primary human skeletal muscle cells were isolated from muscle biopsies obtained from six lean subjects (BMI = 23.4 ± 0.6 kg/m²) and six RYGB patients prior to, 1-month and 7-months after surgery (BMI = 50.2 ± 2.0, 43.2 ± 2.8 and 35.7 ± 2.2 kg/m², respectively) and were differentiated to myotubes. On day 7 of differentiation, myotubes were harvested for immunoblot analysis in order to assess the expressions of mitochondrial dynamics proteins. **RESULTS:** Before surgery, Drp1 Ser⁶¹⁶ phosphorylation and Fis1 protein expression were significantly higher in primary myotubes derived from severely obese patients when compared to lean controls (41% and 26%, respectively, *P* < 0.05). While there were no significant improvements at 1-month post-surgery, Drp1 Ser⁶¹⁶ phosphorylation and Fis1 protein expression were significantly decreased in primary myotubes from severely obese humans at 7-months post-surgery (Pre vs. 7-months post: 0.046 ± 0.004 vs. 0.035 ± 0.003; 0.023 ± 0.008 vs. 0.014 ± 0.003 AU; respectively, *P* < 0.05), and not statistically different from lean controls. However, MFN2 protein expression did not change in primary myotubes derived from severely obese patients at any timepoint post-surgery in comparison to pre-surgery. **CONCLUSION:** These data suggest that RYGB surgery reduces obesity-induced rise in mitochondrial fission, but not fusion, protein expression in primary human myotubes derived from severely obese humans.

383 Board #204 May 31 11:00 AM - 12:30 PM Osteocalcin Does Not Increase Insulin Sensitivity or Mitochondrial Biogenesis in Palmitate Treated C2C12 Myotubes

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PURPOSE: Osteocalcin (OC) is a bone matrix protein that has been shown to regulate systemic glucose homeostasis and increase mitochondrial mass in mice fed a high-fat diet, however the mechanisms by which OC stimulates metabolic adaptations in lipid overloaded muscle remain underexplored. This study examined the effects of OC on regulators of insulin signaling, glucose handling, and mitochondrial biogenesis *in vitro* using palmitate treated C2C12 myotubes.

METHODS: C2C12 myotubes were treated with control media, or media containing undercarboxylated OC (100ng/ml) both with and without 2mM palmitate-BSA conjugate (PA+OC and PA, respectively) for 24 hours. Insulin signaling (IRS-1, pIRS-1, Akt, pAkt, and PTP1B), glucose handling (GLUT-4 and AS160) and mitochondrial biogenesis (PGC-1 α and Citrate Synthase) were measured via western blot. One-way ANOVAs with Tukey's post-hoc tests performed to determine between treatment differences.

RESULTS: IRS phosphorylation and PTP1B protein content remained unchanged. Surprisingly, phosphorylation of Akt significantly increased (52% ± 33%) with PA+OC compared to OC. Additionally, GLUT4 content decreased significantly in all treatments (≥50%) compared to control with no differences between the treatments. GLUT4 regulator AS160 was significantly elevated (300% ± 158%) following PA+OC compared to OC. No changes in PGC-1 α or Citrate Synthase protein content were observed.

CONCLUSIONS: Overall, treatment with OC was unable to improve markers of insulin signaling and mitochondrial biogenesis in palmitate-treated C2C12 myotubes. Moreover, GLUT4 content and possibly translocation may be negatively affected by OC treatment in PA-treated cells.

384 Board #205 May 31 11:00 AM - 12:30 PM MKP-5 Establishes Skeletal Muscle Metabolic Quiescence by Negatively Regulating MAPK-dependent Mitochondrial Function

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Purpose: The mitogen-activated protein kinases (MAPKs) represent a central signaling pathway in the regulation of skeletal muscle function. It is also known that MAPKs are required to promote mitochondrial biogenesis in skeletal muscles. Mitochondrial dysfunction underlies numerous diseases including those of skeletal muscle. The MAPKs are negatively regulated by MAPK phosphatases (MKPs). We have demonstrated that MKP-5 regulates regenerative myogenesis and rescues muscle degeneration by inactivating and dephosphorylating both p38 MAPK and JNK. However, the physiological and molecular roles of MKP-5 in regenerative myogenesis and progression of skeletal muscle degeneration have remained unclear. We tested the central hypothesis that MKP-5 regulates mitochondrial function and thus contributes to enhanced myogenesis and regeneration in mice lacking MKP-5. **Methods:** To test our hypothesis, we induced skeletal muscle damage by cardiotoxin (CTX) injection into both *mkp-5^{+/+}* and *mkp-5^{-/-}* mice. Mitochondrial respiratory function in permeabilized muscle fibers was assessed in regenerating skeletal muscles from *mkp-5^{+/+}* and *mkp-5^{-/-}* mice. Mitochondrial biogenesis was determined by quantitative PCR for mRNA. The amount of mitochondrial DNA (mtDNA) copy number was also quantified by qRT-PCR. **Results:** Our data show that MKP-5-deficient mice exhibited 49% enhanced ADP-stimulated mitochondrial respiratory function in regenerative skeletal muscle compared with *mkp-5^{+/+}* mice (*P* < 0.05). Furthermore, expression of genes associated with mitochondrial biogenesis such as PGC1- α , NRF-1, Tfam, and subunits of complex I were significantly increased in regenerating skeletal muscles of animals lacking MKP-5. The amount of mitochondrial DNA copy number was also significantly increased in *mkp-5^{-/-}* mice, compared with *mkp-5^{+/+}* mice (*P* < 0.001). **Conclusions:** Collectively, these results demonstrate that MKP-5 negatively regulates mitochondrial function and biogenesis in skeletal muscle during myogenesis and regeneration.

385 Board #206 May 31 11:00 AM - 12:30 PM
Mitochondria Content In Rat Ankle Extensor Muscles Following Chronic Endurance Exercise

Peter Christopher, Joseph W. Starnes, FACSM, Douglas J. Oberlin, Mariel Fecych, Coleman Murray, Lauren Vervaecke, Anthony Bocchine, J Lee Beverly. *University of North Carolina at Greensboro, Greensboro, NC.* (Sponsor: Joseph W. Starnes, FACSM)

(No relationships reported)

Endurance exercise studies involving animals typically measure muscle mitochondria content to verify intensity of training. Most use one of the three calf ankle extensor muscles, which vary in fiber type. The soleus is all slow twitch fibers (SO) while the plantaris and gastrocnemius are a mixture of fast twitch glycolytic (FG) and fast oxidative glycolytic (FOG) fibers. **PURPOSE:** To compare mitochondria content changes in the soleus, plantaris, and gastrocnemius in response to a widely used moderate intensity exercise program. **METHODS:** Male, 8-wk-old, Sprague-Dawley rats were divided into two groups: sedentary (S) and exercised (E) on a treadmill 5 d/wk for 6 wks. Exercise duration and intensity were progressively increased to 1 hr at 30 m/min up a 10.5% incline (75-80% VO_2max). Whole muscles plus specific FG and FOG regions of gastrocnemius were homogenized (9-10 for each muscle or fiber type) and cytochrome *c* oxidase activity, a marker of mitochondria content, was determined using a Clark-type oxygen electrode. **RESULTS:** E significantly increased cytochrome *c* oxidase compared to the same S muscle ($P<0.05$) and the amount of increase was similar for all muscles ($P>0.05$). On a relative basis (% above mean S value), the increases were 60.7 ± 13.3 (mean \pm standard error) in soleus, 72.3 ± 6.8 in plantaris, and 78.7 ± 12.4 in gastrocnemius. On an absolute basis ($\mu\text{Mol O}_2$ consumed/min/gram muscle), the increases were 28.5 ± 6.3 in soleus, 35.0 ± 3.3 in plantaris, and 25.7 ± 3.8 in gastrocnemius. E was also greater than S in all fiber types considered ($P<0.05$), but there were considerable differences in the amount of increase. On a relative basis (%), the increase in FOG fibers (115.5 ± 17.0) was significantly greater ($P<0.05$) than those in SO (60.7 ± 13.3) or FG (42.8 ± 12.0). On an absolute basis, all fibers differed from each other with FOG increasing the most and FG the least ($P<0.05$). Specifically, FOG increased by 53.4 ± 7.9 , SO by 28.5 ± 6.3 , and FG by only 5.1 ± 1.4 . **CONCLUSION:** All three whole muscles increase by similar amounts in response to a moderate intensity (75-80% VO_2max) exercise program, thus all are appropriate for verifying training status. Caution is advised when using small portions of plantaris and gastrocnemius because of differences in responses of FOG and FG fibers.

Supported by UNCG School of HHS Research Excellence Grant

386 Board #207 May 31 11:00 AM - 12:30 PM
Myokine/Cardiokine Follistatin-like Protein 1 Promotes Oxidative MyHC Expression and Mitochondrial Function in Myogenic Cells

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(No relationships reported)

Myokine/Cardiokine Follistatin-like Protein 1 Promotes Oxidative MyHC Expression and Mitochondrial Function in Myogenic Cells

Follistatin-like Protein 1 (FSTL1) is a glycoprotein secreted by cardiac and skeletal muscle tissues under stressful conditions. An elevated level of plasma FSTL1 has been observed after a single bout of exercise suggesting its potential myokine-like role involved in the crosstalk between muscle and other organs. **PURPOSE:** To investigate autocrine effects of FSTL1 on myotube differentiation, myosin heavy chain expression and mitochondrial respiration in various myogenic cells. **METHODS:** Primary myoblasts were isolated from canine gastrocnemius muscle. Myotube differentiation was induced by a low serum condition for 4 days. Immunostainings were performed using MF20 antibody (rod-like tail region of myosin) and DAPI (nuclei); and fusion index was determined by calculating the ratio between total number of nuclei and number of nuclei within myotubes formed. RT-PCR assays were performed using primer sets precisely designed to amplify each fiber type-associated myosin heavy chain isoforms. Oxygen consumption of intact cells were measured using a Clark-type oxygen sensor; and mitochondrial respiration was measured using Seahorse XF96 analyzer. **RESULTS:** During canine myotube formation, FSTL1 treatment (300 ng/ml, 4 days) significantly enhanced myogenic potential determined by fusion index (~2-fold increase). There was a significant increase in MyHC7 expression (~1.5 fold) in myotubes treated with FSTL1 during differentiation compared to non-treated myotubes. Acute FSTL1 treatment (up to 500 ng/ml) had no significant effect on mitochondrial respiration in canine myoblasts. Acute FSTL1 treatments (250 ng/ml) significantly increased mitochondrial respiration in L6 myotubes (~1.5 fold) and human rhabdomyosarcoma cells. Chronic FSTL1 treatments (250 ng/ml, 64 hours) significantly increased oxygen consumption in intact canine myoblasts and myotubes. **CONCLUSION:** Our preliminary data suggest that FSTL1 enhances differentiation

potential and increases oxidative metabolism in myogenic cells suggesting that FSTL1 may be an important cellular mediator of the beneficial effects of exercise in the context of skeletal muscle adaptation.

Supported by NIH Grant RO1 HL133248

387 Board #208 May 31 11:00 AM - 12:30 PM
Exercise Preconditioning Improves Mitochondrial Morphology and Function in Rat Loubus Fromatis after Heavy Exercise

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(No relationships reported)

Our previous work has demonstrated that exercise preconditioning can ameliorate the apoptosis in Loubus Fromatis of rats induced by one-time heavy exercise.

PURPOSE: To investigate whether exercise preconditioning affects the morphology and function of mitochondria by influencing the expression of dynamin-related protein 1(Drp1) and mitofusin 2(Mfn2) in rat loubus fromatis following an acute heavy load exercise.

METHODS: Thirty-six male Sprague-Dawley rats were randomly assigned into a control group (C, n=12), an exercise group (E, n=12) and an exercise preconditioning group (EP, n=12). Groups C and E received conventional feeding for four weeks, and then group E completed a one-time heavy load swimming exercise; group EP received feeding and swimming training for four weeks, 60 min/day, 6 days/week, and also completed a one-time heavy load swimming. Some indicators were detected, such as the apoptosis index (AI), the mRNA of Drp1 and Mfn2, index related to the function of mitochondrial respiratory chain (ATP, ADP/O, V3, V4, RCR, OPR). The experimental data are reported as mean \pm SE, and *P* values<0.05 were considered significant.

RESULTS: According to the TUNEL test, the apoptosis index (AI) (C:0.06 \pm 0.01; EP:0.58 \pm 0.17; E:0.89 \pm 0.16; respectively, $P<0.05$) were significantly elevated after heavy load exercise, mRNA of Mfn2 (C:0.25 \pm 0.09; E:0.95 \pm 0.08; EP:1.24 \pm 0.07; respectively, $P<0.05$) and Drp1 (C:0.34 \pm 0.08; EP:1.23 \pm 0.14; E:1.35 \pm 0.07; respectively, $P<0.05$) were also increased. However, the ATP content, ADP/O, RCR, V3 and OPR of the loubus fromatis were significantly lower in group E and EP than C ($P<0.05$), and those index in Group EP were higher than Group E ($P<0.05$) indicates that the function of mitochondrial respiratory chain in Group EP are better after carrying out an acute heavy load exercise.

CONCLUSIONS: Results from this study suggest that one-time heavy load swimming can induce cell apoptosis in rat loubus fromatis by increasing the expression of Drp1.

Four weeks of exercise preconditioning can ameliorate the apoptosis and the function of mitochondrion via increasing the expression of Mfn2.

Supported by the SML of General Administration of Sport of China/SML of Sichuan province Foundation.

A-51 Free Communication/Poster - Nutrition and Athletes

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM

Room: Hall F

388 Board #209 May 31 11:00 AM - 12:30 PM
Energy Balance During A Self-sufficient, Multistage Ultramarathon: a Case Study

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(No relationships reported)

For optimal performance, endurance athletes are recommended to ingest sufficient energy to maintain energy balance (EB) and ensure adequate energy availability (EA).

PURPOSE: Describe and evaluate the EB of an athlete competing in a self-sufficient, multistage ultra-marathon (SSMU). **METHODS:** A male endurance athlete (Age 35 yrs; Ht 183.0 cm; Body mass 78.4 kg; VO_2max 66 ml/kg/min) volunteered to take part in this observational case study prior to competing in the Marathon des Sables 2016. The participant self-reported energy intake (EI) by reviewing his dietary plan after each of the five competitive event stages. The food diary was used to calculate energy and macronutrient intake using dietary analysis software. Basal metabolic rate (BMR) was estimated prior to the MdS based on fat free mass. Distance and moving speed were recorded using a GPS device (Garmin Forerunner 920XT) throughout the race. Exercise energy expenditure (EEE) was calculated using the GPS device algorithm. Total energy expenditure (TEE) was calculated by adding the participant's RMR to

the recorded EEE. EB was calculated by subtracting IE from TEE. EA was calculated as follows: EI - EE / fat free body mass. RESULTS: Mean daily EI was 2946 ± 358 kcal (38 ± 4.6 kcal/kgBM/day). Mean daily EEE was 3006 ± 1030 kcal (62 ± 13 kcal/kgBM/day). This resulted in a total energy deficit of 9609 kcal with a mean daily energy deficit of 1922 ± 952 kcal/day. Mean EA was -0.97 ± 15.4 kcal/kg/FFM/d. The participant did not report any subjective feelings of hunger at any point during the event. CONCLUSIONS: The athlete was unable to consume enough food/fluid to meet estimated energy requirements during all five days of the SSUM, resulting in sub optimal EA and EB throughout the event. Relying on subjective perception of hunger to modulate energy intake is not an effective strategy during a SSUM. Athletes competing in a SSUM are likely to benefit from a strategic diet plan to minimise daily energy deficit and maximise performance.

389 Board #210 May 31 11:00 AM - 12:30 PM
Nutrition Education Improves Nutrition Knowledge, Not Dietary Habits In Female Collegiate Distance Runners

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 (No relationships reported)

BACKGROUND. In order to meet the physical demands of training for and competing in sports, athletes need to fuel their body adequately on a daily basis. Previous research, however, has indicated that the dietary habits of athletes are often insufficient regarding total energy and carbohydrate intake. Furthermore, athletes often do not know what or how much food they should eat in order to meet the nutritional demands of their sport. **PURPOSE.** The purpose of this study was to assess the effect that nutrition education focusing on total energy, carbohydrate, fat, and protein requirements has on the nutrition knowledge and dietary intake of female collegiate distance runners. **METHODS.** Eleven female collegiate Division II cross-country runners (age: 19.4 ± 1.1 years, mass: 56.65 ± 4.90 kg, height: 163.50 ± 5.22 cm) completed a nutrition knowledge for athletes survey consisting of 10 background information questions and 76 true/false statements and recorded a 3-day diet record prior to the start of the intervention. Participants were then presented with four 1-hour nutrition education sessions covering energy balance, carbohydrates, proteins, fats, and hydration. After the nutrition education intervention, participants completed the same nutrition knowledge survey and 3-day diet record. **RESULTS.** The nutrition education sessions increased (P<0.05) the participants' correct answers on the nutrition knowledge survey regarding dietary carbohydrate (45.5 ± 24.5% vs. 68.2 ± 29.8%), fat (57.6 ± 21.6% vs. 72.7 ± 20.1%) and protein (76.6 ± 9.6% vs. 93.5 ± 9.8%) intake (for pre vs. post, respectively). Although the participants were not meeting recommendations regarding total energy and carbohydrate intake before the nutrition education sessions, there were no changes in dietary composition following the nutrition education sessions. **CONCLUSION.** The present data are in agreement with previous findings indicating that enhanced nutrition knowledge does not always translate to enhanced dietary practices, even when improved dietary practices could result in improved sports performance.

390 Board #211 May 31 11:00 AM - 12:30 PM
In Race Nutritional Strategies Comparing Ironman Wisconsin Athletes to Ironman World Championship Athletes

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PURPOSE: The purpose of the current investigation was to compare the nutritional plans of Ironman Wisconsin athletes to elite Ironman World Championship athletes and to determine if differences exist between the two groups. **METHODS:** Athletes competing in Ironman triathlons were surveyed at Ironman Wisconsin (N=73) and the Ironman World Championships (N=79) to determine their in-race nutrition plans. Unpaired t-tests were run to examine the differences in overall finish time, calories consumed per hour on the bike, fluid consumed while biking, and caffeine consumption during the biking portion of the race. **RESULTS:** Athletes participating at the Ironman World Championships consumed significantly more (p < .01) calories per hour on the bike compared to Wisconsin Ironman athletes (299.9 kcal +/- 126.6; 239.5 kcal +/- 130.5, respectively). Ironman World Championships athletes consumed significantly (p < .01) more fluid on the bike compared to Wisconsin Ironman athletes (3827 mLs +/- 1693; 3327 mLs +/- 1874, respectively). Ironman World Championship athletes consumed significantly more (p < .01) caffeine while biking in comparison to Ironman Wisconsin athletes (110.7 mg +/- 172; 65.9 mg +/- 100.8, respectively). **CONCLUSIONS:** Ironman World Championships athletes consumed higher amounts of calories per hour, fluid, and caffeine during the bike in comparison to the Ironman

Wisconsin athletes. This suggests that elite Ironman athletes consume more calories, caffeine, and fluids during their races when compared to average Ironman athletes, and hence increased calorie and caffeine consumption may contribute to faster performances for the elite athletes.

391 Board #212 May 31 11:00 AM - 12:30 PM
Vitamin D Awareness and Intake in Collegiate Athletes

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Approximately 56% of athletes worldwide are vitamin D deficient which may negatively influence health and physical performance. Lack of knowledge about the importance of vitamin D may be contributing to the high prevalence of deficiency. **PURPOSE:** To assess vitamin D awareness in NCAA athletes and examine its association with total dietary vitamin D intake. **METHODS:** 52 women (mean ± SD: age = 20.0 ± 1.5 yr, 4 cross country, 4 golf, 8 hockey, 14 soccer, 6 softball, 8 swim and dive, 6 track and field, 2 tennis) and 29 men (age = 22.1 ± 1.9 yr, 4 baseball, 3 cross country, 9 football, 1 swim and dive, 7 track and field, 5 tennis) competing at the University of North Dakota completed an online survey between November 1, 2015 and January 30, 2016. Vitamin D awareness was assessed using five vitamin D-specific questions related to the following: 1) familiarity with vitamin; 2) concern about levels; 3) risk of deficiency; 4) importance for health; and 5) importance for physical performance. Responses were scored using a 5-point Likert Scale. Total dietary vitamin D intake was assessed using the vitamin D-specific Diet and Lifestyle Questionnaire. Spearman's rank order correlation coefficients were used to evaluate the association between Likert scores for each awareness question and total dietary vitamin D intake. **RESULTS:** Overall, 21% of athletes reported "rarely" hearing anything about vitamin D. The majority of athletes responded that vitamin D "probably" or "definitely" will play a role in their health (88.9%) and physical performance (71.6%). However, only 23.4% and 28.4% of athletes reported concern for their vitamin D levels or believed they were at risk for deficiency, respectively. The RDA for vitamin D was met by 30% of women and 62% of men. Familiarity with vitamin D in women (r = 0.33, p = 0.02) and concern about vitamin D levels in men (r = 0.45, p = 0.02) were positively associated with total dietary vitamin D intake. **CONCLUSIONS:** The majority of collegiate athletes believed vitamin D plays a role in their health and physical performance; however, most expressed low concern for their vitamin D levels. Increased familiarity with vitamin D and concern for vitamin D levels were associated with increased total intake of vitamin D, and thus, interventions addressing these factors could reduce the prevalence of vitamin D deficiency in athletes.

392 Board #213 May 31 11:00 AM - 12:30 PM
Food Servings Habitually Ingested By Mexican Varsity Athletes Depending On The Type Of Sport

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 (No relationships reported)

Several studies have reported the macronutrient intake in different types of sports, however, the type and amount of food that is needed for achieve these quantities is not commonly reported. **PURPOSE:** To describe the habitual amount of food servings ingested in varsity athletes depending on the type of sport performed. **METHODS:** 365 varsity athletes were polled. They were asked about their habitual food intake by trained nutritionists using a food frequency questionnaire. This includes 75 common local foods divided in 9 food groups (Table 1). Each athlete described how many days per week he/she usually ate each food and the usual amount they consume in those days. Then the servings' amount were calculated for each food weekly and a total weekly servings per food group as a daily average was calculated. Servings' size were determined according to the Mexican System for Equivalent Foods. The sample was divided by the type of sport as team (soccer, basketball, baseball, volleyball, handball, n= 184) or individual (weightlifting, tennis, athletics, wrestling, gymnastics, karate, taekwon-do, judo, n=181). For each group, the servings' amount were analyzed as quartiles. **RESULTS:** Analyzing the 50th centile, cereals were the most consumed food group, followed by animal source foods (ASF) and fats. Legumes were the less consumed food group (50th centile: 0 servings; 75th centile: 1 serving) and wasn't included in the table. Foods had a very similar amount of servings per group per type of sport.

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CONCLUSIONS: In our population, the amount of food servings commonly ingested by varsity athletes were very similar between these two types of sport classification. These data could help as a reference for comparing the habitual amount of food serving's ingested (25th to 75th centile) in different types of sports.

Table 1. Amount of food servings ingested per type of sport.

Food group	Quartile					
	25th		50th		75th	
	Team	Individual	Team	Individual	Team	Individual
Cereals	8	9	10	13	16	16
ASF	5	6	7	8	10	12
Fats	4	4	6	7	9	10
Fruits	3	3	5	5	8	8
Dairy	2	2	3	4	5	5
Veggies	2	2	3	3	4	4
Sugars	2	2	3	3	5	5
Seeds	0	0	1	1	2	2

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Amount Of Food Servings By Food Group Commonly Ingested In Mexican Varsity Athletes

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There is huge evidence regarding the macronutrient intake in athletes, however there is little research about the food groups and amount of food servings ingested by athletes. **PURPOSE:** To describe the habitual amount of food servings by food group ingested in male and female varsity athletes.

METHODS: 365 (206 males, 159 females) varsity athletes were evaluated anthropometrically and for dietary habits. They were asked about their habitual food intake by trained nutritionists using a food frequency questionnaire, which includes 75 common local foods divided in 9 food groups (Table 1). Each athlete described how many days per week he/she usually ate each food and the usual amount they consumed on those days. The servings' amount were calculated for each food weekly as a total weekly servings per food group, finally a daily average was calculated. Servings' size were determined according to Mexican System for Equivalent Foods. The sample was divided by sex and then the servings were calculated as quartiles.

RESULTS: Subjects' age, body weight and stature were 21 ±2 and 21 ±2 years old, 76 ±15 and 61 ±11 kg, 177 ±7 and 163 ±7 cm, for males and females respectively. Considering the 50th centile, the most ingested food groups were cereals, animal source foods (ASF) and fats. The less consumed food group was legumes (its quartile analysis revealed 0 serving/day at the 50th centile and 1 servings at 75th centile). Veggies group were repetitive in centile 25th and 50th in male athletes.

CONCLUSIONS: Male and female varsity athletes had the same pattern of food intake, but in different amount. Further research is needed for assessing if these servings are enough to achieve the macronutrient daily needs.

Table 1. Amount of food servings habitually ingested by male and female varsity athletes.

Food group	Quartile					
	25		50		75	
	Males	Females	Males	Females	Males	Females
Cereals	10	7	14	9	19	12
ASF	6	5	9	6	12	9
Fats	4	4	7	6	9	10
Fruits	3	3	6	4	8	7
Dairy	2.5	2	4	3	6	4
Sugar	2	2	4	3	6	4
Veggies	2	2	2	3	4	4
Seeds	0	0	1	1	2	2

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Dietary Characteristics In Medalist Versus No Medalist Varsity Combat Ahtletes

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 (No relationships reported)

Nutrition is an important factor for achieving sports success. Some dietary characteristics could lead to sporting advantage. Therefore, analyzing the dietary characteristics of successful athletes could help to better understand their nutritional practices that lead them to an advantage over their competitors.

PURPOSE: To compare the dietary characteristics between medalist and non-medalist varsity combat athletes.

METHODS: The nutritional characteristics of 58 varsity combat (wrestling, judo, karate, tae-kwon-do) athletes were evaluated one month before a national collegiate sport tournament. After the tournament, subjects were classified as medalist if they earned a medal (first four places, n=28) or non-medalist (n=30). Their dietary characteristics were evaluated with a 24-h dietary recall applied by trained nutritionists. These characteristics were daily food servings, energy and macronutrient intake (g/day and g/kg/day). All variables are expressed as median and interquartile range. Dietary characteristics were compared between groups by U Mann-Whitney test.

RESULTS: For food groups, medalist athletes ingested lower amounts of dairy and fats than non-medalist. Similarly, total fat intake (g/day) were lower in medalist. The relative macronutrient intake (g/kg/day) was significantly lower for fat (1.3 [1.0-1.7] vs 1.8 [1.4-2.0], p=0.003) but not for protein (1.8 [1.5-2.6] vs 2.0 [1.8-3.0], p=0.07) nor carbohydrates (6.0 [3.8-7.5] vs 6.6 [4.7-8.7], p=0.11) in medalist vs non-medalist, respectively. Despite didn't reached statistical significance, sugars' servings, energy intake, and relative protein intake tended to be lower in medalist group.

CONCLUSIONS: In this study, medalist athletes tended to ingest less food groups (dairy, fats, sugars), energy, fat and relative protein one month before an important competition. Perhaps because they were trying to keep their competition weight as controlled as possible in this lapse.

Table 1. Daily dietary characteristics for medalist and non-medalist varsity combat athletes.

	Medalist [Median (interquartile range)]	Non-medalist [Median (interquartile range)]	p-value
Animal source foods (servings)	8.5 (6.0-10.5)	8.5 (6.4-12.5)	0.46
Dairy (servings)	3.5 (2.5-5.0)	5.0 (3.0-6.0)	0.05
Legumes (servings)	0.5 (1.0-1.5)	1.0 (0.6-1.5)	0.71
Cereals (servings)	12.0 (8.5-16.0)	12.8 (10.8-20.0)	0.18
Veggies (servings)	3.0 (1.5-4.5)	2.0 (1.3-3.8)	0.31
Seeds (servings)	1.0 (0.5-1.5)	1.0 (0.4-2.5)	0.54
Fats (servings)	4.5 (2.5-9.5)	7.7 (5.0-12.0)	0.04
Fruits (servings)	5.0 (3.0-8.5)	5.5 (3.5-9.9)	0.36
Sugars (servings)	3.0 (1.5-6.0)	3.7 (2.7-6.3)	0.09
Energy (Kcal)	2891 (1998-3741)	3360 (2592-5050)	0.08
Protein (g)	137 (103-168)	151 (122-206)	0.12
Fat (g)	82 (62-123)	113 (92-158)	0.01
Carbohydrates (g)	396 (231-493)	389 (314-670)	0.25

395 Board #216 May 31 11:00 AM - 12:30 PM
Body Composition and Performance Capabilities Based on Level of Protein Intake in Collegiate Female Dancers

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 (No relationships reported)

The aesthetic nature of dance places pressure on dancers to have low body weight and fat, which often leads to disordered eating. Despite data showing higher protein intake improving body composition in numerous populations, a paucity of data exists on dancers. **PURPOSE:** To examine associations between protein intake, body

composition and performance among dancers. **METHODS:** Female dancers ($n = 25$; age 20.7 ± 1.8 years; mean \pm SD) were recruited to complete a 3-day food log, body composition analysis (DXA), and performance testing for muscular endurance, power and strength. Protein was expressed as g/kg/day and three equal groups were created (Low protein: LP, <1.2 g/kg/day; Moderate protein: MP, 1.2 - 1.6 g/kg/day; High protein: HP, >1.6 g/kg/day). Data were analyzed using one-way ANOVA to compare group means (SPSS v.21.0, Chicago, IL). Significance was set at $p < 0.05$. **RESULTS:** Total caloric intake was significantly greater in HP when compared to LP only (LP: $1,883.5 \pm 500.1$ kcal; HP: $2,439.8 \pm 348.5$ kcal; $p = 0.01$). Protein consumption was greater in HP compared to MP and LP, and for MP compared to LP ($p < 0.05$). Additionally, 22 participants (88% of all participants) fell below the protein recommendation (2.3 g/kg/day) for athletes to maintain lean mass during weight loss. There were no differences between LP, MP, and HP for all body composition and performance measurements. Although not significantly different, HP had lower body weight compared to LP despite consuming more calories. Additionally, although not significant, fat mass (%) was lower and lean mass (%) was greater in HP compared to both LP (fat: -8% ; lean: $+3\%$) and MP (fat: -4% ; lean: $+0.5\%$). **CONCLUSIONS:** Tertiles of protein intake in the female collegiate dancers participating in this study were not significantly associated with more desirable body composition and performance. However, trends for improved body composition observed with HP may be physiologically relevant for dancers. Further research should focus on achieving adequate protein spread between groups to determine the impact higher protein intake may have on dancers' body composition and performance.

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Protein Intake Per Meal in Varsity Athletes with Low and High Lean Body Mass Index

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PURPOSE: To compare the protein intake per meal in varsity athletes with low and high lean body mass index (LBMI). **METHODS:** Protein intake per meal and LBMI were assessed in 94 varsity male athletes. Protein intake was evaluated with a 24-h dietary recall by trained nutritionists. The protein amount per meal was estimated for each subject and was classified as inadequate if it contained lower than 20 g of protein. Lean body mass was evaluated with bioelectrical impedance and LBMI was calculated (lean body mass [kg]/height² [m]). Then the sample was divided per LBMI tertiles, and the lower and higher tertiles defined as low (LLBM) and high (HLBM) lean body mass groups, respectively. Median intake for total (g/day), relative (g/kg/day) and per meal (g) protein as well as prevalence of inadequate protein intake (INPI) per meal were calculated for each group. We made comparisons between groups for protein intake (U Mann-Whitney test) and INPI prevalence (two samples t-test), we also analyzed within groups per meal protein intake (Friedman ANOVA, Dunns post hoc) and per meal INPI prevalence (one sample t-test). **RESULTS:** HLBM group had a higher total but not relative protein intake compared with LLBM group. The per meal protein intake analysis didn't show significant differences between groups. The INPI prevalence was similar in both groups, but one comparison reached statistical significance. LLBM group ingested the majority of their protein at lunch being higher than dinner ($p < 0.05$) and the INPI prevalence was lower at lunch ($p > 0.05$). HLBM also ingested the majority of their protein at lunch, being higher than breakfast and dinner ($p < 0.05$) and the lowest prevalence of INPI was showed in lunch compared with dinner ($p < 0.05$) but not for breakfast ($p > 0.05$). **CONCLUSIONS:** INPI per meal is common in varsity athletes, independently if they are LLBM or HLBM. Despite an adequate daily protein intake, efforts should be addressed to provide adequate amounts of protein on a per meal basis.

Table 1. Protein intake (daily and per meal) and prevalence of inadequate protein intake per meal.

	LLBM [Median (interquartile range),n=31]	HLBM [Median (interquartile range),n=31]	p-value (between groups)
Total protein intake (g/day)	105.5 (90.0-128.7)	129.7 (93.3-197.5)	0.04
Relative protein intake (g/kg/day)	1.8 (1.3-2.3)	1.5 (1.2-2.6)	0.55
Breakfast protein intake(g)	22.3 (12.0-35.3) ^{AB}	28.0 (16.4-35.9) ^A	0.28
Lunch protein intake (g)	31.8 (16.9-52.1) ^A	42.2 (27.4-66.9) ^B	0.13
Dinner protein intake (g)	21.9 (8.0-28.1) ^B	19.6 (12.6-40.5) ^A	0.29
INPI at breakfast (%)	45.2 ^a	35.5 ^{ab}	0.44
INPI at lunch (%)	25.8 ^a	12.9 ^a	0.20
INPI at dinner (%)	48.4 ^a	51.6 ^b	0.80

Different capital letters mean significant differences ($p < 0.05$) in protein intake between meals within groups.
Different lower case letters mean significant differences ($p < 0.05$) in INPI prevalence between meals within groups.

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Dietary Analysis and Body Composition of Male and Female Costa Rican College Soccer Players

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Soccer is a worldwide popular sport and research on several aspects related to performance are available; however, there are only a few studies reporting dietary analysis and body composition of Latin American college players. **PURPOSE:** To determine macronutrient consumption and body composition in male and female college competitive soccer players. **METHODS:** Participants were 22 male (mean age = 21.4 ± 1.9 yr.) and 19 female (mean age = 20.1 ± 1.7 yr.) varsity team soccer players who were interviewed for dietary assessment using a 7-day diet history questionnaire. Body composition was obtained by a full-body dual-energy X-ray absorptiometry (DXA) scan. Total energy and macronutrient analysis was performed following the nutritional interview, and body height, weight, lean mass, fat mass (%), and intermuscular adipose tissue-free skeletal muscle mass (IMAT-SMM) were obtained from the DXA scan. Gender differences were obtained by independent samples t-tests. **RESULTS:** Energy intake was higher in males ($19,377 \pm 5,514$ kJ) than in females ($13,066 \pm 4,610$ kJ; $p \leq 0.001$). Carbohydrate intake was higher in males (10.3 ± 3.2 g/kg) than in females (7.9 ± 3.8 g/kg; $p = 0.010$). Protein intake was higher in males (2.2 ± 0.8 g/kg) than in females (1.6 ± 0.5 ; $p = 0.031$). Fat consumption was similar between males (1.9 ± 0.8 g/kg) and females (1.7 ± 0.6 g/kg; $p = 0.117$). Body height (176.0 ± 6.1 vs. 160.4 ± 3.4 cm), weight (69.3 ± 7.7 vs. 59.2 ± 6.5 kg), lean mass (26.0 ± 2.0 vs. 16.9 ± 1.4 kg), and IMAT-SMM (31.0 ± 2.3 vs. 20.2 ± 1.6 kg) mean values were higher in males than in females ($p \leq 0.001$ for all). Fat mass was higher in females ($31.4 \pm 6.4\%$) than in males ($14.8 \pm 5.2\%$; $p \leq 0.001$). **CONCLUSIONS:** An excessive energy and carbohydrate intake was found in both genders. Protein and fat intake were appropriate for both genders. Body composition in males showed similar values compared to previously reported literature; however, females showed poor body composition compared to international values.

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Weight Loss Practices Of Youth Taekwondo Athletes

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Taekwondo athletes traditionally compete at the lowest weight class possible in order to gain a competitive advantage. To be eligible in lighter weight classes, competitors use a combination of potentially harmful weight loss practices, which may adversely

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affect one's physical and mental health. **PURPOSE:** The present study examined the weight loss practices of youth Taekwondo athletes. **METHODS:** Participants were 280 Taekwondo competitors aged 12 to 18 yrs (116 boys; mean age \pm SD 15.4 \pm 1.6 yr) who completed a previously validated questionnaire developed to evaluate rapid weight loss in combat sports athletes, which provides a score. The higher the score obtained by the competitor, the more aggressive his/her weight management strategies tend to be. Frequency and summary statistics were calculated on all variables. To compare the overall magnitude of weight management behaviours between boys and girls, a Mann-Whitney U Test was conducted with the scores obtained by both genders. A general linear model one-way ANOVA with Tamhane post hoc test for unequal variances was used to compare the scores obtained by the three following groups: regional-, national-, and international-level competitors. The same procedure was used to compare scores between athletes from different weight classes ($P < 0.05$). **RESULTS:** Seventy-five percent of youth Taekwondo athletes reported that have already lost weight to compete. Most of them reported reductions of up to 5% of body weight (mean \pm SD 2.2 \pm 1.9%). The reductions usually occurred within 8 \pm 4 d. Increased exercise and restricted food and/or fluids and training with plastic or rubberized suits, were cited as the most common rapid weight loss strategies. One-third of the athletes reported they took diet pills, diuretics, and/or laxatives to lose weight. No significant differences were found in the score obtained by male versus female as well as by athletes from different weight classes. International- and national-level athletes scored significantly higher in the questionnaire than regional-level athletes ($P < 0.05$). **CONCLUSION:** These results suggest that rapid weight loss is highly prevalent in youth Taekwondo athletes. The level of aggressiveness in weight management behaviors seems to be influenced by the competitive level.

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Sources Of Nutrition Information And Knowledge In Ultra-runners (the SNIKR Study): A Qualitative Analysis

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With the recent increase in ultra-endurance competitions, the role of nutrition in performance has garnered significant attention. While the ACSM, AND, and DC have a joint position stand on nutrition for endurance performance, recent data has demonstrated that many ultra-endurance athletes do not meet the recommendations for athletic performance. **PURPOSE:** The purpose of this study was to understand common sources of nutrition information among recreational ultra-endurance athletes, and determine how this information is used in their training. **METHOD:** Recreational ultra-endurance athletes were recruited to participate in one of two focus groups (N = 8, mean age = 38.2 years), which followed pre-scripted questions to guide discussion. Participants also completed a demographic questionnaire. Focus group data was transcribed and reviewed by multiple researchers, and common themes were identified. **RESULTS:** The sample was 50% female, 100% white or non-Hispanic, 68% attained a college degree or higher, and 62.5% are married/partnered. Regarding their perception of the ideal diet for an ultra-endurance athlete, 87.5% of respondents discussed a "whole foods" diet with little processed food. Most of the participants (62.5%) were aware of the ACSM recommendations, but did not follow them. The most common reason was a belief in individual responsiveness to diet (50%) or the perception that it was too difficult to follow (50%). The most commonly used sources of nutrition information were through experienced athletes (87.5%) or personal relationships (62.5%), followed by magazines and non-academic books (50%). **CONCLUSION:** Overall, the focus group discussion revealed that recreational athletes, while aware of the dietary recommendations, do not believe they are accessible or worth their effort. As many participants look to personal relationships and successful athletes for advice, researchers and dietitians may reconsider how nutritional information is most effectively disseminated.

400 Board #221 May 31 11:00 AM - 12:30 PM
Inadequacy Of Food-Energy Supplying To The Energy Requirements Of Female Ballet Dancers

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PURPOSE: Nowadays athletes use to control strictly their body weight focusing on convenient body weight-dependent competing categories or simply for their sports performance, as commonly seen in dancers. Usually this procedure lead to eating disorders with unfavorable outcomes. To investigate the energy balance of ballet dancers in association with their food intake pattern and anthropometric profile. **METHODS:** The resting energy expenditure (Fitmate), food intake (Food Frequency and 24-h recall questionnaires) pattern and anthropometric (Bioelectrical Impedance

data of ballet dancers was crosssectionally studied in 17 girls (19.1 \pm 7.1 yrs.). Statistical analysis was done by Pearson's correlation and Multiple Stepwise Regression ($p < 0.05$).

RESULTS: The availability of energy (22.48 \pm 13.1 kcal/kgFFM/d) was inadequate for 82.3% of the dancers once their energy intake (1248 \pm 385 kcal/d) achieved only 56% of the total energy expenditure. However, 24.5% showed high body fatness although 52.9% referred episodes of amenorrhea. Overall, their diet was classified as low quality (HEI score 67.9 points).

CONCLUSIONS: The existence of a presently energy-insufficient diet intake was confirmed by the energy expenditure measurements and the self reports of amenorrhea. On the other hand, the found rate of high body fatness would mean some earlier long lasting positive energy-balance in those girls. Supported by CNPq.

401 Board #222 May 31 11:00 AM - 12:30 PM
Twelve-weeks Oral Spray Vitamin D₃ Supplementation Does Not Alter Bone Turnover Markers In Collegiate Gaelic Footballers

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Reported Relationships: S.M. Madigan: Intellectual Property; none. Honoraria; none. Ownership Interest (Stocks, Bonds); none.

Vitamin D deficiency is associated with increased bone remodelling activity. Quantification of reference-standard bone turnover markers total procollagen type I N-terminal propeptide (PINP) (bone formation) and beta C-terminal telopeptide of type I collagen (β -CTX) (bone resorption) therefore enable detection of subtle perturbations in bone remodelling that may result from vitamin D inadequacy and indicate an increased risk of stress fracture in athletes. **PURPOSE:** To investigate the effect of wintertime vitamin D₃ supplementation using an oral spray on bone turnover markers in Irish athletes compared to placebo. **METHODS:** Stored samples from a randomised, double-blind, placebo-controlled trial conducted in Gaelic footballers (3000IU (75 μ g) vitamin D₃ daily versus placebo for 12-weeks, n=42) were analysed for PINP and β -CTX. Dietary vitamin D and calcium intake as well as total 25-hydroxyvitamin D (25(OH)D) data were available from the previous study. **RESULTS:** Overall, 72% of athletes presented with a 25(OH)D concentration $<$ 50nmol/L, and 5 exhibited vitamin D deficiency ($<$ 30nmol/L) at baseline. Dietary vitamin D and calcium intakes averaged 5.9 \pm 4.3 μ g/day and 1037 \pm 651mg/day respectively. Daily supplementation with 3000IU (75 μ g) vitamin D₃ significantly increased mean \pm SD 25(OH)D compared to no significant change in the placebo group (vitamin D; 47.37 \pm 13.29 to 83.68 \pm 32.98nmol/L (+79%) vs. placebo; 43.10 \pm 22.00 to 49.22 \pm 25.40 (+14%) $P=0.006$). However, ANCOVA revealed no significant difference in mean \pm SD change from baseline for PINP (-8.72 \pm 18.83 vs. -5.04 \pm 21.13 μ g/L, $P=0.413$) or β -CTX concentrations (-0.09 \pm 0.18 vs. -0.10 \pm 0.21 μ g/L, $P=0.627$) when compared to placebo. **CONCLUSION:** In this study, 12-weeks vitamin D₃ supplementation using an oral spray solution did not influence bone turnover when compared to placebo, despite increasing mean 25(OH)D concentration by 79%. Vitamin D inadequacy ($<$ 50nmol/L) is apparent in collegiate Gaelic footballers however future interventions, aiming to test change over time in bone turnover as a primary outcome, should consider a longer intervention in athletes with vitamin D deficiency ($<$ 30nmol/L).

402 Board #223 May 31 11:00 AM - 12:30 PM
Anxiety and Stress Predict Gastrointestinal Symptoms during One Month of Running

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PURPOSE: To investigate dietary, training, demographic, anthropometric, pharmacological, and psychological predictors of gastrointestinal (GI) symptoms in distance runners. **METHODS:** A total of 150 runners (74 men) completed a prospective journal recording daily running duration and intensity (Rating of Perceived Exertion [RPE]), as well as GI symptoms experienced during each run. At month's end, participants completed a survey inquiring about demographics, anthropometrics, running experience, analgesic use, antibiotic use, probiotic consumption, fluid/food intake during runs, caffeine intake before and during runs, stress, and anxiety. Stress and anxiety were measured via the Perceived Stress Scale (PSS) and Beck Anxiety Inventory (BAI). Substantial GI distress was defined as a run with at least one GI symptom ≥ 3 on a 0 to 10 scale. **RESULTS:** On average, participants reported experiencing substantial GI distress during 44.1% of runs. Age ($\rho = -0.30$, $p < 0.01$) and years of running experience ($\rho = -0.17$, $p = 0.04$) were negatively correlated

with the percentage of runs with substantial GI distress. Mean run RPE ($\rho = 0.23$, $p < 0.01$), frequency of probiotic food consumption ($\rho = 0.20$, $p = 0.02$), PSS scores ($\rho = 0.29$, $p < 0.01$), and BAI scores ($\rho = 0.27$, $p < 0.01$) were positively associated with the percentage of runs with substantial GI distress. **CONCLUSIONS:** Several factors are associated with substantial GI distress over one month of running, including perceived stress and anxiety, which have largely been neglected in previous research.

A-52 Free Communication/Poster - Occupational/Firefighter Physiology

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

403 Board #224 May 31 9:30 AM - 11:00 AM The Physiological Responses of Specialist-Role Paramedics Undertaking a Simulation Treating Casualties Exposed to Hazardous Materials

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The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. Specialist ambulance responders (HART) are trained to deal with mass casualty incidents, during which they may need to wear Breathing Apparatus (BA) inside fully encapsulated Gas Tight Suits (GTS) to treat casualties in a hazardous area. **PURPOSE:** To measure the physiological strain of paramedics during a simulated task to treat casualties exposed to hazardous materials. **METHODS:** Six participants (5 male / 1 female; age 39 ± 8 y; body mass 80.1 ± 7.9 kg; VO_{2max} 38.05 ± 4.31 ml·kg⁻¹·min⁻¹) wearing BA and GTS (36.7 ± 1.3 kg) undertook a 30 min simulated task, which included walking 200 m to an incident, moving casualties and administering CPR for approximately 14 min. Participants' urine osmolality was measured before the task. Sweat losses during the task were estimated by changes in body mass, with participants unable to drink due to the BA. Participants wore a heart rate monitor, rectal thermistor, and skin thermistors (neck, hand, scapular and shin). The day before the simulation, participants completed an incremental shuttle run test to measure VO_{2max} and maximum heart rate (HR_{max}). Data are presented as the mean \pm SD; differences were compared using paired sample t-tests with significance set at $p < 0.05$. **RESULTS:** Mean urine osmolality at the start of the task was 380 ± 150 mOsm·kg⁻¹. Total estimated sweat losses during the simulation were 0.47 ± 0.39 L. Mean heart rate during the simulation was 75 ± 15 % HR_{max} . During the simulation both rectal (start and end; 37.45 ± 0.03 to 38.13 ± 0.19 °C, $p < 0.05$) and mean skin temperature (31.57 ± 0.02 to 34.04 ± 0.06 °C, $p < 0.05$) increased. The range of peak rectal temperatures were $37.8 - 38.3$ °C. **CONCLUSION:** Participants started the simulated task in a hydrated state and sweat losses were unable to be matched by fluid intake. Although cardiovascular strain during the task was 'moderate' to 'very hard' and body temperature increased, all participants successfully completed the 30 min simulation. These data can be used to inform interventions to enhance physical performance and to develop physical competency assessments for specialist ambulance responders.

404 Board #225 May 31 9:30 AM - 11:00 AM The Physiological Responses of Specialist-role Paramedics Treating Casualties in a Simulated Firearms Incident

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(No relationships reported)

The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. Specialist ambulance responders are trained to deal with hazardous or difficult situations, particularly incidents such as situations involving firearms and mass casualties. **PURPOSE:** To measure the physiological strain of paramedics during a scenario to treat multiple casualties in a simulated firearms incident. **METHODS:** Six participants (5 male / 1 female; age 27 ± 3 y; body mass 80.4 ± 11.8 kg; VO_{2max} 46.5 ± 1.6 ml·kg⁻¹·min⁻¹) wearing ballistic personal protective equipment (19.1 ± 1.0 kg) undertook a 120 min

scenario, which included a 400 m approach walk, casualty drags, sprints, and stretcher drags. Participants' urine osmolality was measured before the scenario. Sweat losses during the scenario were estimated by changes in body mass with ad libitum fluid intake measured. Participants wore a heart rate monitor, rectal thermistor and skin thermistors (neck, hand, scapular and shin). The day before the simulation participants completed an incremental shuttle run test to measure predicted VO_{2max} and maximum heart rate (HR_{max}). Data are presented as the mean \pm SD; and analysed with paired sample t-tests with significance set at $p < 0.05$. **RESULTS:** Urine osmolality at the start of the simulation was 450 ± 160 mOsm·kg⁻¹. Total estimated net sweat losses during the scenario were 2.23 ± 0.34 L which was not different to fluid intake of 2.43 ± 0.42 L ($p > 0.05$). Mean heart rate during the scenario was 73 ± 11 % HR_{max} . During the simulation both rectal (start to end; 37.54 ± 0.29 to 38.34 ± 0.51 °C, $P = 0.24$) and mean skin temperatures (32.04 ± 1.08 to 30.85 ± 0.68 °C, $P = 0.78$) did not change significantly. The range of peak rectal temperatures was $37.10 - 39.15$ °C. **CONCLUSION:** Participants started the scenario in a hydrated state and sweat losses were matched by fluid intake. Although cardiovascular strain during the simulation was 'moderate' to 'hard', body temperature did not rise significantly and all participants successfully completed the two-hour scenario. These data can be used to inform interventions to enhance physical performance and develop physical employment standards for specialist ambulance responders.

405 Board #226 May 31 9:30 AM - 11:00 AM The Physiological Response of Specialist-role Paramedics Undertaking a Casualty Decontamination Scenario.

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(No relationships reported)

The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. Specialist ambulance responders are trained to wear Powered Respirator Protective Suits (PRPS) to move, treat and decontaminate casualties exposed to hazardous materials. **PURPOSE:** To measure the physiological strain of paramedics during a scenario to move and decontaminate multiple casualties exposed to hazardous materials. **METHODS:** Eight participants (7 male / 1 female; age 38 ± 10 y; body mass 90.4 ± 16.2 kg; VO_{2max} 34.5 ± 5.6 ml·kg⁻¹·min⁻¹) undertook a 193 min scenario involving erecting a decontamination tent, then donning PRPS (11.9 ± 0.4 kg) to work for ~120 min to move and decontaminate multiple casualties. Urine osmolality was measured before the scenario. Sweat losses during the scenario were estimated from changes in body mass, with ad libitum fluid intake recorded. Participants wore a heart rate monitor, rectal thermistor, skin thermistors (neck, hand, scapular and shin). The day before the scenario participants completed an incremental shuttle run test to measure VO_{2max} and maximum heart rate (HR_{max}). Data are presented as the mean \pm SD; differences were compared using paired sample t-tests with significance set at $p < 0.05$. **RESULTS:** Urine osmolality at the start of the scenario was 350 ± 170 mOsm·kg⁻¹. Estimated sweat losses during the scenario were 1.40 ± 0.36 L which were less than fluid intake 2.54 ± 0.96 L ($p < 0.05$). Mean heart rate during the scenario was 64 ± 11 % HR_{max} . During the scenario rectal temperature increased (start to end; 37.51 ± 0.32 to 37.88 ± 0.19 °C, $p < 0.05$) and mean skin temperature was unchanged (31.16 ± 0.10 to 31.67 ± 1.23 °C, $p > 0.05$). The range of peak rectal temperatures was $37.95 - 38.60$ °C. **CONCLUSIONS:** Participants started the scenario in a hydrated state and sweat losses were lower than fluid intake. Cardiovascular strain during the scenario was 'moderate' and body temperature increased slightly. One participant was withdrawn during the scenario by the investigators due to becoming excessively fatigued. These data can be used to inform interventions to enhance physical performance and develop physical employment standards for specialist ambulance responders.

406 Board #227 May 31 9:30 AM - 11:00 AM A Case Report: The Physiological Strain Incurred by Electrical Utility Workers During Consecutive Work Days

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(No relationships reported)

Heat strain in electrical utilities workers has been assessed in a single work day and it has been shown that workers can experience high levels of thermal and cardiovascular strain. However, the impact of consecutive work shifts performed in hot conditions on the level of physiological strain remains unclear. **PURPOSE:** To examine the influence

of working consecutive shifts in hot conditions on the physiological strain experienced by electrical utility workers. **METHODS:** Four male electrical utility workers (age 38 ± 12 years) were monitored as they performed their normal work duties over two consecutive work days in hot conditions (average: 34°C , 60% relative humidity). Hydration was assessed using urine specific gravity (USG) prior to and following the participants regularly scheduled work shift. The proportion of work spent at various levels of physical effort as defined by the American Conference for Governmental and Industrial Hygienists (i.e., rest, light, moderate, and heavy effort) was determined using video analysis. Body core temperature (T_{core}) and heart rate (HR; presented as a percentage of maximal heart rate, HR_{max}) were measured continuously throughout the work shifts. **RESULTS:** Based on the ACSM guidelines, the workers were considered dehydrated ($\text{USG} \geq 1.020$) prior to (Day 1: 1.025 ± 0.005 ; Day 2: 1.029 ± 0.004) and following (Day 1: 1.027 ± 0.015 ; Day 2: 1.032 ± 0.004) each work shift. On day 1, workers spent 50, 25, 21, and 4% of the work period at rest and performing tasks considered as light, moderate and heavy physical exertion, respectively; whereas, 65, 19, 11, and 5% of the work shift was spent in these physical exertion categories during the second day. The proportion of the work shift at rest was higher on the second day compared to the first ($P=0.07$). Peak T_{core} tended to be greater on the second (Day 2: $38.4 \pm 0.2^{\circ}\text{C}$; range: $38.2\text{--}38.7^{\circ}\text{C}$) relative to first work shift (Day 1: $38.1 \pm 0.2^{\circ}\text{C}$, range: $37.8\text{--}38.2^{\circ}\text{C}$; $P=0.08$), whereas the peak HR response was similar between days (Day 1: $91 \pm 7\% \text{HR}_{\text{max}}$; range: $83\text{--}100\% \text{HR}_{\text{max}}$; Day 2: $87 \pm 11\% \text{HR}_{\text{max}}$; range: $74\text{--}98\% \text{HR}_{\text{max}}$; $P=0.57$). **CONCLUSION:** Our case report findings suggest that despite the fact that work effort is decreased over consecutive work shifts, thermal strain continues to be elevated in electric utility workers. Funding support by the Electrical Power Research Institute

407 Board #228 May 31 9:30 AM - 11:00 AM

Heat Stress, Dehydration and Cardiovascular Responses in Sugar Cane Cutters in Brazil

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Current evidence demonstrates that the planet's climate is warming and that extreme heat waves are occurring more frequently. Outdoor workers are vulnerable to climate changes and are subject to risk of heat-related illness. Sugar cane cutters represent a labor force that is at high risk of heat-related illness due to high physical demands, long labor hours, and use of uniforms that dissipate heat poorly. **PURPOSE:** To investigate heat stress, dehydration and cardiovascular responses of sugar cane cutters during a typical work shift. **METHODS:** Eight male sugar cane workers (27 ± 7 years) volunteered for the study. Data collection occurred on a sugar cane plantation during the spring season. An ingestible telemetric temperature sensor and a heart rate monitor were used for measuring core temperature (T_{core}) and heart rate (HR), respectively, continuously. Oxygen consumption (VO_2) was measured using a portable metabolic cart during the first and second half of the work shift. Urine samples were collected pre- and post-work shift. Total sweat loss was calculated using body weight change and adjusting for water ingestion and urine output. A wet-bulb globe temperature (WBGT) station was used to monitor environmental heat stress. **RESULTS:** Total work shift time was $6:55 \pm 0:18$ hr with physical work duration of $5:28 \pm 0:21$ hr and rest time of $1:27 \pm 0:09$ hr. Mean and peak T_{core} during the work shift were 37.82 ± 0.31 and $38.60 \pm 0.41^{\circ}\text{C}$, respectively. All subjects achieved T_{core} above 38°C . Mean and peak HR during the work shift were 137 ± 18 and 165 ± 11 bpm, respectively. VO_2 was, on average, $21.2 \pm 5.4 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and was not different ($p=0.296$) between the first ($22.6 \pm 3.4 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) and second half ($21.2 \pm 5.4 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) of the work shifts. Volunteers ingested 6.0 ± 1.0 L of fluid and experienced a total sweat loss of 7.6 ± 2.3 L. WBGT index was on average $26.8 \pm 2.3^{\circ}\text{C}$ and above the permissible heat exposure threshold of 25°C for 1 hour of heavy work. **CONCLUSIONS:** Sugar cane cutting is a physically demanding occupation performed in a hot environment and associated with high T_{core} and fluid loss. Preventative actions such as water ingestion, adequate rest, access to shade, and physiological monitoring should be implemented to reduce the risk of heat illness, particularly with the warming global climate. Supported by CNPq (404201/2013-0).

408 Board #229 May 31 9:30 AM - 11:00 AM

Thermal Exposure Limit for Mine Refuge Chambers: A Pilot Study

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Refuge chambers (RCs) provide shelter to miners trapped during a disaster. Industry standards mandate that RCs not exceed a Steadman Apparent Temperature (AT) (also known as Heat Index) of 95°F (35°C). This limit is designed for adults performing moderate work and maintaining thermal equilibrium at a core temperature $\leq 37^{\circ}\text{C}$. However, occupants in a RC spend most of their time at rest, and are able to maintain thermal equilibrium at a core temperature $> 37^{\circ}\text{C}$. Thus, the temperature limit may be unnecessarily restrictive. **PURPOSE:** To determine the upper limit of sustainable heat stress that is protective for most individuals during long-term heat exposure at rest. **METHODS:** In Phase 1, five men (age = 23.6 ± 3.2 ; BMI = 23.6 ± 2.5) underwent five 4-hr trials in a semi-recumbent position (mean $\text{VO}_2 = 0.43 \text{ L/min}$) at ATs of 39.4, 40.0, 42.8, 45.6 and 49.0°C , rh 90%. In phase 2, five men (age = 23.6 ± 3.2 ; BMI = 25.1 ± 2.2) underwent five 8-hr trials in a semi-recumbent position (mean $\text{VO}_2 = 0.44 \text{ L/min}$). The starting AT for phase 2 was 3°C below the highest AT from Phase 1, and increased in a stepwise fashion (ATs = 45.6, 50.8, 51.7, 54.4 and 56.1°C ; 90% rh). In all trials, gastrointestinal temperature (T_{gi}) and heart rate (HR) were assessed every 15 min. Oxygen uptake was assessed at the midpoint of each trial. Fluids were offered ad libitum. Sweat rate (SR) was determined from pre- and post-body weights. Repeated measures ANOVA was used to assess differences between trials. T-tests were used to assess pre- to post-trial differences. Significance was set at 0.05. **RESULTS:** Maximum AT of 56.1°C had an ending HR of 76 ± 1 bpm and ending T_{gi} of $37.5 \pm 0.3^{\circ}\text{C}$; well below the assumption of the Steadman AT limit. There were no differences ($p>0.05$) in T_{gi} at 45.6°C at 4 hrs in Phase 1 ($T_{\text{gi}} = 37.0 \pm 0.6^{\circ}\text{C}$) or Phase 2 ($T_{\text{gi}} = 37.2 \pm 0.1^{\circ}\text{C}$) or at 8 hrs in Phase 2 ($T_{\text{gi}} = 37.1 \pm 0.3^{\circ}\text{C}$). As AT increased, the difference in T_{gi} from 4 to 8 hrs increased ($p<0.05$). There was no difference in HR ($p>0.05$) and no between-phase difference in SR ($p>0.05$). **CONCLUSION:** As there were no differences in T_{gi} at 4 hrs and a greater difference from 4 to 8 hrs as AT increased, 4 hrs may not be long enough to detect a change in T_{gi} . The effect of climate evidenced by increasing T_{gi} which occurred between 43.3 and 46°C -AT provides support for sustainable exposures greater than 35°C -AT with a likely ceiling below 46°C -AT.

409 Board #230 May 31 9:30 AM - 11:00 AM

The TLVs Fail to Maintain Body Core Temperature within Safe Limits in Older Adults

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Industries rely on the American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLVs) to manage the health and safety of workers in hot conditions. A key shortcoming of the TLVs is the assumption that the guidelines are generalizable to broad population groups and do not consider age-related impairments in heat dissipation. **PURPOSE:** To evaluate core temperature and change in body heat storage during work in the heat using the TLVs, which are designed to ensure that a stable core temperature (and therefore heat balance) is achieved and remains below 38°C . **METHODS:** Nine older (58 ± 5 yrs) males performed three 120-min work bouts consisting of cycling at a fixed rate of heat production (360 W) under increasing ambient temperatures. Based on the TLVs, each protocol consisted of different work-to-rest (WR) ratios performed at different wet-bulb globe temperatures (WBGT). The first was 120-min of continuous (CON) cycling at 28°C WBGT while two protocols consisted of intermittent work bouts (15-min duration) adjusted for increases in WBGT: i) WR of 3:1 at 29°C (WR3:1) and ii) WR of 1:1 at 30°C (WR1:1) (equivalent exercise time of 90 and 60-min, respectively). Rectal (T_{re}) and mean skin temperatures were measured continuously and used to calculate the change in mean body temperature (ΔT_{b}). The change in body heat storage was determined via direct calorimetry and subsequently used to calculate ΔT_{b} . **RESULTS:** Heat balance was not achieved during exercise in any work conditions as the rate of change in T_{re} was greater than $0^{\circ}\text{C}\cdot\text{min}^{-1}$ (all $P \leq 0.05$). As a consequence, mean T_{re} exceeded 38°C ; albeit, time for T_{re} to exceed 38°C decreased as total exercise time increased (CON: 53 ± 7 ; WR3:1: 79 ± 12 ; and WR1:1: 100 ± 29 min). Moreover, a greater ΔT_{b} was observed with calorimetry relative to thermometry in all work protocols during the first 15-min of exercise [thermometry vs. calorimetry; CON: 0.21 ± 0.07 vs. $0.45 \pm 0.06^{\circ}\text{C}$ ($P<0.01$); WR3:1: 0.18 ± 0.05 vs. $0.51 \pm 0.06^{\circ}\text{C}$ ($P<0.01$); and WR1:1: 0.20 ± 0.06 vs. $0.50 \pm 0.09^{\circ}\text{C}$ ($P<0.01$)]. **CONCLUSION:** We show that the TLVs do not adequately protect older workers from potentially dangerous increases in core temperature during moderate work in the heat. Supported by the Ontario Ministry of Labour, Electric Power Research Institute and Natural Sciences and Engineering Research Council of Canada

410 Board #231 May 31 9:30 AM - 11:00 AM
Uncompensable Heat Stress Improves Manual Dexterity, But Does Not Affect Risk Propensity
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PURPOSE: Healthcare workers in the West African Ebola Treatment Units experienced substantial heat stress from wearing personal protective equipment (PPE) while performing light activities in a hot environment. It is unknown if uncompensable heat stress alters risk propensity or manual dexterity, which could impact the health of the worker and/or patient. We tested the hypothesis that uncompensable heat stress increases risk-taking propensity and impairs manual dexterity. **METHODS:** Fifteen healthy subjects (2 women) aged 22 ± 2 y completed a single experimental trial in 40°C and 60% relative humidity while wearing a hooded Tyvek chemical resistant coverall, an N95 respirator mask, goggles, gloves, boots, and an autopsy apron. Subjects walked on the treadmill for 30 min at 60% of their age predicted maximal heart rate, which was followed by 15 min seated rest. This cycle was repeated until participants reached 120 min, the subject terminated the test, or their physiological measures exceeded safe parameters. Subjects completed the Balloon Analogue Risk Task (BART) and two dexterity tasks (Tool Dexterity and Minnesota Manual Dexterity) pre and post the exercise while in the hot environment. **RESULTS:** Core temperature ($1.8 \pm 0.6^\circ\text{C}$; $p < 0.01$), mean skin temperature ($3.8 \pm 0.7^\circ\text{C}$; $p < 0.01$), and heart rate (55 ± 21 bpm; $p < 0.01$) increased during exercise, while body mass decreased ($1.1 \pm 0.4\%$; $p < 0.01$). Core-to-skin temperature gradient decreased from pre to post ($1.1 \pm 0.02^\circ\text{C}$ vs. $1.0 \pm 0.02^\circ\text{C}$; $p < 0.01$). During exercise, perceived exertion ($p < 0.01$), thermal sensation ($p < 0.01$), thermal comfort ($p < 0.01$), sweating sensation ($p < 0.01$), and dyspnea ($p < 0.01$) ratings increased. There was no change in the number of balloon explosions on the BART, an objective measure of risk propensity, from pre to post ($p = 0.43$). Time to complete the Tool Dexterity task did not differ between pre and post ($p = 0.49$). Time to complete the Minnesota Manual Dexterity task decreased from pre to post for both placing (270.4 ± 29.6 s vs. 252.0 ± 27.7 s; $p = 0.03$) and turning (230.2 ± 25.7 s vs. 204.9 ± 33.3 s; $p < 0.01$). **CONCLUSION:** Despite considerable thermal strain, light exertion in the heat while wearing encapsulating healthcare PPE did not alter risk propensity, but improved aspects of manual dexterity.

411 Board #232 May 31 9:30 AM - 11:00 AM
Selection into Shipbuilding Occupations when Dealing with Missing Data
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Building battle ships involves transforming sheets of steel into many shapes and joining the segments using welding, brazing, torquing, and other methods. **PURPOSE:** To design and validate selection tests for 30 jobs (e.g., shipfitter, joiner). One of the challenges was prevalence of missing data due to intermittent availability of the workers in the shipyard. Thus, this research used alternative methods to identify statistically the tests predictive of job performance for 30 occupations. **METHOD:** A job analysis survey completed by 629 workers identified the essential tasks for each job. Research staff identified the physical abilities required to perform essential job tasks. Researchers conducted a criterion-related validity study that included ten predictor tests and five criterion measures. The criterion measures included performance of tasks onboard a ship, along with supervisor evaluations of physical job performance. The sample included 197 men and 47 women across 24 of the 30 jobs. **RESULTS:** Validation data yielded a model ($R^2 = .59$) that consisted of lift/carry climb stairs, arm endurance, container lift, and plank. Further analysis showed the test battery was fair to protected groups (e.g., sex, age). Due to varying shift schedules, missing data occurred for the predictor tests and criterion measures for many subjects. Listwise deletion in the regression analysis resulted in a final sample of 155. Although statistical power was high for this sample, we conducted a Full Information Maximum Likelihood (FIML) analysis to determine whether the missing data affected the conclusions. FIML used a maximum likelihood approach to estimate the missing data based on all available information for a subject in an unbiased manner, rather than not replace or impute missing data. **CONCLUSIONS:** Comparison of squared multiple Rs for all ten tests for the FIML (0.61) and original (0.59) analyses found a small difference with FIML accounting for 1.3% more variance. The FIML standardized beta coefficients with the highest values were the same as the original regression analysis, thus confirming the original results. We established separate passing scores by job and test using information from the validation and job analysis results. Each job's test battery contained only tests and passing scores relevant to the job.

412 Board #233 May 31 9:30 AM - 11:00 AM
Flow-resistive Inspiratory Muscle Training Improves Running Time To Exhaustion With Thoracic Load Carriage
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 (No relationships reported)

Exercise while carrying an external load upon the thoracic cavity imposes extra stress on the cardiopulmonary and limb locomotor systems. This in turn, negatively impacts exercise tolerance and performance, as well as pulmonary and respiratory muscle function. Thoracic load carriage exercise (LC) has been shown to induce global respiratory muscle fatigue as assessed by volitional mouth pressures, with a concomitant impairment in running time-trial performance. Inspiratory muscle training (IMT) has been shown to improve performance in a running time-trial with thoracic LC. However, in many occupational and recreational activities that require thoracic LC, the capacity to sustain prolonged exercise may be of equal or greater importance than performance in a time-trial. **PURPOSE:** To determine the efficacy of 6 weeks of flow-resistive IMT on running time to exhaustion with thoracic LC; and to determine whether 6 weeks of flow-resistive IMT moderates diaphragmatic fatigue that may occur following a thoracic LC running time to exhaustion test. **METHODS:** Twelve recreationally active males completed two runs to exhaustion (T_{lim}) at a fixed speed eliciting 70% of $\dot{V}O_{2max}$ while carrying a 10 kg backpack. Visits were completed at baseline and after 6 weeks of either IMT or placebo-IMT. Exercise metabolic and ventilatory measures were recorded and diaphragm strength was measured using bilateral phrenic nerve stimulation in conjunction with esophageal balloon-tipped catheters to measure intrathoracic pressures. Twitch transdiaphragmatic pressure amplitude was recorded pre-exercise and immediately post-exercise in both trials. Maximal volitional mouth pressures (P_{imax}) were recorded at baseline and post-IMT. **RESULTS:** 6 weeks of IMT significantly improved T_{lim} ($p = 0.029$, $\% \Delta +29.3 \pm 6.4\%$ IMT, $-8.8 \pm 11.1\%$), but did not alter the change in diaphragm strength following a run to exhaustion ($p > 0.05$). The $\% \Delta$ in P_{imax} from pre- to post-training was significantly correlated with the $\% \Delta$ in T_{lim} from pre- to post-training ($p = 0.031$, $r = 0.622$). No changes were observed in minute ventilation or breathing mechanics (all $p > 0.05$). **CONCLUSIONS:** IMT improves exercise tolerance with thoracic LC, but does not attenuate the severity of diaphragmatic fatigue following a running time to exhaustion test.

413 Board #234 May 31 9:30 AM - 11:00 AM
Assessment of the Physical Requirements Related to the Basic Training Program in Police Patrolling
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PURPOSE: To evaluate the demands of the basic training program in police patrolling (BTPPP) at the École Nationale de Police du Québec in order to develop a job-related physical test (JRPT). The aims were to: 1. quantify the physiological demands of the training and 2. identify and analyze the physically demanding and critical tasks of the training. **METHODS: AIM #1:** To determine the physiological demands, 56 cadets were recruited (27 M, 26 F). Their $\dot{V}O_{2max}$ and maximal heart rate (HR_{max}) were directly assessed ($\dot{V}O_{2max} = 48.9 \pm 6.8$ mlO₂ · kg⁻¹ · min⁻¹) using an incremental treadmill test. The physiological demands of the BTPPP were later quantified by recording the HR of participants during the physically demanding classes and then $\dot{V}O_2$ was extrapolated using a personalized regression function. Video sequences were also taken during those classes to allow further analyses. **AIM #2:** To identify the critical tasks of the BTPPP, 12 police training-experts participated in an advisory activity in which they were asked to individually rate the critical aspect of various tasks using a seven point Likert-like scale. A ranking of the most critical physically demanding tasks was established based on the scores given by the experts. The tasks scored as the most critical were later analyzed by 4 experts in kinesiology in order to identify the physical abilities needed to execute those tasks. **RESULTS: AIM #1:** HR analysis showed participants spent very little (Avg. = 0.62%) of their time in class at a HR > 90%; the most difficult classes required $\dot{V}O_2$ averaging only 35.2 mlO₂ · kg⁻¹ · min⁻¹ for females and 43.1 mlO₂ · kg⁻¹ · min⁻¹ for males. **AIM #2:** Critical tasks identification by police training-experts allowed the creation of a rank order list of 11 tasks of which the 7 most critical were, in order: reactive shooting, wrestling, self-defence with a baton, pursuing a suspect, force open a door, crowd control, and moving an unconscious person. Analysis of these 11 tasks by experts in kinesiology allowed the ranking of the most essential physical abilities, the first four being lower body power, coordination, upper body power and agility.

CONCLUSION: The assessment of the physical demands of the BTPPP allowed the creation of a JRPT based on the proper abilities and tuned to the energy expenditure and critical physically demanding tasks taught during the training.

414 Board #235 May 31 9:30 AM - 11:00 AM
Development of a New Job-Related Physical Test for the Basic Training Program in Police Patrolling
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Purpose: Based on previous observation and analyses of the basic training program in police patrolling, the main physical abilities required to successfully accomplish the critical and essential tasks of the program were identified. The objective of the study was then to develop and validate a new physical test for the École Nationale de Police du Québec (ENPQ) based on a job related approach sustaining the bona fide occupational requirements criteria. **Methods:** Our approach focused both on job task simulation and assessment of specific motor and physiological abilities. Seventeen tasks representing the main physical abilities elicited in the training program were evaluated throughout the test circuit, especially: lower and upper limb power, upper limb strength, global coordination and agility. To validate the test, 184 male and 56 female police students were recruited. Students executed the new ENPQ test and also a series of six 'convergent' measures (C): Edgren agility test (C1), dynamometer test for strength (C2), seated medicine ball throw for upper body power (C3), vertical (C4) and horizontal (C5) jump tests for lower limb power, and a maximal aerobic power estimation (C6). Among the experimental group, 39 male and 9 female police students did twice the ENPQ test for establishing test-retest reliability. **Results:** The new ENPQ test consists of a time circuit including various tasks in continuity, separated by 3 laps: lap 1 (8 tasks), lap 2 (7 tasks) and lap 3 (7 tasks). Mean completion time was significantly different (p<0.001) between male (210 ± 25 sec) and female participants (282 ± 52 sec). Correlation between the ENPQ test time and the six convergent tests were all significant (p<0.01) and moderately high: C1 (r=-0.43), C2 (r=-0.62), C3 (r=-0.59), C4 (r=-0.50), C5 (r=-0.71) and C6 (r=-0.49). Test-retest reliability (n=48) was r=0.81. **Conclusion:** The construction design used for the development of the new test insures *per se* its content (face) validity. On the other hand, the correlations obtained between the independent six 'convergent' ability measures and the new test's time performance confirm its multi-faceted concurrent validity. As for its predictive, or practical, usefulness for the tightening and betterment of the training standards of future police officers, this remains to be investigated.

415 Board #236 May 31 9:30 AM - 11:00 AM
DEXA Body Composition and Cardiovascular Risk Factors are Weakly Related in Police Officers
 Alison McGuire, Stephen F. Crouse, FACSM, Steven Martin, Allison Donnell, Daniel Mohnke, John S. Green, FACSM. *Texas A&M University, College Station, TX.* (Sponsor: Dr. Stephen Crouse, FACSM)
 (No relationships reported)

There is currently little research on whether fat mass and distribution are predictors for cardiovascular risk. **PURPOSE:** To determine if obesity measures, such as fat mass and distribution (e.g. android vs gynoid), could be used to predict cardiovascular risk, particularly lipid levels, systolic blood pressure (SBP) and blood glucose. **METHODS:** 182 police officers (166 males, 16 females; age 37.6±8.1 yrs; ht 1.7±0.1 m; wt 92.2±17.8 kg; BMI 28.9±4.8) were part of an annual cardiovascular risk profile testing group. We measured resting blood pressure and body composition via DEXA scan (SBP 127.16±10.33 mmHg; fat mass 26.85±9.99 kg; lean mass 62.01±9.90 kg; percent android fat 35.5±10.1; percent gynoid fat 29.7±6.9). Fasting blood samples were drawn and analyzed by a clinically certified lab to determine total blood cholesterol (TC) (192±37 mg/dL), LDL (119±35 mg/dL), HDL (46±10 mg/dL), triglycerides (129±99 mg/dL), and glucose (87±19 mg/dL). Correlations were determined by using a bivariate Pearson correlation matrix, significance was set at and p<0.01**. **RESULTS:** As fat mass increased, total cholesterol and LDL increased and HDL decreased. Triglycerides, glucose, and SBP also increased as fat mass increased. There were also significant increases in total cholesterol, LDL, triglycerides, glucose and SBP as android fat percentage increased. HDL decreased significantly as android fat percentage increased.

		Lean Tissue Mass	Fat Tissue Mass	Android Fat %	Gynoid Fat %	BMI
Cholesterol	Pearson	-.068	.193**	.242**	.196**	.211**
	R ²	.005	.037	.059	.038	.045
HDL	Pearson	-.258**	-.252**	-.262**	-.030	-.233**
	R ²	.067	.064	.069	.001	.064
LDL	Pearson	-.017	.169*	.178*	.154*	.168*
	R ²	.000	.029	.032	.024	.028
Triglycerides	Pearson	.075	.240**	.302**	.134	.215**
	R ²	.006	.058	.091	.018	.046
Glucose	Pearson	.152*	.150*	.153*	.024	.215**
	R ²	.023	.023	.023	.001	.046
Resting SBP	Pearson	.246**	.258**	.196**	.073	.299**
	R ²	.061	.067	.038	.005	.089

CONCLUSION: Fat mass and distribution are significantly, but weakly related to blood lipids/lipoproteins and blood pressure. We suggest that factors other than fat mass affect these cardiovascular disease risk markers, such as genetics, lifestyle, and diet. More research is needed to see if this correlation holds or is stronger in similar and different populations.

416 Board #237 May 31 9:30 AM - 11:00 AM
DXA Body Composition Is Weakly Related To Blood Lipids, Blood Pressure, And Glucose In Firefighters
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Current published data are inconclusive regarding whether DXA body composition measures of fat, lean, and regional fat mass are predictive of other CVD risk factors. **PURPOSE:** To determine if DXA measures can be used in a cardiovascular risk-predictive manner to indicate unhealthy levels of circulating lipoproteins in firefighters. **METHODS:** 256 male firefighters (age=35±10; ht=179±6.6 cm; wt=94±16 kg; BMI=29.9±4.6; fat mass=27.5±10.4 kg; lean mass=63±7.5 kg; gynoid%fat=28.7±6.5%; android%fat=36±11.3%; glucose=85±12.9 mg/dL; SBP=128±9 mmHg) underwent an annual cardiovascular risk profile screening and DXA scan; resting BP was also measured. We collected fasted blood samples and a clinically certified lab analyzed them to determine glucose, HDL, LDL, total cholesterol, and triglycerides. Statistics included simple statistics and Pearson's correlations. **RESULTS:** Table (*=p<.01)

		Percent Fat	Lean Mass	Fat Mass	Android % Fat	Gynoid % Fat	BMI
Cholesterol	Pearson	.262*	.003	.212*	.281*	.197*	.180*
	R ²	.069	.000	.045	.079	.039	.032
HDL	Pearson	-.203*	-.228*	-.253*	-.251*	-.070	-.286*
	R ²	.041	.052	.064	.063	.005	.082
LDL	Pearson	.248*	.002	.206*	.266*	.191*	.185*
	R ²	.062	.000	.042	.07	.036	.034
TRIG	Pearson	.284*	.166*	.285*	.322*	.128	.277*
	R ²	.081	.028	.081	.104	.016	.077
Glucose	Pearson	.287*	.044	.271*	.277*	.238*	.208*
	R ²	.082	.002	.073	.077	.057	.043
Resting SBP	Pearson	.126	.201*	.178*	.130	.102	.176*
	R ²	.016	.040	.032	.017	.010	.031

CONCLUSIONS: Though the correlations were statistically significant, none of the DXA body composition measures explained a physiologically relevant portion of the variance in the CVD risk markers measured. We suggest that factors other than body fat contribute to lipid and blood pressure profiles in firefighters, a population at high risk for CVD.

417 Board #238 May 31 9:30 AM - 11:00 AM
Analysis of Dietary Intake in Volunteer Firefighters
 Kelly C. McLaughlin¹, Lauren N. Chavis¹, Rachel Dickinson¹, Emily Reeve¹, Christian K. Roberts, FACSM², Deborah L. Fearheller¹. ¹Ursinus College, Collegeville, PA. ²Occidental College, Los Angeles, CA. (Sponsor: Christian Roberts, FACSM)
 (No relationships reported)

Cardiovascular disease remains the leading cause of death in the United States. Dietary patterns can influence many risk factors for cardiovascular disease, such as blood pressure, lipid levels, body composition and glucose metabolism. Cardiac events are the leading line-of-duty deaths in firefighters. Due to the fast-paced and unpredictable

nature of the work as well as lack of proper kitchen equipment, firefighters often rely on quick, easy meals that may not be optimally nutritious. Limited research has examined firefighter's dietary intake and preferences. **PURPOSE:** To analyze the dietary intake of volunteer firefighters. **METHODS:** Seemingly healthy male volunteer firefighters (n=18, 34.1 ± 11.7 years of age) participated in a dietary workshop. Height and weight of each participant was measured. Participants were asked to collect a three-day diet recall which was analyzed using Diet Analysis Plus. **RESULTS:** The BMI of study participants was 32.4 ± 4.9 kg/m². On average, the participants consumed 1753 ± 503 kcals daily. The macronutrient breakdown was 197.8 ± 83.8 g (45.1%) carbohydrates, 71.6 ± 19.6 g (36.8%) fats and 75.6 ± 18.3 g (17.2%) protein. Types of fat intakes were: saturated fat (24.8 ± 6.7 g), monounsaturated fat (20.5 ± 7.8 g), polyunsaturated fat (11.5 ± 6.9 g), and trans-fat (2.0 ± 5.5 g) per day. In addition, 14.1 ± 6.2 g of dietary fiber, 70.9 ± 57.6 g of sugar, and 3008 ± 1231 mg sodium was consumed. Furthermore, the firefighters reported intakes of 10.0 ± 6.0 g linoleic acid, 1.0 ± 0.7 g linolenic acid, 735 ± 466 mg calcium, 170 ± 78 mg magnesium, 1775 ± 850 mg potassium, and 3 ± 2 µg vitamin D. **CONCLUSION:** Our results suggest volunteer firefighters do not consume diets in line with the 2015 Dietary Guidelines for Americans; however, additional data is needed to completely understand the dietary preferences of firefighters.

418 Board #239 May 31 9:30 AM - 11:00 AM

The Body Mass Index And Its Relationship With Cardiovascular Risk in Québec Firefighters

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Firefighting tasks in emergency conditions impose high physiological and psychological demands, which can be particularly deleterious to the health and safety of firefighters. According to the *National Fire Protection Association*, 51% of the deaths that occurred among U.S. firefighters in 2015 while on duty were sudden cardiac deaths. Therefore it is essential for firefighters to maintain a healthy body weight throughout their career in order to reduce the risk of on-duty death. Body mass index (BMI) is very likely associated to a higher cardiovascular disease (CVD) risk in firefighters. Misclassifying mesomorphic firefighters as obese by using BMI occurred infrequently in a U.S. firefighters' cohort (Poston et al. 2011, *J Occup Env Med*, 53(3), 266-273). **PURPOSE:** To document CVD risk among Québec firefighters according to their BMI. **METHODS:** Seven hundred and seventy nine (779) male firefighters (age: 41.6 ± 10.4 years; BMI: 28.0 ± 3.6 kg/m²) answered an online questionnaire evaluating the presence of CVD risk factors and symptoms. All data collected were self-reported. Three groups were formed based on the BMI; Group 1 (G₁): 18.5 kg/m² ≤ BMI < 25 kg/m², Group 2 (G₂): 25 kg/m² ≤ BMI < 30 kg/m², Group 3 (G₃): BMI ≥ 30 kg/m². **RESULTS:** Prevalence of overweight (25 kg/m² ≤ BMI < 30 kg/m²) and obesity (BMI ≥ 30 kg/m²) is 59.9% and 23.6% respectively. The number of modifiable risk factors (diabetes, hypertension, physical inactivity, smoking and dyslipidemia) is higher among firefighters with higher BMI before adjusting for age (G₁: 0.70 ± 0.71, G₂: 0.94 ± 0.78, G₃: 1.32 ± 1.00, P ≤ 0.001) and after (G₁: 0.77 ± 0.70, G₂: 0.94 ± 0.75, G₃: 1.23 ± 0.93, P ≤ 0.001). The BMI of participants who didn't have any cardiovascular symptom (n=463) was lower than that of participants who did report at least one cardiovascular symptom (n=285) before adjusting for age (27.35 ± 2.94 vs 28.44 ± 3.97, P ≤ 0.001) and after (27.37 ± 2.85 vs 28.44 ± 3.83, P ≤ 0.001). **CONCLUSION:** These results show the important prevalence of overweight and obesity among Québec firefighters based on BMI. They also show the relationship between BMI and CVD risk factors and symptoms. These relationships suggest that the BMI is an important indicator of CVD in Québec firefighters.

P. Gendron was supported by a doctoral research scholarship from Fonds de recherche du Québec en santé.

419 Board #240 May 31 9:30 AM - 11:00 AM

Efficacy of a Goal Setting Intervention on Firefighters' Cardiorespiratory Fitness: A Pilot Randomized Controlled Trial

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PURPOSE: The purpose of this study was to assess the effectiveness of a goal setting and implementation planning intervention on cardiorespiratory fitness among firefighters. **METHODS:** Male career firefighters (N=18) from a large municipal fire department with nine or more years on the job were randomized to an intervention arm (n=10) or passive control arm (n=8) of a 14-week study involving cardiorespiratory exercise. The intervention consisted of a goal setting and implementation planning coaching toward improving cardiorespiratory fitness at baseline, as well as support

throughout the 14 weeks of the study (i.e., midpoint goal coaching, surveys on goal adherence). Cardiorespiratory fitness was assessed through a standardized physical protocol for firefighters (Candidate Physical Ability Test; CPAT) at baseline, 6 week, at 14 week time points, using the Cosmed K4b2 portable metabolic system to measure physiological variables. Using intention-to-treat principles, we employed a 2-level multilevel model to examine the effect of intervention group on intercept and change over time on primary outcomes of interest: oxygen transport and utilization (VO₂), heart rate (HR), and respiratory exchange ratio (R). **RESULTS:** The intervention and control groups both exhibited a significant increase in VO₂ (B=0.1414, SE=0.0253, p<.0001), and a decline in R (B=-0.0026, SE=0.0008, p<.01) over the course of the study. However, there were no significant effects of randomization group on intercepts or slopes of any of the three outcomes, indicating that there were no significant differences in cardiorespiratory fitness when intervention group was compared to the control group. **CONCLUSION:** Although both groups exhibited improvements on two of the three cardiorespiratory outcomes, the addition of goal setting and planning implementation intervention did not convey additional benefits over the effect of a control group. The current study was the first to directly measure cardiorespiratory demands of actual firefighter job tasks (CPAT), as measured by using a portable metabolic system. Importantly, the results of this intervention provided estimates that will be used to appropriately power a larger future trial testing the effect of goal setting and planning implementation in improving cardiorespiratory health.

420 Board #241 May 31 9:30 AM - 11:00 AM

The Effect of Age on Cardiorespiratory and Muscular Fitness Measures in Female Firefighters

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The profession of firefighting is physically demanding, requiring a high level of both cardiorespiratory and muscular fitness. However, few studies have examined these fitness components among female firefighters (FF) and it remains unclear if this population is meeting minimum standards adopted by the National Fire Protection Association (NFPA). **PURPOSE:** To describe cardiorespiratory and muscular fitness of female career FF, and to determine if ageing affected their achievement of recommended profession standards. **METHODS:** A cross-sectional analysis of age groups (25-34, 35-44, 45-54, >55 yr) was conducted on 96 female FF over a ten-year span. Outcomes included cardiorespiratory fitness (CRF) expressed as maximum METs achieved during graded exercise to volitional fatigue, and muscular fitness (push-ups, sit-ups, and Sorenson back endurance). A one-way analysis of variance (ANOVA) with Bonferroni post-hoc comparisons was used to determine mean (± SD) differences (alpha level of 0.05) between age groups. **RESULTS:** The mean maximum METs achieved was significant across age groups, decreasing from 14.0 ± 2.2 in the 25-34 age group to 12.8 ± 1.4 in the 55+ age group (p<0.0001). The mean maximum number of push-ups was significant across age groups, decreasing from 34.0 ± 13.8 in the 25-34 age group to 31.6 ± 16.1 in the 45 to 54 age group, but increased to 35.8 ± 13.2 in the 55+ age group (p=0.02). Mean differences between age groups for sit-ups and the Sorenson test were not significantly different (p>0.05). **CONCLUSION:** While the mean values for age-groups consistently met or exceeded the 12-MET minimum CRF standard of the NFPA, the percentage of FF that fell below this cut-off ranged from 13% in the 25-34 age group to 39% in the 45-54 age group. Strategies to maintain fitness among all female FF are needed to ensure safe and effective job performance.

421 Board #242 May 31 9:30 AM - 11:00 AM

Heart Rate Recovery As Part Of Firefighters' Selection Process?

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(No relationships reported)

During a fire response, firefighters must carry out interventions that can vary in time followed by pauses for recovery. Thus, the ability to assay effort recovery is essential for firefighters to perform the requested task several times. **PURPOSE:** The objective of this study was to observe the heart rate (HR) recovery after a firefighter task simulation course test and rank their performance. **METHODS:** During the session, three groups of participants were asked to pass the course test, totalling n=48. Participants had an average of 23 ± 2.6 years, body weight 82 ± 8.7 kg and height 177 ± 6.4 cm (BMI of 26.2 ± 2.2 kg / m²). The course included seven tasks: fire hose handling, obstacles course with equipment, climbing up and down a 5 stair

staircase with hose, forced entry simulations with a sledgehammer, portable ladder manipulation, exploration work with a gaff pole and transporting an unconscious victim. Each participant was equipped with a HR monitor. A performance index, using heart rate at minute two of a 4 minute recovery period sitting down immediately after the course test and time of completion, was created to determine if a participant could in theory pass to the next stage of a hiring process. **RESULTS:** The maximal heart rate was 197 ± 2.6 bpm and represented the HR reached during the course test. The percentage of HR recovery after 2 min was $30 \pm 4.1\%$ for participants who passed ($n=40$) and $20 \pm 2.6\%$ for participants who did not pass ($n=8$) ($p<0.001$). Decrease of relative recovery was significantly different for the participants who passed or did not pass ($p < 0.05$), between 8 and 10 %. The index identified the overall performance with discrimination ($p<0.001$) for the two groups (7.79 ± 0.52 and 6.14 ± 0.52 , respectively). **CONCLUSIONS:** The evaluation of firefighters reveals the high intensity of effort required during intervention situations and the need to consider the moments of pauses, duration of pauses and aerobic fitness.

422 Board #243 May 31 9:30 AM - 11:00 AM
Physical Fitness, Body Composition And Quality Of Life Among Brazilian Police Recruits

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Policing is a dangerous activity with intense physical and psychological demands that might impact police officers (PO) quality of life **PURPOSE** To evaluate physical fitness (PF), body composition (BC) and the quality of life (QL) among Brazilian male military police officer recruits **METHODS** Participants were 219 male PO recruits of a northern state of Brazil engaged on a mandatory 6-month training course before admission in the Police Department. The course is a 6-month full-time activity that includes 3 sessions of physical training/week and other police tasks. During the early part of the course, cardiorespiratory fitness (CRF) and muscle strength (MS) were evaluated by means of the Cooper running test (CRF), curl up, pull up and push up tests (MS). BC was evaluated by BMI, body fat percentage (BF% - Jackson & Pollock 3 skin fold) and waist circumference (WC). In the same evaluation, QL was assessed by the WHOQOL-Bref, that ascertains the QL in four domains: physical, psychological, social, and environmental. We compared the QL by BMI categories (normal vs overweight+obese) using Mann-Whitney test. We also evaluated the correlation between PF tests and QL (Spearman test), always applying 5% level of significance **RESULTS** Mean (\pm SD) PO age and BMI were 25.5 ± 3.6 years and 24.4 ± 2.5 kg/m². PO showed high level of PF and reduced QL (Table 1). There was no association between all PF components and all QL domains ($r < 0.1$, $p > 0.12$). Using BMI, 33% of PO would be classified as overweight and 2.7% as obese, but all participants were in the normal range for BF% and WC ($< 20\%$ and < 94 cm, respectively) **CONCLUSION** We observed high levels of PF and a relatively impaired QL among young PO recruits. Contrarily to previous findings, QL was not correlated to PF which may be related to high demands during the course. Therefore, considering BF% and WC values, the adequacy of using BMI for BC evaluation in this population (young well fit PO recruits) needs further

Table 1 Descriptive values of physical fitness, BC and QL among 219 Brazilian male PO recruits	
	mean \pm sd
Push up (repetitions)	30.4 \pm 2.32
Curl up (repetitions)	34.4 \pm 3.58
Pull up (repetitions)	7.7 \pm 3.68
CRF (VO ₂ max-mL.kg ⁻¹ .min ⁻¹)	48.5 \pm 3.65
BF (%)	11.2 \pm 3.8
WC (cm)	80.3 \pm 5.5
QL Physical domain	66.5 \pm 15.17
QL Psychological domain	75.6 \pm 17.06
QL Social domain	69.5 \pm 18.33
QL Environmental domain	54.4 \pm 13.48

A-53 Free Communication/Poster - Perception of Effort, Pain and Fatigue

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

423 Board #244 May 31 11:00 AM - 12:30 PM
Effect Of Bench Press Load Knowledge On Repetitions, RPE, And Attentional Focus

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The central governor theory (CGT) states that metabolites that act through sensory feedback mechanisms act on the brain and spinal cord, allowing the nervous system to decide the extent of skeletal muscle recruitment during exercise. This ensures that homeostasis is maintained throughout exercise, regardless of the conditions of the exercise. Few studies have examined the role of the CGT and teleoanticipation during resistance training. **PURPOSE:** Examine the role of the CGT and teleoanticipation during resistance training, while completing the bench press (BP) during a known and unknown load. **METHODS:** A convenience sample of 26 participants (age=21.31 + 1.99 yrs, ht 175.08 + 9.15 cm; mass 81.04 kg + 13.16 kg) completed three testing sessions: 1) 1 RM BP determination; 2) Submaximal BP reps to fatigue known weight (KW); 3) Submaximal BP reps to fatigue unknown weight (UW). KW and UW sessions were randomized and completed at 70% 1RM. **RESULTS:** One-way ANOVA revealed no significant effects for testing order. Repeated measures t-tests revealed no significant differences in number of repetitions (KW 14.23+ 2.76 v. UW 14.73 + 2.24; t = 1.18, df = 25, p = .25), RPE (KW 13.37 + 1.40 v. UW 13.00 + 1.66; t = 1.26, df = 25, p = .22) or attentional focus (% associative v. % dissociative) (KW 68.46 + 12.87 v. UW 68.85 + 13.36, t=0.15, df = 25, p = .88). **CONCLUSIONS:** While completing the BP participants used more associative rather than dissociative attentional strategies. RPE, reps to fatigue, and attentional did not differ across KW and UW conditions. Load knowledge did not influence performance.

424 Board #245 May 31 11:00 AM - 12:30 PM
Evaluating Instructions For Use Of The Rate Of Perceived Exertion Scale: A Pilot Study

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PURPOSE: The purpose of this study was to determine if there is a difference in understanding of Rate of Perceived Exertion (RPE) with two types of instructions. **METHODS:** Older adults that lived independently at a life care community participated in this study (N = 18). Two interviews took place more than seven days apart from each other. One participant only attended the first interview. At the first interview, participants signed the necessary paperwork and randomly chose which script (Brief or Modified Borg) would be read. At the second interview the remaining script was read. Identical sets of description, scenario and feedback questions were asked after each script. Participants were asked to describe the feeling of RPE's 6,9,13, 17, and 20. In addition, scenarios were said and they were asked to label the situations RPE level for themselves. Scenarios included gate closing at the airport (Airport Scenario), playing with children, and a typical trip to the grocery store. Responses were rated 'Good,' 'Needs Improvement,' and 'Exact.' Situations were analyzed by script and frequency. **RESULTS:** The Modified Borg instructions had a higher number of 'Good' descriptions for 6 (n = 13 vs. n = 12), 9 (n = 14 vs. n = 11), 13 (n = 9 vs. n = 4), and 17 (n = 12 vs. n = 3). RPE of 20 had equal (n = 10) participants with 'Good' descriptions for both scripts; however, the Modified Borg had two more participants that 'Needed Improvement.' The Airport scenario for the Brief instructions ranged from 13 to 20 RPE and 8 to 17 RPE for the Modified Borg. The most common answers were 13 (n = 5) and 15 (n = 5) for the Brief, and the Modified Borg's were 12 (n = 4) and, 11, 13 and 14 (n = 3). Playing with children scenario resulted in 11 and 12 being the most common answer given for both scripts (n = 3 - 6). The children scenario ranged from 7 to 18 for the Brief Script and 6 to 13 for the Modified Borg. Most answered response was 11 (n = 6) to the grocery store scenario for both scripts ranging from 8 to 14 and 6 to 14 for the Brief and Modified Borg. **CONCLUSION:** Perception widely varies between the participants for the different scenarios. The longer more descriptive instructions were helpful but were possibly too long for the adults to be more accurate than the brief script.

WEDNESDAY, MAY 31, 2017

425 Board #246 May 31 11:00 AM - 12:30 PM
The Effect of an Energy Harvesting Backpack on Perceived Exertion during Locomotion

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Biomechanical energy harvesting from elastically-suspended load carriage is a promising source of power for Soldiers, who often march with heavy loads at varying speeds on various terrains. An energy harvesting backpack (EHB) has been developed which generates power from vertical oscillations during locomotion. Ideally, the EHB should not increase psycho-physiological burden compared to the standard military assault pack (AP). **PURPOSE:** To compare ratings of perceived exertion (RPE) while walking with an EHB and an AP at different speeds on different grades. **METHODS:** 16 subjects (M±SD; 28.6±4.9 years; 173.4±10.6 cm; 78.7±16.4 kg) walked on a treadmill with each pack for 5 minutes at each of three grades (+5%, 0%, and -5%) and each of two speeds (1.34 m/s and self-selected faster speed). Both the AP and EHB contained a 15.9 kg load, but the design of the EHB made it 4.4 kg heavier than the AP. A Borg RPE score was taken during the last 10 seconds of walking at each grade and speed. A within-subjects ANOVA was used to determine effects of pack, grade, and speed on log-transformed RPE. Alpha level was set a priori at p<0.05. Post-hoc comparisons were explored using Bonferroni corrections. **RESULTS:** There were main effects for pack, speed, and grade ($F_{1,152}=14.3$, $F_{1,152}=100.1$, and $F_{1,152}=346.3$, respectively; p<0.001) with no interaction effects. Subjects reported a greater sense of exertion with the EHB (11.9±2.8) than with the AP (11.2±2.6) regardless of speed and grade. Faster speeds elicited higher RPE scores than slower speeds (13.1±2.4 and 10.1±2.1, respectively), while the incline grade produced higher RPE scores (13.1±2.5) than decline and level grades (10.3±2.3 and 11.2±2.5, respectively). **CONCLUSIONS:** The EHB caused greater levels of perceived exertion that were not altered by walking speed or grade. This may be due to the extra stabilization required or the extra weight cost of the EHB. Kinematic variables (trunk lean) related to this research suggest potential non-linear effects of EHB use, which may also be related to the increased perceptions of exertion found here. This may affect trade-offs between power generation, perceived exertion, and metabolic cost that warrants further research and may ultimately affect user-acceptance of suspended-load energy harvesting systems in the field.

426 Board #247 May 31 11:00 AM - 12:30 PM
Validity And Reliability Of Borg's 6-20 RPE Scale Among Chinese Mandarin Speaking Young Healthy Adults

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The validity and reliability of the Borg's 6-20 Rating of Perceived Exertion (RPE) scale has not been tested among Chinese people from Mainland China. Leung and Wang each have published a Chinese version RPE scale but neither has been validated in Chinese speaking people from Mainland China. **PURPOSE:** This study assessed: 1. The validity of Leung Chinese version (n=22) and Wang Chinese version (n=23) of the Borg 6-20 scales; 2. The reliability of Wang Chinese version (n=11) of RPE scale; and 3. The agreement of these two Chinese versions (n=21) of the RPE scales during the Bruce treadmill protocol testing among young healthy adults from Mainland China. **METHODS:** A total of 26 subjects (11 males, and 15 females), age 22.7±3.0 yr., volunteered to participate. They performed one (n=3), two (n=14), or three trials (n=9) of the identical Bruce treadmill protocol exercises within a time span of 9.0±5.1 days (validation trials), and 30.4±27.9 days (reliability trials). The objective measures of exercise intensity (power output, heart rate, and oxygen consumption) and the subjective measure of effort (RPE) were observed during the incremental exercise. **RESULTS:** Significant (p<0.01) Pearson linear correlations coefficients (r) were found where RPE values were strongly correlated with power output (Leung version $r_{s\geq 0.75}$, Wang version $r_{s\geq 0.73}$), heart rate (Leung version $r_{s\geq 0.84}$, Wang version $r_{s\geq 0.87}$), and oxygen consumption (Leung version $r_{s\geq 0.80}$, Wang version $r_{s\geq 0.81}$). The overall test-retest interclass correlation coefficient (ICC) was 0.94. All the Bland-Altman plots for stage 1 to 3 showed that at most 1 data point was outside of the limits of agreement. Fisher z-transformation test found no significant differences in correlation (all $p>0.05$) between trials for the reliability test of Wang version scale, and found no significant difference (p>0.05) in correlation with objective measures between the two Chinese versions of RPE scale. **CONCLUSIONS:** Both Leung and Wang Chinese versions Borg's 6-20 RPE scales are valid psychophysiological tools to measure perceptions

of exertion during controlled Bruce treadmill protocol exercise among young healthy Chinese adults. The Wang scale is reliable, and the Leung and Wang scales show good agreement with each other.

427 Board #248 May 31 11:00 AM - 12:30 PM
Perceptual Responses Of High Intensity Interval Training Among Overweight And Obese Individuals

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INTRODUCTION: Poor exercise adherence is resulting in a rise of chronic diseases. High intensity interval training (HIIT) may improve adherence as it takes less time and is less monotonous. Beneficial physiological effects have been measured, but perceptual responses to HIIT have not been researched in overweight and obese (OW/OB) individuals. **PURPOSE:** To analyze whether participants prefer HIIT in comparison to continuous aerobic exercise (CON). **METHODS:** OW/OB individuals (30-55 years old) completed, in a randomized order: CON) a 45 minute walk at 65% of the age predicted maximal heart rate (APMHR), HIIT60) a 20 minute exercise in which the intensity alternated between 80% AMPHR and 60% APMHR every 60 seconds, and HIIT90) a 21 minute exercise in which the intensity alternated between 80% AMPHR and 60% APMHR every 90 seconds. Heart rate (HR), ratings of perceived exertion (RPE), and exercise enjoyment were measured during the exercise. Feeling scale (FS) and physical activity enjoyment scale (PACES) was measured 5 and 35 minutes post exercise. A qualitative (QUAL) interview was conducted 35 minutes post exercise. **RESULTS:** HIIT was more preferred than CON as evidenced by a higher (p<0.05) Friedman's rank score in HIIT90 and HIIT60 compared to CON. Post exercise PACES was higher (p<0.05) in HIIT60 and HIIT90, and FS was higher with HIIT60. Higher HR during HIIT60 and HIIT90 (p<0.05) indicate higher intensities during the exercise. Perceived exertion was higher (p<0.05) in HIIT90 and HIIT60, as evidenced by Friedman's rank scores of 2.36, 2.29, and 1.36 in HIIT90, HIIT60, and CON. QUAL data showed a feeling of passive exercising among CON compared to dynamic exercising among HIIT. Inability to self-regulate and safety concerns were felt in regards to HIIT. Lack of time and energy were factors for not exercising; HIIT was seen to be an effective method for time compared to CON for lack of energy. **CONCLUSIONS:** HIIT was a more preferred exercise, both during and after the exercises, regardless of the higher intensities. Greater challenges as well as dynamic changes in intensity were referenced as positive exercise perceptions. Both exercises were seen to be utilized in different scenarios such as lack of time for HIIT and a family activity for CON. Thus, HIIT is a preferred exercise within those who are OW/OB.

428 Board #249 May 31 11:00 AM - 12:30 PM
Impact of Using Perceptually Regulated Recovery Periods During Repeated Sprint Work

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Work-to-rest ratios (W:R) are designed to allow optimal recovery in sequential exercise bouts with particular consideration of intensity and duration. Emerging evidence supports the use of perceptual measures of recovery as valuable training tools in human performance. However, the efficacy of a perceptual measure of recovery compared to pre-established W:R during bouts of repeated sprint work has not been explored. **PURPOSE:** To compare performance during identical bouts of repeated sprints using either traditional W:R methodology vs. the use of a perceptual measure to gauge recovery. **METHODS:** Eight sprint-trained individuals completed two repeated sprint trials consisting of 3 sets of 8, 30-meter sprints on a non-motorized treadmill. Between each set of sprints, participants were given either a standard 5-min recovery whereupon the next set of sprints began or they were allowed to gauge recovery using a previously tested 0-10 Perceived Recovery Status (PRS) Scale. When using the PRS, once a participant estimated a recovery level '5' they began their next set of sprints. Performance measures included power (watts), decrements in power (DEC), recovery of power between sets (REC), and acute RPE estimated per sprint, but averaged to represent RPE in a set. **RESULTS:** When using the PRS, individuals self-selected longer recovery times than the standard 5 minutes (on average 24 sec longer between sets 1 and 2 and 1 min 54 sec longer between sets 2 and 3). A 2 (trial) x 3 (sets of sprints) repeated measures ANOVA revealed no significant differences (p > 0.05) in performance measures. However, performance was improved, albeit not significantly, when participants used the PRS method vs. the traditional W:R. In general, when using

the perceptually-regulated recovery strategy, improvements (~8-12%) were observed in power, DEC, REC, and RPE vs. a set 5-min recovery period. **CONCLUSIONS:** Results indicate that perceptually regulated recovery periods were longer but produce, at a minimum, statistically similar repeated sprint performance results. In addition to greater convenience associated with subjective markers, increased adherence to exercise associated with this form of training is plausible when using perceptual markers to set intensities during exercise.

429 Board #250 May 31 11:00 AM - 12:30 PM
Comparison Of Different Instructional Sets For Patient-Generated Indexes Of Pain Severity

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Patient-Generated Indexes (PGIs) are a form of individualized patient-reported outcome measure that request patients to self-identify a predetermined number of health concerns and then rate the severity of the concerns. PGIs have been used to measure such concerns as quality of life, physical function, disability, and pain. The instructional sets of PGIs vary, but no studies were located that have tested the impact of different PGI instructional sets on severity ratings. **PURPOSE:** This study directly compared a PGI instructional set that requested painful activities (PGI-pain) to a PGI instructional set that requested activities from which the respondent most wanted less pain (PGI-painrelief). **METHODS:** The sample consisted of cohorts of patients with knee osteoarthritis (OA) who were either non-surgically managing their OA (n = 31, 62 yrs old (SD = 10.18), 64.5% women) or scheduled for their first joint replacement/s (n = 30, 56 yrs old (SD = 6.45), 70.0% women). During a single visit, patients completed both PGIs without any activity prompts. Also, they completed a numeric pain scale for rating the highest pain in the most painful knee. **RESULTS:** Both PGIs correlated with the numeric pain ratings ($r^2 = .76 \text{ \& } .80, p < .01$). No significant differences in the patients' pain ratings were detected between the two PGIs ($t_{60} = 0.35, p > .05$), but the pre-surgical patients' pain ratings were higher than the non-surgical patients using both PGIs ($t^*_{59} = -6.94 - -5.55, p < .01$). The importance of the activities that the patients identified for the PGI-painrelief was higher than for the PGI-pain ($t_{60} = -4.28, p < .01$) and the pre-surgical patients' ratings of activity importance were higher than the non-surgical patients using both PGIs ($t^*_{59} = -4.56 - -3.31, p < .01$). **CONCLUSIONS:** The results support the construct and concurrent validity of both PGIs. Although ratings of pain severity did not differ between the two PGIs, the importance of the self-selected activities varied between them. Thus, the instructional set of PGIs may influence the criteria respondents use for identifying their concerns. These findings contribute to previous reports from qualitative studies that people prefer to assess activities they view as important. Future studies should test the impact of PGI instructional sets on responsiveness to change across time.

430 Board #251 May 31 11:00 AM - 12:30 PM
Predicting Affective Exercise Responses from a Submaximal Exercise Test Using the Feeling Scale

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The feeling scale (FS), rated -5 to +5, where -5 is an affective state of very bad and +5 is very good, has been validated across the moderate to severe exercise domains during incremental exercise; however, little has been reported on constant-load exercise. **PURPOSE:** To examine the FS during the Mankato submaximal exercise test (MSET) and predict FS responses at intensities above and below gas exchange threshold (GET). **METHODS:** A total of 8 women and 6 men (age 21 ± 1) completed the MSET using stages of 35 and 65% of estimated maximal work capacity (W_{peak}). Participants returned for 10-minute constant-load bouts at 50 and 70 or 72% estimated W_{peak} . FS was assessed at the end of each minute of the MSET and constant-load bouts. Linear regression from the MSET was used to predict FS at 50 and 70% W_{peak} . Actual and predicted values were compared using the Wilcoxon test. **RESULTS:** Actual ratings declined in the 50% W_{peak} trial reaching the lowest FS rating of 0.63 ± 2.84 , a value not differing from the estimate of 0.64 ± 2.43 ($z = 0.11, p = 0.92$). Six participants failed to complete the entire 70% W_{peak} trial. Continual time-dependent decreases in FS were reported by the remaining participants. The actual end-exercise value (-1.00 ± 2.06) did not differ from the predicted (0.21 ± 2.06) ($Z = 1.40, p = 0.16$). **CONCLUSION:** Affective responses using the FS can be predicted for exercise below GET; however, it may be limited in predictability above GET.

431 Board #252 May 31 11:00 AM - 12:30 PM
Caffeine but not Low-Carbohydrate Improves Exercise Capacity in Sedentary Adults Similar to Endurance Trained Athletes

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Caffeine (CAF) and small amounts of carbohydrate (CHO) ingested or simply exposed to the oral cavity appear to delay fatigue during prolonged exercise, possibly through central nervous system mechanisms. However, this has been primarily documented in endurance trained (ET) athletes. **PURPOSE:** To determine if: 1) CAF and/or a low dose of CHO (equivalent to CHO contained in ergogenic mouth rinse and insufficient to trigger a peripheral metabolic response) improves endurance capacity in sedentary adults (SED) similar to ET and 2) potential ergogenic mechanisms differ based on fitness status. **METHODS:** Using a double-blind crossover design, ET and SED (n=12 each) completed four exercise trials consisting of 30 min cycling at 90% lactate threshold followed by cycling time to fatigue (TTF) at 105% lactate threshold. The following solutions were ingested after standardized 43 g CHO breakfast: CAF (3 mg/kg), low (<1%) CHO (LCHO), combined CAF+LCHO, and placebo (PLA). **RESULTS:** ET and SED did not differ in overall mean (\pm SD) TTF (23.8 ± 8.1 vs. 24.1 ± 11.3 min) but TTF improved ($p < 0.05$) in CAF+LCHO versus LCHO. When averaging across both CAF treatments (CAF+LCHO and CAF), perceived exertion was lowered and TTF was increased by 21% (26.3 ± 10.4 vs. 21.7 ± 9.9 min) compared to the two no-CAF treatments (PLA and LCHO), but CAF did not alter muscle strength/activation. Blood glucose, lactate, and CHO oxidation were higher with CAF vs. no-CAF treatments. Fat oxidation was higher in ET compared to SED, but CAF did not alter fat oxidation. **CONCLUSIONS:** The ergogenic benefit and action of CAF appears to be independent of fitness status. The addition of LCHO ingestion, previously observed to act centrally, did not further augment benefits of CAF in the fed state.

432 Board #253 May 31 11:00 AM - 12:30 PM
Fatigue as a Rehabilitation Strategy to Reduce Quadriceps Inhibition Following Anterior Cruciate Ligament (ACL) Reconstruction

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Arthrogenic muscle inhibition (AMI), an inability to fully activate the quadriceps muscles, has been consistently observed in patients with anterior cruciate ligament reconstruction (ACLR) surgery. Reductions in quadriceps activation may be partly due to the flexion reflex pathway, which includes the activation of the hamstrings and reciprocal inhibition of the quadriceps. Central fatigue has been shown to reduce muscle activation, change movement strategy, and shift loading to other muscles. Therefore, we hypothesized that the fatigue of the hamstrings could be used to alleviate the quadriceps muscle inhibition by counteracting the flexion reflex. **Purpose:** To determine the effects of fatigue on reducing quadriceps muscle inhibition after ACLR reconstruction. **Methods:** A total of nine adult athletes (19.9 \pm 1.7 years old) with unilateral ACLr and nine control athletes (24.0 \pm 2.4 years old) with no previous history of knee injury were recruited. Fatigue was induced in subjects by performing tempo squats, in which the ACLr group tended to use hamstrings for more hip flexion and trunk forward flexion than the control group. Quadriceps inhibition was assessed through the central activation ratio (CAR), measured by twitch interpolation, before and after the fatigue for each subject. A Mixed ANOVA was performed to examine the effect of fatigue on the CAR between pre- and post-fatigue, and among ACLr and control groups. **Results:** The CAR of the quadriceps was significantly greater post-fatigue than pre-fatigue for the ACLr group (96.0 \pm 7.6% vs. 81.2 \pm 15.8%, $p=0.010$); whereas no significant differences were observed for the control group between post-fatigue and pre-fatigue (96.9 \pm 9.6% vs. 97.0 \pm 17.1%, $p=0.969$). Additionally, in pre-fatigue trials the ACLr group had marginally significant less CAR (81.2 \pm 15.8% vs. 97.0 \pm 17.1%, $p=0.067$) than the control group; after fatigue trials no significant differences of CAR were observed between the ACLr and control groups (96.0 \pm 7.6% vs. 96.9 \pm 9.6%, $p=0.838$). **Conclusion:** These results suggest that fatigue training can be used as a rehabilitation strategy to restore normal quadriceps function at the knee joint following ACL reconstruction by relaxing the hamstrings and overcoming the inhibition of the quadriceps.

433 Board #254 May 31 11:00 AM - 12:30 PM
Recreationally-Trained Subjects are Unable to Attenuate VO₂ Slow Component During Severe Exercise Using RPE
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Previous research indicates that recreationally-trained subjects are able to attenuate the slow component of oxygen uptake (VO₂) during heavy intensity exercise using rating of perceived exertion (RPE). Little is known, however, about the use of RPE to attenuate the slow component when exercising in the severe exercise domain. **PURPOSE:** The present study examined the degree to which recreationally-trained subjects could attenuate the VO₂ slow component while cycling in the severe exercise domain. **METHODS:** A total of 15 volunteer subjects, 9 males, and 6 females (mean age ± SD = 22.3 ± 1.8), completed a 3-minute all-out exercise test for the determination of critical power (CP) and the curvature constant (W'). Subjects then returned and completed two separate bouts at 10% >CP. The constant bout required subjects to sustain their preferred cadence until exhaustion. The regulated bout involved subjects attempting to maintain their RPE from 2-min into the bout by adjusting power output until their power output declined to a value ≤ CP. **STATISTICAL ANALYSIS:** Paired t-tests were conducted. **RESULTS:** The constant bout evoked a VO₂ value (43.3 ± 7.3 ml·kg⁻¹·min⁻¹) that was not different from VO_{2max} (43.1 ± 7.4 ml·kg⁻¹·min⁻¹) (t = 0.17, p = 0.87), confirming that the intensity was in the severe exercise domain. In the regulation bout, there was a significant gain (~7 ml·kg⁻¹·min⁻¹) in VO₂ between 2 min and the end of exercise (t = 6.25, p < 0.01). A wide range of utilization for the work capacity above CP was observed (2.0 - 13.7 kJ). **CONCLUSION:** In contrast to exercise in the heavy domain, recreationally-trained subjects are unable to attenuate the VO₂ slow component using their RPE in the severe domain. Future research is needed on fitter subjects and/or different psychometric scales.

434 Board #255 May 31 11:00 AM - 12:30 PM
Acute Affective Responses To High-Intensity Interval Training In Trained and Untrained Men
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Although exercise has been shown to alter transiently affective variables, the impact of fitness levels on affective response to high-intensity interval training (HIT) remains unclear. **PURPOSE:** The present study was designed to compare affective responses between HIT and continuous exercise at low-intensity in trained and untrained men. **METHODS:** Twenty male subjects (21.2 ± 0.34 years) were divided into trained group (TR, n=10, maximal oxygen uptake (VO_{2max}) 55.6 ± 1.1 ml/kg/min) or untrained group (UT, n=10, VO_{2max}: 40.5 ± 1.0 ml/kg/min). All subjects completed two trials in random order, consisting of HIT (10 × 1 min pedaling at 90% of VO_{2max}) with 1 min of active rest at 30% of VO_{2max}) or 60 min of pedaling at 50% of VO_{2max} (LOW). Scores of muscle soreness, fatigue, vitality and desire for exercise were evaluated using visual analog scale before exercise and during 60 min of post-exercise period. Moreover, two-dimensional mood scale (TDMS) was conducted to assess vitality, stability, pleasure and arousal. Blood samples were also collected to determine blood lactate glucose concentrations. During exercise, heart rate (HR) and rating of perceived exertion (modified 10 scale) were recorded. **RESULTS:** Exercise-induced blood lactate elevation was significantly greater in the TR group than in the UT group (group × time, P < 0.05). The results of TDMS revealed that exercise altered significantly arousal, vitality, stability and pleasure (main effect for time, P < 0.05) after HIT and LOW. However, scores of vitality, stability and pleasure were significantly (P < 0.05) elevated 60 min after HIT in the UT group, whereas the TR group did not show similar change. **CONCLUSIONS:** These findings suggest that exercise improves acutely affective variables. However, the affective response to exercise appears to be particularly influenced by fitness levels, and HIT augments vitality, stability and pleasure during post-exercise period only in untrained men, not in trained men.

435 Board #256 May 31 11:00 AM - 12:30 PM
The Validity of Oxygen Uptake Efficiency Measures in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome
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Maximum oxygen uptake is often used to evaluate cardiopulmonary function in patients with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). However, many ME/CFS patients may not be capable of giving the level of effort required for a valid test. Oxygen uptake efficiency slope (OUES) has been proposed as an effort independent measure to assess aerobic fitness in populations where maximal exercise is contraindicated, but has not been assessed in ME/CFS. **PURPOSE:** To determine the validity of OUES as a measure of aerobic fitness in ME/CFS. **METHODS:** Maximal exercise testing was performed using a ramped protocol on a cycle ergometer in a clinical sample of ME/CFS patients as part of the CDC multi-site study. Oxygen consumption (VO₂), carbon dioxide production (VCO₂) and pulmonary ventilation (VE) were directly measured using a metabolic cart. Ventilatory equivalents for O₂ (VE/VO₂) and CO₂ (VE/VCO₂) were calculated. Peak effort was determined using American College of Sports Medicine criteria. Anaerobic threshold was determined using the Vslope method. OUES was determined by VO₂ = a*log VE + b, where a = OUES, b = intercept. Linear regression was used to determine the relationship between VO_{2peak} and OUES. Group comparisons were analyzed using Independent t-tests and Mann-Whitney tests with an alpha = 0.05. **RESULTS:** A total of 180 tests were evaluated including 135 (39 male) ME/CFS patients and 45 (18 male) controls (CO). Over 80% of the sample achieved peak exercise effort. Anaerobic threshold occurred at similar percentages of peak VO₂ (ME/CFS: 54%; CO: 53%, p > 0.05) and peak Watts (ME/CFS: 39%; CO: 45%, p > 0.05). Maximum VO₂ correlated with OUES in both groups (CFS: Rho = 0.695, p < 0.01; CO: Rho = 0.709, p < 0.01). OUES values were significantly lower for ME/CFS patients (ME/CFS Median 1.77, interquartile range (IQR) 0.86; CO Median 2.3, IQR 1.29, p < 0.05). Ventilatory equivalent measurements were significantly higher in ME/CFS at anaerobic threshold compared to CO (VE/VO₂: ME/CFS Median 25.8, IQR 7.8; CO Median 24.0, IQR 3.8; VE/VCO₂: ME/CFS Median 30.1, IQR 9.2; CO Median 28.5, IQR 4.1, p < 0.05). **CONCLUSION:** These data demonstrate the validity of OUES to predict aerobic capacity and might discriminate ME/CFS patients from healthy controls, thereby encouraging future research using submaximal effort tests.

A-54 Free Communication/Poster - Preparticipation and Injury Risk Assessment

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

436 Board #257 May 31 11:00 AM - 12:30 PM
Association of Interrelated Neuromechanical Factors with Injury Occurrence among College Football Players
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PURPOSE: The purpose of this prospective cohort study was to assess the predictive value of injury risk screening methods that collectively assess aspects of environmental awareness, cognitive processing of neural input, and motor control, as well as any persisting effects of previous injuries. **METHODS:** Prior to participation, 43 NCAA Division I-FCS college football players (20.2 ± 1.2 years; 185.7 ± 5.8 cm; 105.4 ± 20.6 kg) completed the 10-item Sport Fitness Index (SFI) survey and performed both a 60-second Reactive Peripheral Response (RPR) test and a 10-second Unilateral Forefoot Squat (UFS) test of postural stability. The 0-100 SFI score quantified perceptions of persisting effects of previous injuries. The RPR represented the number of outermost target hits (rings 4 and 5 of 64 target buttons arranged in a pattern of 5 concentric rings on a 1.2 m x 1.2 m board) while simultaneously reciting text that scrolled across a centrally located screen. The UFS test utilized a smartphone accelerometer to quantify the root mean square (RMS) of instantaneous change in body mass acceleration (Jerk) on the dominant extremity. All sprains, strains, and head injuries sustained from the beginning of practice sessions to the end of the 13-game season were documented, along with the number of player appearances in games.

RESULTS: Injuries were sustained by 14 of 43 players (33%). Univariable associations of binary risk classification with injury occurrence were: SFI ≤ 86 (OR=1.77), UFS Jerk RMS ≥ 0.06 (OR=4.19), RPR ≤ 11 Hits (OR=2.95), and Games Played ≥ 8 (OR=3.16). A large SFI X UFS X RPR interaction effect was identified (OR=11.20). Logistic regression results for the combination of the 3-way interaction (Adjusted OR=21.32) with Games Played ≥ 8 (Adjusted OR=6.19) yielded a strong prediction model ($\chi^2_2 = 9.04$, $p = .011$; $R^2 = .265$). Cox regression results for a binary SFI X UFS X RPR risk classification, adjusted for the potentially confounding effect of differential game exposure among players (0-13 games), demonstrated a strong association with time to injury occurrence (HR=4.65; 90% CI: 1.74, 12.44).

CONCLUSIONS: The findings support the potential for reduction of football injury risk through targeted interventions that address modifiable deficiencies in peripheral visual awareness, reaction time, and postural stability.

437 Board #258 May 31 11:00 AM - 12:30 PM
Relationships Among Lower Extremity Range Of Motion, Postural Control, And Power Generation Asymmetries: The FPPE Project

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Lower extremity (LE) musculoskeletal (MSK) injury risk factors are often examined in isolation without regard to how their interrelationships may influence injury risk. Developing a better understanding of relationships among MSK injury risk factors may help inform future injury risk assessment models. **Purpose:** Identify relationships among LE range of motion (ROM), postural control and power generation asymmetries. **Methods:** Prior to the start of their competitive sports seasons, high school football, soccer, basketball and lacrosse athletes completed the ankle dorsiflexion weight-bearing lunge (DF), single leg anterior reach (SLAR), and anterior single leg hop for distance (SLHOP) tests as part of the Functional Pre-Participation Physical Evaluation project. These tests were used as assessments of LE ROM, postural control, and power generation, respectively. DF measurements were recorded in centimeters while SLAR and SLHOP distances were recorded in centimeters and normalized to the participants' leg lengths. Limb symmetry indices (LSI) were calculated for all tests as the minimum score of the two legs divided by the maximum score. Linear regression was used to assess direct effects of DF LSI and SLAR LSI on SLHOP LSI. A linear regression-based mediation analysis was performed to determine if DF LSI was indirectly related to SLHOP LSI through an effect on SLAR LSI. Statistical significance of the indirect effect was assessed using a 95% bias-corrected bootstrapped confidence interval (CI) with 50,000 samples. A 95%CI that did not include 0.00 was considered statistically significant. Alpha level was set *a priori* at $p < 0.05$. **Results:** 3,765 male (15.65 \pm 1.23 years, 1.77 \pm 0.09m, 74.34 \pm 16.38kg) and 1,874 female (15.51 \pm 1.17 years, 1.65 \pm 0.07m, 60.26 \pm 9.94kg) high school athletes participated in this study. DF LSI (coefficient: 0.03, 95%CI=0.02-0.04; $p < 0.001$) and SLAR LSI (coefficient: 0.21, 95%CI=0.17-0.24; $p < 0.001$) were directly related to SLHOP LSI. DF LSI was indirectly related to SLHOP LSI (coefficient: 0.005, 95% bootstrapped CI=0.003-0.007) through its effect on SLAR LSI. **Conclusions:** LE ROM, postural control, and power generation asymmetries are related through a combination of direct and indirect effects. Future research should examine how these interrelationships influence LE MSK injury risk.

438 Board #259 May 31 11:00 AM - 12:30 PM
The Comprehensive High-level Activity Mobility Predictor-Sport (CHAMP-S): A Performance-Based Outcome Measure to Quantify High-level Mobility and Assist with Return to Sport for Division I Collegiate Football Players

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The Comprehensive High-level Activity Mobility Predictor (CHAMP) is a reliable and valid outcome measure that assesses high-level mobility in Service Members (SM) with traumatic lower limb loss. The CHAMP has the potential to be used to assess current high-level mobility capabilities in healthy, athletic individuals, to determine those athletes that may be at risk for injury, can be administered throughout rehabilitation process, and can assist with return to play decision making for collegiate athletes that suffer lower limb injuries.

Purpose: To develop the reliability and validity of the Comprehensive-High-Level Activity Mobility Predictor-Sport (CHAMP-S) in Division I Collegiate Football Players. **Method:** 206 student athletes participated in the study. 97 were tested at one time by three testers (two using the paper format and one using a mobile

device application) to determine CHAMP-S interrater reliability. 115 had completed CHAMP-S, anthropometric measures, upper and lower limb power, speed, and agility measures and underwent correlation analysis. 206 underwent ANOVA followed by post hoc analysis to determine differences between CHAMP-S scores between different football positions. Twenty athletes who underwent season ending injury were administered the CHAMP-S every 4-5 weeks throughout rehabilitation to assess change in high-level mobility and determine return to sport.

Results: The ICC's for the CHAMP-S items ranged from 0.90 (95% Confidence Interval, CI: [0.85, 0.93]) to 0.98 (95% Confidence interval, CI: [0.97-0.99]) for Single Limb Stance, Four-meter side step test, L-Test, and Illinois Agility Test. The CHAMP-S was significantly correlated with BMI, % Body Fat, Vertical Jump, Broad Jump, 40-yard dash, and shuttle run. The CHAMP-S demonstrated differences between linemen and skilled position players in all planes of movement. All 20 athletes returned to play safely and have not suffered re-injury to the ipsilateral or contralateral lower extremity. The athletes achieved 103% \pm 5% (95-109%) of their baseline CHAMP-S score ($p = 0.09$). **Conclusion:** The CHAMP-S is a reliable and valid measure of high-level mobility in Division I Collegiate Football Players that can help determine differences by position and assist return to sport following lower limb injury.

439 Board #260 May 31 11:00 AM - 12:30 PM
Predicting Knee and Thigh Injury Risk Using Scaled Vertical Jump and Standing Long Jump Power

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 (No relationships reported)

Movement tests, such as the VJ and SLJ, are used to determine power, athlete development, and quantify training protocol effectiveness. An idea exists to compare the power outputs from a VJ and a SLJ to give a picture of lower extremity injury risk. The ability to use easy and cost-efficient common movement tests could greatly enhance the capabilities of allied health care professionals.

PURPOSE: to examine the ability to predict knee and thigh injury based upon an allometrically scaled ratio of VJ and SLJ power.

METHODS: Participants included 26 female NCAA-I athletes from soccer and volleyball teams. The study examined testing data on the athletes before an off-season training cycle. Previous thigh or knee injury was compared to scaled Avg. power ratio, scaled peak power ratio, and z-scores for Avg. power and peak power. Correlation and ROC curves analyzed the relationships. Significance was set at the .01 level.

RESULTS: There were no correlations between the variables of interest and an athlete's past injury history. The individual team variables also revealed no correlation. ROC curves indicated: VJ Avg. power (.631), VJ peak power (.663), SLJ Avg. power (.622), and the VJ/SLJ peak power ratio (.663) indicated individuals who are at risk for injury.

CONCLUSIONS: Correlation indicates that ratios of power output for VJ and SLJ are not effective for predicting injury potential. A reason for the lack of correlation could be due to the crossover in vertical and horizontal components of VJ and SLJ success. The crossover of the horizontal components in the VJ jump is not as impactful as the vertical pieces of the SLJ. Each sport has different skills involved. The ROC curves do not provide strong specificity or sensitivity for predicting injury risk. The peak power ratio does not provide a solid means to predict injury risk. The z-scores of the Avg. power ratio and the peak power ratio failed in sensitivity and specificity. However, using the individual outputs of each revealed interesting information. VJ Avg. power, VJ peak power, and SLJ Avg. power provide a degree of prediction capability. The data confirms that the two sports are different from each other in power needs. Using the performance tests of the VJ and the SLJ to determine injury risk does seem to predict the possibility of a knee or a musculoskeletal thigh injury.

440 Board #261 May 31 11:00 AM - 12:30 PM
Test-Retest Reliability of Functional Tasks in Healthy High School Athletes: The FPPE Project

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(No relationships reported)

The 4th edition of the Pre-Participation Physical Evaluation (PPE) recommends functional testing for the musculoskeletal portion of the examination. However, limitations exist concerning currently recommended functional test components and the feasibility of implementing this test battery in the secondary school setting. In particular, test-retest reliability for recommended functional tests across secondary school settings has yet to be established.

PURPOSE: Determine test-retest reliability of three functional tests utilized in the Functional Pre-Participation Physical Evaluation (FPPE) project.
METHODS: A convenience sample of four high schools currently enrolled in the FPPE project participated. Prior to the start of their competitive sports seasons, high school athletes completed a weight-bearing lunge to assess ankle dorsiflexion range of motion (DF) as well as the single leg anterior reach (SLAR) and anterior single leg hop for distance (SLHOP) tests as part of the FPPE project. Athlete testing was conducted by the head Certified Athletic Trainer (AT) at each high school and was repeated one week after the initial test date. Intraclass correlation coefficients (ICC) using a two-way mixed effects model and an absolute agreement definition were calculated for each functional test. Separate ICCs were calculated for each AT. ICC(3,1) values were interpreted as: excellent (>0.75), fair to good (0.40-0.75), and poor (<0.40).
RESULTS: 40 athletes (m/f= 23/17, 16.4±1.1 y, 1.78±0.11 m, 70.1±13.1 kg) participated in this study (10 athletes per high school). Test-retest reliability was excellent for all raters for both the DF (ICC(3,1) range: 0.817-0.975) and SLHOP tests (ICC(3,1) range: 0.832-0.963). Test-retest reliability of the SLAR was found to be excellent for two raters (ICC(3,1): 0.813, 0.876) and fair to good for two raters (ICC(3,1): 0.583,0.693).
CONCLUSIONS: Test-retest reliability for functional tasks utilized in the FPPE project was generally excellent across a sample of high school ATs, supporting the utility of these tasks in longitudinal assessments in secondary school settings. Supported by NIH Grant 5R01-AR062578-02.

441 Board #262 May 31 11:00 AM - 12:30 PM
Injury And Illness Profiles During The 2014 South African Ironman Ultra-distance Triathlon
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PURPOSE: High physiological demands on ultra-endurance triathletes and potentially serious medical complications require scrutiny of illness and injury profiles. Accurate data are required for planning of medical services. The aims of the study were to record medical history, illness and injuries of athletes receiving medical attention during the 2014 Ironman South Africa (IMSA) triathlon, and to investigate the temporal presentation of medical encounters, to optimise deployment of medical services for IMSA events.
METHODS: A retrospective, cross-sectional study of all medical encounters and associated factors during the 2014 IMSA was conducted.
RESULTS: The incidence of medical encounters was 7.8%. A significantly higher percentage of younger participants encountered medical problems (p=0.04). The majority of patient encounters (80.1%) occurred after completion of the race, and 49.2% of patient encounters occurred during the last eight hours of the event. The median duration of treatment was 26 minutes (2-126 minutes). Medication was used by 35.1% of patients during the race, and 36.2% in the three preceding days. The most common medical encounters were exertion-related (71.2%), followed by gastro-intestinal (16.4%), dermatological (11.9%), musculoskeletal (9.6%) and cardiorespiratory conditions (2.4%).
CONCLUSION: Medical encounters occurred more frequently in later stages of the 2014 IMSA, as recorded elsewhere. The majority of medical conditions were exertion-related. Potential higher risk has been associated with medication use, recent illness, and in younger participants. Temporal stacking of medical personnel and resources, planning of resources according to expected conditions, preventative measures for high-risk behaviour, and on-going data collection are recommended.

442 Board #263 May 31 11:00 AM - 12:30 PM
Adding BMI to Electrocardiographic Criteria improves Accuracy of Predicting Left Ventricular Mass in Football Athletes
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Electrocardiographic (ECG) measurements are commonly used to diagnose left ventricular (LV) hypertrophy in men, yet the validity of this practice has seldom been appraised in American-style football (ASF) athletes. **PURPOSE:** Evaluate the accuracy of five commonly used ECG criteria for LV hypertrophy – Murphy (AJC, 1984), Sokolow (AHJ, 1949), Gruber (Arch Intern Med, 1943), Cornell (Casale, JACC, 1985), and Cornell voltage-duration product (C-VDP) (Malloy, JACC,

1992) – to predict echocardiographically (ECHO) measured LV mass (LVM) in ASF athletes. **METHODS:** Resting 12-lead ECG and ECHO procedures were performed on 62 collegiate ASF players first entering an NCAA Football Bowl Subdivision university; age=18±1 yr., ht=186±7 cm, wt=99.9±22.6 kg, BMI=28.6±5.0 kg·m⁻², and BSA=2.23±0.26 m². Regression was used to predict ECHO-derived LVM and LVM/BSA from the five ECG criteria, and from the ECG criteria with BMI (+BMI) added to the model. **RESULTS:** Table (*p<0.01 for regression)

R ² for Model ECG Criteria	LVM r ²	+BMI R ²	LVM/BSA r ²	+BMI R ²
Murphy	.001	.169*	.039	.039
Sokolow	.010	.200*	.052	.052
Gruber	.001	.164*	.030	.034
Cornell	.006	.160*	.018	.022
C-VDP	.000	.159*	.021	.026

None of the ECG criteria alone were predictive of LVM or LVM/BSA in ASF athletes. Adding BMI to the regression significantly improved the predictive accuracy for LVM but not for LVM/BSA. **CONCLUSION:** ECG criteria alone are not useful in diagnosing LVH in ASF athletes. Our results suggest that adding demographic measures to the predictive model may improve diagnostic accuracy. Thus, new algorithms for evaluating LVM and LVH in ASF athletes should be explored using demographic, body habitus, cardiovascular, and other ECG criteria.

443 Board #264 May 31 11:00 AM - 12:30 PM
Effect of Previous Injury on Functional Movement Screening Outcomes
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To improve player safety, medical professionals use questionnaires, pre-participation physicals, screening tests, biomechanical analyses, and strength testing to describe characteristics of high risk athletes. The seven-test Functional Movement Screening (FMS) is widely used in current practice, and research efforts have demonstrated the efficacy of the FMS to predict future injury. However, the effect of previous injury on FMS scores has not been defined. Because previous injury is a significant predictor of subsequent injury, an understanding of the effects of previous injury on total FMS score is critical to assess the efficacy of the screening tool to predict future injury. **PURPOSE:** Determine the efficacy of the FMS evaluation to assess prior musculoskeletal injury. **METHODS:** From 2012-2015, 58 incoming football athletes completed the FMS and a medical history questionnaire. Trained sports medicine researchers performed the screens and distributed questionnaires. Descriptive statistics were calculated to assess the effectiveness of total FMS results to predict previous injury. The previously established ≤ 14 score cut-off was utilized to establish the two groups' at-risk levels. The established cut-off was reported to indicate football players at-risk for serious injury defined as out of physical participation for > 2 weeks. **RESULTS:** 46 athletes reported a prior musculoskeletal injury compared to 12 that denied prior injury. The group of 46 athletes was equally split on FMS scores with 23 athletes that recorded a score of ≤ 14 and 23 athletes that recorded a score > 14. The group that denied previous injury (N=12) was also evenly split with 6 athletes that recorded of score of ≤ 14 and 6 with a score > 14. The FMS with a cut-off score of 14 recorded a sensitivity and specificity of 0.500. The positive predictive value was 0.793 with a negative predictive value of 0.207. **CONCLUSIONS:** Prior history of musculoskeletal injury as reported on the incoming medical questionnaire did not affect total score on the FMS with specificity or sensitivity. Future studies should evaluate the effects of previous injury on other clinical screening tools. In addition, better screening tools could be developed that assess the incidence of previous injury and risk of future injury.

444 Board #265 May 31 11:00 AM - 12:30 PM
High School Preparticipation Evaluation Screenings: Do States Include Mental Health Recommendations?
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7.7 million high school students participate in sports annually and are required to have a physical. Given the focus on illness and injury, physicians may be more likely to focus on physical health than mental health. ACSM recommends the *Preparticipation Evaluation, 4th Edition* (PPE-4), which is the standard assessment tool and includes

guidelines for assessing mental health. However, little is known about the inclusion of mental health recommendations in state PPE forms. Screening mental health among athletes may prevent psychological and performance-related difficulties. **PURPOSE:** This study examines the inclusion of mental health in PPE forms in the US. We describe the mental health content of state PPE forms and consistency with the PPE-4. The content of the PPE-4 suggests that eating disorder symptoms be assessed using yes/no questions and other topics (e.g., mood, anxiety, stress, home safety, and substance use) be included as physician reminders (e.g., open-ended). **METHODS:** PPE forms were retrieved via the National Federation of State High School Associations website (n=47; 4 states did not have forms). Two raters independently coded PPE forms to evaluate adherence to the PPE-4. PPE forms were coded as whether mental health issues were not addressed, addressed as a question, or addressed as a reminder. **RESULTS:** There was acceptable agreement between coders (kappa range: 0.7-1.0; M=0.9). 55.3% of forms included a question about history of an eating disorder, 83.0% included a question pertaining to worry about weight, 83.0% included a question about presence/frequency of menstrual period, and 70.2% included a question about attempts at weight loss/gain. The physician reminders were used in less than 60.0% of forms. 46.8% of forms provided a reminder to physicians to assess substance use and safety at home. Stress was included as a reminder on 59.6% of forms. 59.6% of states included a reminder to assess for sad, hopeless, depressed, or anxious mood, with only 8.5% including a question about mood or anxiety. **CONCLUSIONS:** The PPE-4 is used to ensure safe participation in high school sports, but most state forms omit questions related to mental health. Future studies should examine physician assessment of mental health during PPE, as well as the course of treatment following a positive screen for mental health issues.

445 Board #266 May 31 11:00 AM - 12:30 PM
Predicting Musculoskeletal Injuries from Psychological, Neurocognitive and Physical Factors in Collegiate Athletes Without Injury History

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Musculoskeletal injury (MSI) risk in athletes is thought to be multifactorial in nature and to include psychological, neurocognitive and physical sources. However, most researchers lack the time and resources to assess these multiple factors in large groups of athletes. Examining multiple factors at once may yield improved injury prediction. **PURPOSE:** To determine if body fat percentage (high or low BF%), ImPACT reaction time (RT in sec), ImPACT visual motor speed (VMS in sec), Functional Movement Screen (FMS) scores, Beck's depression indices (BDI), and/or Beck's anxiety indices (BAI) could predict MSI in athletes without MSI history. **METHODS:** Seventy-one [(males, n=35; age, 19.9±1.5 yrs; height, 1.77±0.08m; mass, 73.2±14.6kg) (females, n=36; age, 19.1±1.1 yrs; height, 1.68±0.06m; mass, 70.1±9.4kg)] NCAA Division II athletes without MSI history participated in this prospective cohort study. Data were collected during pre-participation examinations as part of standard protocol. Injuries were tracked for an academic year by each team's certified athletic trainer via computer software. Pearson Chi-square analyses were used to determine if MSI could be predicted by BF%, RT, VMS, BDI, BAI, presence of a "1" on the FMS, or presence of an asymmetry on the FMS, $p < .05$. BF% was dichotomized as high or low for males (>15%) and females (>25%). **RESULTS:** Twenty-seven athletes (38.0%) sustained a total of 54 MSI. Two of the 7 independent variables were statistically significant predictors of MSI. Athletes with asymmetry on any of the FMS tests ($\chi^2=12.299$, $p < .001$) or high BF% ($\chi^2=5.820$, $p < .015$) were more likely to sustain a MSI. The relative risks for an FMS asymmetry and high BF% were 1.89 (CI: 1.22-2.94, $p = .001$) and 1.99 (1.06-3.75, $p = .015$), respectively. **CONCLUSION:** Athletes without a history of MSI may be at risk of MSI if they have high BF% or an asymmetry on any of the FMS tests. The neurocognitive and psychological test components may not yield significant injury prediction value in this group. Since BF% and FMS scores are modifiable risk factors clinicians may justify their assessment during pre-participation examinations.

446 Board #267 May 31 11:00 AM - 12:30 PM
The Efficacy Of Performance On Clinical Hop Tests To Predict Previous Lower Extremity Injury

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 (No relationships reported)

Background: Clinical hop tests, such as the 6-meter timed hop (6TH) and single-leg triple crossover hop (TXH) evaluate strength and neuromuscular coordination in athletes' lower extremities. Clinicians use symmetry in performance of these tests as a return to sport criteria after an injury, such as an anterior cruciate ligament (ACL) rupture. In addition, symmetries have been identified as a risk factor for lower extremity injuries. However, the efficacy of clinical hops to identify athletes with a history of previous injury is not well defined.

Purpose: Determine the efficacy of performance on 6TH and TXH to predict previous lower extremity injury.

Methods: 51 and 52 male division I football players performed a 6TH and TXH, respectively. All athletes completed a medical history questionnaire. Players were categorized as either self-professing to have a previous lower extremity injury, or not having a previous lower extremity injury. Bilateral asymmetry was defined as a greater than 10% difference in performance on the 6TH and TXH between limbs. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated to evaluate the efficacy of symmetry to predict previous injury history. Results: of the 51 players that performed the 6TH, 14 reported a previous lower extremity injury. 14 of the 52 players that performed the TXH reported previous lower extremity injury. Sensitivity, specificity, PPV, and NPV are reported for the 6TH (Figure 1a) and TXH (Figure 1b).

a.	Injury (+)	Injury (-)
Symmetry $\geq 10\%$	7	11
Symmetry $< 10\%$	7	26
Sensitivity	0.500	
Specificity	0.703	
PPV	0.389	
NPV	0.788	
b.	Injury (+)	Injury (-)
Symmetry $\geq 10\%$	2	11
Symmetry $< 10\%$	12	27
Sensitivity	0.143	
Specificity	0.711	
PPV	0.154	
NPV	0.692	

Figure 1. Analysis of previous injury history and performance on the a. 6TH and b. TXH tests.

Conclusion: Bilateral asymmetry does not predict previous injury incidence. The efficacy of additional clinical tests, such as the single-leg hop, should be evaluated.

447 Board #268 May 31 11:00 AM - 12:30 PM
Effects of Previous Lower Extremity Injury on Functional Movement Screening Results

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Background: Functional movement screening (FMS) is a seven-movement screening test frequently utilized as a component of pre-season physicals. Individual tests evaluate movement patterns to identify athletes potentially predisposed to injury and previous research has established a cut-off for football athletes at high risk for serious injury defined as out of physical participation for > 2 weeks.

Purpose: To examine the effects of previous lower extremity injury on functional movement screening scores, specifically the lower extremity FMS tests.

Methods: All incoming freshman football student-athletes for the 2012-2015 seasons completed functional movement screening performed by FMS trained sports medicine researchers. All incoming athletes completed a past medical history questionnaire to document any previous injury history. Descriptive statistics were calculated to measure the effect of lower extremity injury on the FMS scores for deep squat, hurdle step, active straight leg-raise, rotary instability and inline lunge tests. The established ≤ 8 lower extremity cut-off was utilized to establish the two groups' level of risk.

Results: 60 incoming football athletes completed both the medical questionnaire and functional movement screening from 2012-2015. 36 athletes reported a previous lower extremity injury and 17 of those athletes demonstrated scores below the lower extremity cut-off (Sensitivity: 0.472). The 24 remaining athletes reported no prior lower extremity injury and 12 scored above the cut-off (Specificity: 0.500). Previous lower extremity injury had a higher positive predictive value (0.586) than negative predictive value (0.387) on lower extremity functional movement screening scores.

Conclusion: The self-reported previous lower extremity injury history of our incoming football student-athletes was not specific or sensitive for prediction of score on the functional movement screening evaluation to identify high risk lower extremity movement patterns. Future work should continue to evaluate variables that may affect results of screening tests for athletes at high risk of injury to continue to optimize athlete safety.

448 Board #269 May 31 11:00 AM - 12:30 PM
Identifying Metabolic Syndrome Risk Factors in Division 1 and Division 3 Football Players: a Pilot Study

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 (No relationships reported)

Retired NFL football players are at an increased risk for Metabolic Syndrome (MetS). Cross sectional studies in high school and college football players suggest an increased risk even at this level. It is not clear when MetS risk factors (RF) develop and if certain markers can be used to assess risk for early intervention. **PURPOSE:** The purpose of this pilot study was to identify MetS risk factors using the NCEP ATP III standards and measures of abdominal obesity in freshmen football players from a Division 1-FCS and a Division 3 team. Additionally, this study sought to identify if risk differed by player position and/or by college division. **METHODS:** Fifty freshmen (Division 1, n = 18, Division 3, n = 32) football players volunteered to be tested before the start of the competitive season. Testing for MetS risk factors included fasting Triglyceride (TG), High Density Lipoprotein (HDL), blood glucose (BG), blood pressure (BP), and waist circumference (WC). Additional measures included percent body fat (%BF) and subcutaneous (SCAT) and visceral fat (VAT) depth. Descriptive statistics and comparison between schools related to MetS RF were analyzed. A Pearson Correlation was used to determine the relationship between the clinical markers. **RESULTS:** Ten players (20%) met the criteria for MetS (n = 2 with 3 RF, n = 6 with 4 RF, and n = 2 with 5 RF). Division 1 had a higher percentage of players (n = 5, 27.8%, 3 offensive linemen) meeting the criteria for MetS compared to the Division 3 players (n = 5, 15.6%, 1 offensive lineman). All NCEP ATP III risk factors except BG were positively correlated with meeting the criteria for MetS, with the WC being the highest (r = 0.766, p = 0.000). Using non NCEP ATP III risk factors positive correlations were found between the %BF (r = 0.645, p = 0.000), SCAT (r = 0.352, p = 0.013), and VAT (r = 0.489, p = 0.000). Lineman meeting the criteria for MetS had a %BF > 21. **CONCLUSIONS:** This data suggests that freshmen football players have a high incidence of MetS RF. Waist Circumference and %BF should be included in pre-season evaluation with follow up for early intervention as necessary.

449 Board #270 May 31 11:00 AM - 12:30 PM
Examination of Y-Balance Performance in Chronic Ankle Instability

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 (Sponsor: Lee Brown, FACSM)
 (No relationships reported)

Chronic ankle instability (CAI) is associated with reduced proprioception and range of motion, which often results in postural control deficits. The Y-Balance Test has been used to assess lower extremity mobility, functional performance, and risk of injury. An inability to maintain single leg stance, a component of the Y-Balance Test, is associated with CAI. The Y-Balance Test has not been examined to determine performance differences in cases of CAI. **PURPOSE:** To assess maximum reach distance (MRD) differences of the Y-Balance Test in CAI participants and healthy controls. **METHODS:** A case control study of 28 subjects (14 healthy [age: 27.57±3.23 years; height: 169.61±8.33 cm; weight: 76.98± 17.95 kg], 14 CAI [age: 24.07±4.46 years; height: 175.06±5.09 cm; weight: 82.24± 10.38 kg]); CAI participants were recruited per International Ankle Consortium guidelines using the Foot and Ankle Ability Measure (FAAM) and Cumberland Ankle Instability Tool (CAIT). Subjects performed three trials in each direction (Anterior [ANT], Postero-medial [PM], Posterolateral [PL]) of the Y-Balance Test. The trials were averaged and normalized for limb length to produce a MRD value for each direction. Independent sample t-tests were used to compare MRD differences between groups. Alpha was set at p ≤ .05; an effect size above .3 was considered clinically meaningful. **RESULTS:** Significant differences were not found for MRD in the ANT (mean difference = -1.23, p = .61, Cohen's d = 0.20, 95% CI for Cohen's d = -0.94 - 0.55), PM (mean difference = 4.03, p = .27, Cohen's d = 0.43, 95% CI for Cohen's d = -0.32 - 1.17), or PL (mean difference = 4.21, p = .26, Cohen's d = 0.43, 95% CI for Cohen's d = -0.32 - 1.18) directions. The control group exhibited higher scores in the PM (106.77 vs. 102.73) and PL (105.16 vs. 100.96) directions, while the CAI group produced a higher score (61.62 vs. 60.39) in the ANT direction. **CONCLUSION:** Statistically significant differences were not found between groups on the Y-Balance Test; however, the differences in the PM and PL directions may be clinically meaningful. Clinicians may need to consider PM and PL MRD deficiencies on the Y-Balance Test when treating CAI patients; however, further research is needed to determine the sensitivity of the Y-Balance Test for identifying CAI.

A-55 Free Communication/Poster - Resistance Training

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

450 Board #271 May 31 9:30 AM - 11:00 AM
Effects of Rest Interval Duration on the Volume Completed During a High-Intensity Bench Press Exercise

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Between set rest intervals (RI) are one of the most important variables in resistance training; however, no known research has investigated the effects of RIs greater than 5-min during strength training (> 85% of 1RM). **PURPOSE:** The purpose of this research was to examine the effects of three different RIs (2, 5, and 8-minute) on training volume (TV) (kg, sets x reps x resistance) completed during a high-intensity bench press exercise (> 85% of 1RM). **METHODS:** 15 resistance trained males (mean± sd, age = 26+ 5 yr, height = 161+ 6 cm, body mass = 79+ 6 kg, bench press 1RM ratio = 1.39+ 0.1) completed 3 experimental sessions, during which 4 sets of the bench press were performed with 85% of a 1RM load. During experimental sessions, the bench press was performed with a 2, 5, or 8-minute RI in a randomly counterbalanced design. Data was analyzed using a one-way ANOVA with repeated measures. **RESULTS:** The greatest TV (p < 0.05) was attained when subjects used an 8-min RI between sets (table 1). Additionally, TV completed using the 5-min RI was significantly greater (p < 0.05) when compared to the 2-min RI (table 1). **CONCLUSIONS:** Resistance trained males, with the goal of greater volume during strength training, would benefit from longer RIs. Specifically, using an 8-min RI between 4 consecutive sets of a bench press allows for a greater TV.

	2-min	5-min	8-min
Volume(Kg)	1448 + 215*#	1793 + 315*	2207 + 372

* p < 0.05, value significantly different from 8-min RI
 # p < 0.05, value significantly different from 5-min RI

451 Board #272 May 31 9:30 AM - 11:00 AM
Evaluation Of Strength And Conditioning With On-court Success In Division I Collegiate Volleyball: A Retrospective Study

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Strength, fitness, and athleticism are often emphasized in sport, but there is little evidence addressing the relationship of these variables to performance. **PURPOSE:** To assess relationships between strength and conditioning (SC) measures and game performance in Division I volleyball. **METHODS:** Five years of data, were collected from one women's Division I collegiate team, n = 76. All game and SC stats were normalized to z-scores. SC measures included: T-drill, 18.3 m sprint, squat, hang clean, sprint recovery test, vertical jump, and broad jump. ANOVA was used to assess performance differences by position, and multiple stepwise regression was used to assess relationships between game and SC stats. **RESULTS:** There was a significant difference by position for broad jump (p = .002), 18.3 m sprint (p = .036), vertical (p < .001), and total strength (p = .019). Overall, there was a significant correlation between on-court performance and SC measures (r = .439, p < .001). Significant position-specific correlations (p < .05) are as follows: defensive specialist, total strength with digs (r = .798); setters, hang cleans with assists (r = .818) and digs (r = .886), broad jump with block assists (r = .846) and total game performance (r = .801); outside hitters, vertical with digs (r = .444) and total game success (r = .529), and total strength with kills (r = .660) and errors (r = .577); middle blockers, broad jump with kills (r = .694), errors (r = .736), block assists (r = .705), block solos (r = .691), and total game success (r = .594).

CONCLUSIONS: These data indicate that some SC measures correlate well with on-court performance and are specific by position. A prudent training approach may be for SC coaches to focus on improving specific measures by position, which could then translate to improved game performance.

452 Board #273 May 31 9:30 AM - 11:00 AM
Effects Of Barbell-based, Full-body Resistance Training On Muscular Strength, Lean Body Mass, And Cardiometabolic Biomarkers.

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(No relationships reported)

Resistance training improves muscular strength and hypertrophy, as well as cardiometabolic biomarkers. However, results in the literature have been inconsistent which may relate to the heterogeneity in training protocols. **PURPOSE:** This single-group pilot study defined a standardized barbell-based linear periodization full-body resistance training program and assessed its effect on muscular strength and biomarkers. **METHODS:** Ten healthy, untrained males (26.4±7.5 y) underwent 4 weeks of a barbell-based, full-body, linear periodization program 3x/week. Exercises included the squat, standing press, bench press, and deadlift. Participants performed 3 sets of 5 repetitions on the squat, bench press, and standing press and 1 set of 5 repetitions on deadlift. Weight was incrementally added each training session. Maximum dynamic strength was assessed by 5-repetition maximum (5RM), and biomarkers (lipids, insulin, HOMA-IR, CRP, and glucose) were assessed. The study was IRB approved. **RESULTS:** 5RM increased on squat (79.4%; $p=0.005$), bench press (25.9%; $p=0.004$), standing press (45.3%; $p=0.004$), and deadlift (52.9%; $p=0.05$). The sum of four lifts also increased after 4 weeks of training (50.3%; $p=0.005$). Over the 4 weeks, lean body mass (LBM) increased (1.5%; $p=0.025$). Total and HDL cholesterol decreased significantly (-14.4% and -11.7% respectively) and LDL cholesterol trended downward (-15.8%) but the total:HDL cholesterol ratio was unaltered. **CONCLUSION:** It appears that untrained males can increase body strength on a 4-week full-body, barbell-based linear periodization training program. Changes in LBM occurred sooner than previously reported. A standardized resistance training protocol for building strength would facilitate research interpretation in this field. Randomized control trials with larger samples over longer time periods are needed to further investigate the effects of full-body barbell exercise training on changes in muscular strength, LBM, and cardiometabolic biomarkers.

453 Board #274 May 31 9:30 AM - 11:00 AM
Eccentric Resistance Training in Adults with and without Spinal Cord Injuries

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Following incomplete spinal cord injuries (iSCI), individuals lose motor control, muscle fiber cross sectional area, and contractile force capacity, ultimately resulting in compromised functional independence. An innovative exercise modality for populations with impaired functional capacity is eccentric resistance training (ERT). **PURPOSE:** The purpose of this study was to examine the effects of active lower body ERT using a seated eccentric ergometer in individuals with iSCI and controls (CON). Specifically, the study was designed to determine if those with iSCI adapt similarly to ERT as CON participants, as well as the overall safety and efficacy of ERT in this population. **METHODS:** This pilot investigation involved the recruitment of persons with iSCI ($n=3$) and age- and sex-matched able-bodied CON ($n=3$). The 8-week intervention focused on building lower extremity eccentric strength by progressively increasing the duration and intensity of the three training sessions per week. Control participants completed the same training intervention. Main outcome measures were eccentric strength (eccentric ergometer), isometric strength (hand held dynamometer), and leg muscle mass (DEXA). **RESULTS:** All participants completed all sessions of the ERT. At posttest, eccentric strength improved from pretest ($p=.044$, $\eta_p^2=.68$) with similar changes between groups ($p>.05$). The percent improvement in isometric strength for those with iSCI (41.5%) was different than CON (-2.8%) after training ($p=.044$). Neither group demonstrated a change in grams of muscle mass in the legs at posttest ($p>.05$). **CONCLUSION:** Active lower body ERT is well tolerated and effective at increasing lower extremity strength in those with iSCI. These adaptations are likely attributable to neuromuscular development rather than a hypertrophic response.

454 Board #275 May 31 9:30 AM - 11:00 AM
Bench Press Strength Changes Over 23 Years in Police Recruits with Gender Comparisons

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Strength is a vital component in the performance of police duties to ensure the safety of officers and those they serve. Therefore, the initial strength the officers brings to the training program predicts the level of strength they will maintain throughout their careers. **PURPOSE:** To evaluate bench press strength changes that occur in police recruits from 1990 to 2013 with gender comparisons. **METHODS:** During the first week of police recruit training in a large southeastern metropolitan area, bench press strength and bench press weight ratio were evaluated in 2,460 recruits. ANOVA and Bonferroni post hoc procedures were used to evaluate data. **RESULTS:** The initial ANOVA indicated significant differences in males for both variables at $p\leq 0.05$. Males tended to increase in bench press strength from 1990 to 2007 (83.7±2.0 kg to 95.9±2.1 kg, $p\leq 0.01$). Male bench press strength tended to plateau after 2007. No discernible pattern was seen in females for both variables and little change in males was observed in bench press weight ratio. **CONCLUSIONS:** Overall, males had a tendency to become stronger over time when considering their initial test scores in recruit school. However, females tended to remain at approximately the same muscular strength across the 23 years.

455 Board #276 May 31 9:30 AM - 11:00 AM
Testosterone And Cortisol Responses To Superslow And Traditional Resistance Exercise In College-aged Males

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Recent evidence suggests that Superslow resistance training (SS), involving low intensity workloads and slow repetitions, has potential to produce improvements in muscular strength similar to traditional high intensity resistance training (TR). Few studies have compared endocrine responses to SS and TR protocols. **PURPOSE:** To compare acute hormonal responses to two resistance exercise protocols that have similar exercise volumes, but differ in intensity and contraction speed. **METHODS:** Thirteen males (18-35 years) participated in this randomized crossover study. Participants performed two protocols in random order separated by 3-week washout periods. For TR, participants completed 3 sets of 8 reps at 80% 1-RM for four upper and lower body exercises with 1.5 seconds of concentric and eccentric contraction speeds. For SS, participants performed 1 set of each exercise to voluntary failure at 50% 1-RM with 10 seconds concentric and 5 seconds eccentric contraction speeds. Fasting morning blood draws were taken before (Pre), immediately post exercise (IP), and 15 min post exercise (15P). Serum samples were analyzed for testosterone (TES) and cortisol (Cor) concentrations using ELISA. Lactate and hematocrit were also measured for each condition. **RESULTS:** There were no significant differences in baseline values between the two conditions. There was a significant ($p<0.05$) time effect for raw concentrations of TES and Cor. TES significantly ($p<0.05$) decreased from IP to 15P for both conditions (SS- 8.25 ± 1.37 ng/ml to 7.38 ± 1.26 ng/ml; TR- 8.50 ± 1.25 ng/ml to 6.94 ± 0.88 ng/ml). There was a trend ($p=0.059$) for Cor to increase from Pre to IP for both conditions (SS - 166.66 ± 15.15 ng/ml to 216.08 ± 18.16 ng/ml; TR- 157.55 ± 8.77 ng/ml to 201.03 ± 19.84 ng/ml). TES % change showed a significant time effect as it increased from Pre to IP (SS- 0.95 ± 4.39%; TR- 15.39 ± 7.73%) and decreased from Pre to 15P (SS- -5.48 ± 6.70%; TR- -5.41 ± 3.79%). Cor % change was not different between the two conditions. Correcting for hemoconcentration eliminated the significant responses. **CONCLUSION:** Both protocols showed similar patterns of hormonal responses, which may have been mediated by plasma volume shifts. This finding supports that SS exercise could be a beneficial alternative for those unable to perform high-intensity resistance exercise.

456 Board #277 May 31 9:30 AM - 11:00 AM
Comparison Of Peak Power In The High Bar And Low Bar Squat Across Eight Loads
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 (No relationships reported)

PURPOSE: To examine differences in peak power output between high bar (HBS) and low bar back squats (LBS).

METHODS: Six trained males (25.0 ± 3.1 years, 1.78 ± 0.04 m, 87.6 ± 7.5 kg) with previous squatting experience (experience: 7.5 ± 4.1 years, HBS 1RM: 157.0 ± 15.3 kg, squat/bodyweight: 1.8 ± 0.18) completed the study using a crossover design. Subjects completed a 4-week familiarization phase with both conditions. Peak power data was collected over 2 sessions using dual uniplanar force plates synchronized with 2 string potentiometers on each side of the bar collecting at a sampling frequency of 1000 Hz using a BNC 2110 connector with an analog to digital converter. Subjects were randomly assigned to the HBS or LBS for 1 set of 3 repetitions at 20, 30, 40, 50, 60, 70, 80, and 90% of their most recent HBS training 1RM with 3 to 5 minutes' rest between sets and >72 hours between testing conditions. A 2x8 repeated measures analysis of variance was used to determine interactions and main effects for condition and load with post-hoc tests conducted for statistical main effects.

RESULTS: Analysis revealed significant main effects for load ($p < 0.01$) but not for condition. Peak power output was greatest at 70% of HBS 1RM for the LBS, and 80% of HBS 1RM for the HBS.

CONCLUSIONS: According to this pilot data, athletes seeking to increase power production ability should choose a squatting style in which they feel most proficient and comfortable. Furthermore, either the HBS or LBS can be used as the primary squatting movement, or as a secondary movement to provide variation and remove linearity from the training program. However, based on previous research it is likely that sport specific biomechanical parameters will influence the squatting style selection for the majority of athletes who participate in sports that involve jumping, sprinting, and change of direction. Training with loads between 70% and 80% of HBS 1RM may be optimal for increasing power production ability. Further research using a larger population of well-trained athletes is suggested in order to more precisely compare HBS and LBS power outputs.

457 Board #278 May 31 9:30 AM - 11:00 AM
Increased Performance of Upper-Body Strength Exercise: Effect of Leg Induced Increase in Blood Lactate Concentration
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Studies have shown that high systemic blood lactate concentrations led to inhibition of glycolysis and an increase of oxidative metabolism in subsequent anaerobic exercise. **PURPOSE:** The aim of this study was to examine the effect of increased blood lactate (La) concentration induced by high intensity leg exercise on net lactate production and performance in subsequent dynamic arm pull-ups. **METHODS:** Nine trained sport students (age: 25.1 ± 1.9 yr; BMI: 21.7 ± 1.4) performed arm pull-ups on a horizontal bar with legs placed on a box either with or without pre-load (PRE) in a randomized order. PRE was a 26.6±2s all out shuttle run to increase La to ~8 mmol.l⁻¹. Each testing was preceded by a 15 min standardized warm up. Time between warm-up and testing was 14 min. During testing, heart rate (HR) and respiratory gas exchange measures ($\dot{V}O_2$, $\dot{V}CO_2$, \dot{V}_E) were monitored and La levels were measured at specific time points. Respiratory gas exchange measures were compared via the area under the curve (AUC). **RESULTS:** In pull-ups without PRE, La increased from 1.24 ± 0.4 to 6.4 ± 1.4 mmol.l⁻¹, whereas in conditions with PRE, La increased from 9.28 ± 1.98 to 10.89 ± 2 mmol.l⁻¹. In PRE conditions net La accumulation was significantly reduced by 75.5%. Performance was significantly increased by 1 rep (4%) after PRE. In PRE, net oxygen uptake $\dot{V}O_2$ (50% AUC), pulmonary ventilation \dot{V}_E (34% AUC) and carbon dioxide $\dot{V}CO_2$ production (26% AUC) were significantly increased during pull-ups but net respiratory exchange ratio (RER) was significantly decreased during work and recovery. **CONCLUSION:** Increased La induced by anaerobic leg exercise, inhibits glycolysis and increases oxidative metabolism in subsequent anaerobic dynamic upper body exercise. Increased oxidative metabolism during strength endurance exercise leads to superior performance outcome. This concept may be beneficial in sports climbing, due to a shift to an increased oxidative metabolism. However, this aspect needs to be evaluated further and in greater detail.

458 Board #279 May 31 9:30 AM - 11:00 AM
Effects Of A Two-week Lower-body Resistance Training Protocol On Aerobic Capacity In Sedentary Middle-aged Females
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PURPOSE: The aim of this study was to examine the effect of two-weeks of lower body resistance training on cardiopulmonary capacity ($\dot{V}O_{2peak}$) as well as its impact on muscle strength/size in sedentary middle-aged females. **METHODS:** After familiarization, $\dot{V}O_{2peak}$ was assessed via maximal cardiopulmonary exercise testing (CPET), leg extensor strength via isokinetic dynamometry, and muscle size of the vastus lateralis (VL) via cross-sectional area (CSA) using a B-Mode ultrasound. **RESULTS:** $\dot{V}O_{2peak}$ significantly improved by 10.8% ($2.1 \text{ mlO}_2 \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; $p=0.002$). Leg extension peak torque (PT) significantly improved by 6.1% (5.9 Nm ; $p=0.027$), while EMG amplitude did not change (-3.69% ; $p=0.388$). Similarly, VL CSA did not increase in response to training (0.17 cm^2 ; $p=0.456$). No significant relationships were observed between changes in $\dot{V}O_{2peak}$ and selected strength variables (PT/Amplitude). **CONCLUSIONS:** These results suggest that strength training appears to have had a positive effect on $\dot{V}O_{2peak}$ and strength in middle-aged females. However, future studies including a control group are warranted to confirm or refute the results of this current study.

459 Board #280 May 31 9:30 AM - 11:00 AM
Effect of Three Different Muscle Action Training Protocols on Hamstrings-to-Quadriceps Muscle Size Ratio
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 (No relationships reported)

Hamstrings-to-quadriceps (H:Q) muscle size ratio measured by muscle thickness (MT) is a measure of muscle balance, which can identify risk of lower-extremity injuries during sports. However, the most advantageous muscle action training protocol to elicit optimal H:Q is unknown. **PURPOSE:** To compare 3 different training protocols on H:Q muscle size ratio. **METHODS:** Forty untrained males (age 22.87 ± 2.28 yrs, mass 70.66 ± 11.04 kg, ht 174.29 ± 6.9 cm) performed 6 weeks (2 sessions per week) of training of their dominant leg H and Q on a Biodex isokinetic dynamometer. They were randomly assigned to one of 4 groups; concentric Q and concentric H (CON/CON), concentric Q and eccentric H (CON/ECC), eccentric Q and eccentric H (ECC/ECC), or no training (CNTRL). Training began with 1 set of 10 maximal repetitions at 210°/s concentrically and 60°/s eccentrically. Intensity of training was increased every week by decreasing the angular velocity for concentric and increasing it for eccentric in 30°/s increments. Volume of training was increased by adding 1 set each week. MT measurements were taken 72h before and after training in the transverse plan of Q rectus femoris (RF), vastus intermedius (VI), vastus lateralis (VL) and vastus medialis (VM), and H biceps femoris long head (BF), semitendinosus (ST) and semimembranosus (SM) using a real-time portable B-mode ultrasound device. H:Q muscle size ratio was calculated as H MT/quadriceps Q MT. **RESULTS:** A 7x2x4 (muscle x time x group) ANOVA showed interactions of muscle x time and time x group. They were followed up with seven paired t-tests, one for each muscle, and two paired t-tests, one for each group. MT post was greater than pre for VL ($8.05 \pm 4.78\%$), VM ($5.71 \pm 31.79\%$), BF ($7.93 \pm 10.87\%$), ST ($8.99 \pm 15.88\%$) and SM ($6.09 \pm 7.65\%$), while there was no difference for RF ($2.98 \pm 7.43\%$) or VI ($4.23 \pm 10.95\%$). MT post was also greater than pre for CON/CON ($7.75 \pm 8.92\%$), ECC/ECC ($11.81 \pm 0.76\%$), and CON/ECC ($6.68 \pm 1.68\%$), while CNTRL (-1.38 ± 15.22) was not different. **CONCLUSIONS:** These findings suggest that all training protocols may increase MT of H and Q similarly, which may not lead to improvements in H:Q muscle balance. A greater volume of training may need to be performed for H to elicit greater H:Q muscle size balance.

460 Board #281 May 31 9:30 AM - 11:00 AM

Reliability Of Open- And Pinch-grip Weight-assisted Pull-ups

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PURPOSE: The purpose of this study was to evaluate the reliability of open-handed and pinch-grip weight-assisted pull-ups in recreationally-trained rock climbers. **METHODS:** Recreationally-active volunteers (n = 9) completed four counterbalanced trials. Trials (two grips each test-retest) were used to determine the reliability of the grips. Each trial included one set of open-handed or pinch-grip weight-assisted pull-ups until failure. Each trial used one of two grips each repeated twice. Sets consisted of either the open-handed or pinch-grip pull-ups assisted by 50% reduction of body weight. **RESULTS:** Heart rate, ratings of perceived exertion (RPE), perceived recovery scale and session-RPE were not significantly different (p > 0.05) among trials. Intra-class Rs for test-retest of the open-handed (R = 0.99) and pinch-grip (R = 0.96) weight-assisted pull-ups evidenced reliable values. However, Bland-Altman analysis (BA) revealed large errors indicating weight-assisted pull-ups using open-handed (95% error range: upper limit 6.34, lower limit -3.90) and pinch-grip (95% error range: upper limit 5.35, lower limit -6.91) were only somewhat reliable. **CONCLUSIONS:** Based upon the ICCR's measurement was reliable, however the BA indicated the device was only somewhat reliable.

461 Board #282 May 31 9:30 AM - 11:00 AM

Strength Training Between Science and Practice

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Evidence-based ACSM guidelines provide a comprehensive framework for the design of strength training interventions. Yet, a variety of practice-based approaches are used in gyms, clubs and sport federations based on empirical evidence, fashion and tradition while their scientific validation remains elusive. **PURPOSE:** We developed a practice-based strength training (*pST*) and tested its performance against an evidence-based (*eST*) intervention. **METHODS:** 18 young healthy males with minimal ST experience were randomly assigned to *eST* (#6), *pST* (#6) or *Control* (C, #6) group. *eST* and *pST* trained for 4 weeks (three, one-hour sessions per week composed of a warm-up, three main exercises -squat, chest press and deadlift- and two complementary exercises -pull-ups and push press- and a cool-down). Interventions differed in: 1) periodization strategy (linear vs. daily undulating); 2) intensity target (Repetition Maximum (RM) vs. % of maximum load) and volume (repetition range vs. exact number of repetitions); 3) amount of within-session and between-sessions variation of intensity and volume (small vs. large). *Pre* and *post* training, we measured 1RM tests (squat and deadlift) and maximal isometric force (IF_{peak}) and maximal rate of force development ($IRFD_{peak}$) through a whole-body isometric-strength test (mid-tight pull test) on a force platform. Groups were compared by a 2-way ANOVA. **RESULTS:** Groups were not different *pre* training. The ability to produce force significantly increased in the *post* condition (15±5% for 1RM squat and deadlift, 14±5% in IF_{peak} , 33±14% in $IRFD_{peak}$) in *pST* group while *eST* showed a significant improvement only in the 1RM Squat (10±5%) that was significantly smaller than that observed for *pST*. No changes occurred in C. **CONCLUSIONS:** In young healthy subjects who trained three times per week for 4 weeks with the same type of exercises, *pST* improved the ability to produce force to a larger extent compared to *eST*. Although further studies are warranted to investigate the amount and time course differences between the two interventions, it seems that the periodization strategy, intensity and volume prescription and the large within-session and between-sessions modulation of training volume and intensity that characterize *pST* may offer an advantage in strength outcome compared to *eST*.

462 Board #283 May 31 9:30 AM - 11:00 AM

Effects Of Full-body Barbell-based Linear Progression Resistance Training Program On Healthy Untrained Participants

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Resistance training (RT) has been shown to have numerous health and performance benefits across varied populations; however the majority of the research conducted on the general population has focused on machine-based RT protocols. **PURPOSE:** To evaluate the chronic effects of a standardized whole body barbell training program on healthy participants. **METHODS:** 51 subjects (age 21.4 ± 4.7 yrs, ht. 170.3 ± 10.6 cm, body mass 69.6 ± 15.2 kg, waist 73.6 ± 9.3 cm, and hip 96.1 ± 8.0 cm, 22 ♂) were familiarized and a five repetition training load was titrated to the point the subject reached a load that they could lift safely 5 times without any degradation of form. Subjects performed the barbell squat (BS) (50.5 ± 28.8 kg), standing shoulder press (P) (26.2 ± 10.1 kg), barbell deadlift (DL) (60.2 ± 31.3 kg), and the barbell bench press (BP) (56.1 ± 29.5 kg). Following warm-up, all exercises were performed for 3 sets of 5 repetitions except DL was performed for a single set of 5 repetitions. Subjects were asked to perform a full-body resistance training protocol two or three times per week. BS was performed at each session, the P and BP alternated at each session, and the DL was performed a minimum of once per week. The training load was increased at each session that followed the attainment of 5 repetitions for each set. The progression continued until the subject was unable to make linear progress on the BS exercise. **RESULTS:** The mean duration of the intervention was 11.1 ± 3.46 weeks. Statistical analysis by t-test (P<.05) was applied to both the anthropometric and RT data. Despite no significant difference between anthropometric measurements, strength showed dramatic improvement across all lifts. Final BS (80.9 ± 33.6 kg) improved an average of 60.2%, P (38.2 ± 17.1 kg) improved an average of 45.8%, DL (87.4 ± 40.6 kg) improved an average of 45.2%, and BP (56.2 ± 29.5 kg) improved an average of 32.2%. No subjects suffered an acute injury throughout the duration of the intervention. **CONCLUSION:** A barbell-based, full-body RT protocol utilizing a linear approach to loading can be a safe and effective means of rapidly improving strength in a novice population.

463 Board #284 May 31 9:30 AM - 11:00 AM

The Effect of Knee Sleeves on Muscle Function During the Squat Exercise

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Knee sleeves (KS); made of neoprene; provide compression around the knee without restricting flexibility. KS are commonly used by weightlifters, powerlifters, and fitness competition athletes, who report attenuated knee discomfort and increased performance. Purportedly the use of KS helps to stabilize the knee, improve strength performance, and reduce the risk of injury during lower body resistance training. **PURPOSE:** To assess the impact of KS use on muscle activity and power output during the performance of the squat exercise, 19 subjects (age 26.0 ± 2 yr, ht 172.9 ± 3.6 cm, body mass 74.8 ± 3.7 kg, 13 ♂), with a minimum of six months training with squat exercise were randomly assigned to KS or no KS (NKS) trials with a repeated-measures design. **METHODS:** EMG data were obtained on the vastus lateralis (VL), semitendinosus (S) and gluteus maximus (G) muscles with a baseline obtained by two isometric maximal voluntary contractions (MVC) for five seconds, using an immovable and secure barbell at mid-range of the squat position. A warm-up of 10 reps of unloaded barbell and 5 reps @ 65% of self-reported 1RM preceded (5 min) the trial (KS or NKS) of 5 reps @ 85% 1RM (94.1 kg). Following an 8 minute rest, subjects completed the cross over trial. EMG normalized to MVC was recorded for each trial. Peak power (PP) and average power (AP) were determined by measuring the bar speed with a micro-computer system. Statistical analysis by ANOVA (p<.05) was applied to the data. **RESULTS:** VL: 65.0 ± 44.7 & 64.5 ± 46.0, S: 71.6 ± 35.0 & 69.9 ± 37.9, and G: 48.4 ± 25.3 & 49.7 ± 24.2 for K and NKS, respectively, revealed no significant difference between conditions. In addition, %MVC for VL: 171.9 ± 126 & 180.9 ± 111, S: 215.1 ± 160 & 230.2 ± 166, and G: 145.6 ± 96 & 147.8 ± 111 for K and NKS, respectively were not significantly different. PP(watts): 624.1 ± 216 and 638.5 ± 229 and AP: 349.3 ± 100 and 345.7 ± 113 for KS and NKS trials, respectively were not significantly different. **CONCLUSION:** The use of KS during the squat exercise required almost identical motor unit recruitment and provided comparable power output, thus the use of KS is a subjective decision.

464 Board #285 May 31 9:30 AM - 11:00 AM
Comparison of 4 Weeks of Circuit Training Versus Resistance Training in Middle-Aged Adults
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Despite significant progress, cardiovascular (CV) disease remains the leading killer in the US, with lack of physical activity being a primary risk factor. Research suggests that 4 weeks of exercise training reduces blood pressure (BP) and fat mass, as well as improves fitness; yet it is unclear whether circuit training (CT) or resistance training (RT) yields better short-term improvements. **PURPOSE:** To compare changes in CV and fitness measures after a 4-week CT or RT program. **METHODS:** Eighteen middle-aged adults (CT: N = 9, 49.7±8.4 yrs; RT: N = 9, 49.3±11.7 yrs) completed 4 weeks of either CT or RT exercise. Pre- and post-intervention, CV health measures, including fasting glucose, blood lipids, carotid artery intima media thickness (IMT), body composition by bioelectrical impedance analysis (BIA) and central and brachial BP were determined. Fitness testing involved measurement of maximum oxygen consumption ($\dot{V}O_{2max}$), and indices of balance and strength. **RESULTS:** Between group analyses revealed no differences between groups with exercise training, although several variables tended to improve in both groups. In the CT group, we noted improvements in central BP (SBP: 108.9±11.6 to 104.9±7.8; DBP: 76.1±8.2± to 72.3±5.6 mmHg, p<0.05). No changes in body weight, lean mass or fat mass occurred in the CT group; however, body weight (84.5±20.7 to 83.8±20.7 kg), lean mass (57.5±15.8 to 59.5±15.8 kg), and body fat (31.9±8.6 to 29.0±7.9 %) all changed in the RT group (p<0.05). For fitness measures, the CT group improved balance (right leg: 78.3±70.4 to 152.2±122.1; left leg: 41.2±39 to 167.9±206.6 sec) and 2-min stair climb (266.1±37.8 to 314.1±46.7 stairs), while the RT group improved 12-step sprint (3.3±0.5 to 2.7±0.4 sec) and maximum strength measures (leg press: 164.3±91.0 to 178.9±92.9 kg; bench press: 29.1±43.3 to 32.9±43.9 kg) (all p<0.05). Both groups improved wall sit (CT: 44.5±18.2 to 96.4±56.9; RT: 69.6±42.5 to 100.1±65.7 sec, p<0.05). No changes in lipids or glucose were found in either group. **CONCLUSION:** Our results suggest that 4 weeks of CT or RT improves CV health and fitness measures, with no differences between these two types of training.

465 Board #286 May 31 9:30 AM - 11:00 AM
Acute Effects of the Power Snatch on Vertical Jump Performance
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 (No relationships reported)

Postactivation potentiation can increase a muscle's ability to generate force. In practical terms, this may mean that acute weight lifting could improve vertical jump performance. **PURPOSE:** To examine vertical jump performance after performing prior power snatch exercises. **METHODS:** Following a standardized warm up, ten trained Olympic-style weight lifters performed power snatch exercises at increasing intensities (40% 1 repetition max [RM], 60% 1RM, and 80% 1RM) followed by vertical jump performance. Their vertical jump was measured using a Vertec in a control condition and following each power snatch intensity. Each condition was counterbalanced and separated by at least 48 hours. Two-way repeated measures ANOVA analyzed each lift intensity using vertical jump height as the dependent variable. Also, vertical jump performance in every post-power snatch condition was compared to control using a Student's t-test. **RESULTS:** There was no statistical difference in jump height in the repeated measures ANOVA or the t-test. However, there were small improvements across group means (0.3 to 0.6 inches) in the power snatch conditions. Power analysis for that effect size showed that 58 subjects would be needed to demonstrate significance. **CONCLUSION:** Power snatch exercise may be either inappropriate for eliciting postactivation potentiation or the effect was not large enough to demonstrate improvement in vertical jump performance. Future studies could examine this effect using different exercises, a single gender, or more experienced weight lifters.

466 Board #287 May 31 9:30 AM - 11:00 AM
Hip, Knee and Ankle Joint Power in Three Weighted Squat Jump Techniques
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INTRODUCTION: The vertical jump is one movement used to train and assess power output of the legs. Specifically, loaded vertical jumps have been proven to increase vertical jump performance in a training environment. **PURPOSE:** The purpose of this study is to evaluate three loaded vertical jump training methods: the barbell back squat jump (BB), the goblet squat jump (GB) and the dumbbell squat jump (DB) on lower limb, peak joint powers. **METHODS:** Nine male volunteers (age: 22.1 ± 1.2 yrs; Ht: 1.75 ± 0.05 m; Wght: 76.0 ± 10.0 Kg) with at least 2 yrs experience in weight lifting performed 5 trials in each condition of the goblet, back and dumbbell squat jumps (randomized order) utilizing 10% of their 1-RM back squat as the experimental weight. Ten infrared cameras (200Hz) and an AMTI force plate (1,000Hz) collected a full body, 3-marker per segment model and ground reaction force data. All data were smoothed using a 4th order Butterworth filter of 20Hz. GRF data were interpolated down to 200Hz to temporally align camera and force data. Commercial software was used to calculate 3D lower limb joint angles, moments and powers via inverse dynamics. Differences in peak ankle, knee and hip power values during the jump were compared with RMANOVA (alpha ≤ 0.05) with Bonferroni post hoc tests. **RESULTS:** DB resulted in greater COM maximal jump height compared to BB (p < .0001) and GB (p = .005). No differences were noted for peak hip joint power (p = .23). Peak knee power was larger for DB compared to BB (p = .01) but not GB (p = .06). At the ankle, DB produced greater power than BB (p = .01) and GB (p < .001); but no differences were noted between GB and BB (p = .40). **CONCLUSION:** DB produced a greater COM maximal jump height, and greater knee and ankle powers. DB may be a superior training tool to produce increased knee and ankle joint powers.

467 Board #288 May 31 9:30 AM - 11:00 AM
Assessment of Sprint Performance Following the Use of Resistance Training Masks During Dynamic Warm-Up
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A proposed method of increasing warm-up intensity without inducing muscular fatigue is using a respiratory training mask to provide breathing resistance. Despite the lack of research-based evidence and equivocal anecdotal evidence, this particular warm-up strategy does appear to be of increasing popularity among both athletes and active individuals. **PURPOSE:** The purpose of this study was to investigate sprint performance following the use of training masks during dynamic warm-up in Division I American football athletes. **METHODS:** Seventeen male (mean±SD: age = 17.94±.75 years, weight = 104.43±23.02 kg, height 184.93±7.06 cm) NCAA Division I, American football athletes from a Midwestern university were recruited to participate in this study. Athletes were informed of risks, and completed 3 testing sessions separated by 7 days each. All testing sessions took place at the same time of day on artificial turf in the university's indoor training facility. Testing sessions began with a warm-up (WU) under the instruction of a member of the university's Strength and Conditioning staff. The WU consisted of dynamic exercises targeting the lower body musculature. During the initial visit, participants completed the dynamic WU and tested on 5x10-meter sprints without a respiratory training mask and all data collected during the initial visit were used to establish baseline measurements. During the second and third visits, participants were randomly selected to complete the WU with the respiratory training mask set to simulate an altitude 3,657.6 (EXP) m or 914.4 m (SHAM). Upon completion of the WU, participants removed the mask and performed 5 × 10-meter sprints. A one-way repeated measures analysis of variance (ANOVA) design was used to assess differences between control and experimental results. All statistical analyses were performed using SPSS (Version 21.0 for Windows; SPSS, Chicago, Illinois) with statistical significance set at p < .05. **RESULTS:** No significant differences were found between control, sham, and experimental measures (P = 0.7-0.874). **CONCLUSION:** These findings suggest that the use of respiratory training masks during WU does not improve sprint times in Division I football athletes.

468 Board #289 May 31 9:30 AM - 11:00 AM
Decrease of Muscle Performance After Two Different Load Protocols in Well-Trained Men: a Pilot Study

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To study muscle damage recovery, firstly muscle damage has to be induced by an exercise. A specific drop jumps protocol has been largely used in previous studies. However, all participants studied were untrained.

PURPOSE: To assess muscle strength, muscle power and muscle swelling after two different load drop jump protocols in well-trained athletes.

METHODS: Eighteen strength and/or power-trained male athletes (4.31±2.75 years of training experience) were randomly assigned into one of two groups. DJ100 consisted in 5 sets of 20 drop jumps from a 60-cm box with 2-minute rest interval (n=9, 23.00±2.74 years). DJ140 consisted in seven sets of 20 drop jumps also (n=9, 22.89±3.37 years). Volunteers performed a maximally explosive vertical jump. Both groups performed the assessment of indirectly markers of muscle damage before and immediately after exercise protocol. Muscle thickness of knee extensors was measured using B-mode ultrasound. Maximal isometric muscle strength (PT) was measured by 2 sets of 4 seconds maximal isometric knee extension at 60°. For vertical jump, the athletes performed three countermovement jumps as high as possible, with one-minute rest between jumps. After normal distribution confirmed by Shapiro-Wilk tests, independent samples T-tests were used to compare the magnitude of changes of muscle thickness, isometric strength and vertical jump between groups. A p-value of ≤ 0.05 was adopted.

RESULTS: There was no significant difference (p>0.05) in sample's baseline characteristics between groups. There was no significant difference in the increase of muscle thickness (DJ100: 6.47 ± 1.67 (16.50%) vs. DJ140: 7.51 ± 2.31 mm (17.82%); p = 0.286). The decrease of isometric strength was significantly greater in DJ140 than DJ100 (DJ100: 34.24 ± 22.30 (11.20%) vs. DJ140: 67.06 ± 38.79 N.m (22.41%); p = 0.043; ES = 1.037). The decrease of vertical jump was also significantly greater in DJ140 than in DJ100 (DJ100: 0.48 ± 2.88 (0.95%) vs. DJ140: 7.72 ± 7.44 cm (17.42%); p = 0.015; ES = 1.283).

CONCLUSIONS: The main finding of this study was that an exercise protocol composed by 100 drop jumps did not decrease lower limb muscle power in well-trained athletes. Furthermore, 140 drop jumps induced a decrease in muscle performance greater than 100 drop jumps in well-trained athletes.

469 Board #290 May 31 9:30 AM - 11:00 AM
Heavy And Light Training Days Attenuates Decline In Force Output During 3-weeks High-volume Resistance Training

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High volume resistance training is employed by coaches during training emphasizing enhanced body composition, hypertrophy, and work capacity. However, high volume training may cause levels of fatigue that impact strength and power performances. It is not well known if using fatigue-management strategies such as heavy and light days affect these performances.

PURPOSE: To compare changes in kinetic variables following high volume resistance training employing heavy and light days. **METHODS:** Eight strength trained males (age = 27.4 ± 4.2 years, body mass = 90.8 ± 11.8 kg, isometric peak force = 4397.1 ± 636.9) participated in the study. Pre- and post-training each subject was evaluated for isometric peak force (IPF), allometrically-scaled isometric peak force (IPFa), and rate of force development at 90 ms (RFD90) during an isometric mid-thigh pull test on a dual force platform sampling at 1000Hz. The training protocol consisted of resistance training 3 days/wk with each week progressing in intensity. Each 3rd training day was a light day (10% lighter than day 1). Paired-samples t-tests were calculated pre-post the 3 weeks to assess changes associated with training. Magnitudes of change were examined using percent change and effect size using Cohen's *d*. **RESULTS:** The change in body mass (BM) was significantly higher (90.8 ± 11.8 kg to 92.5 ± 11.7 kg) (p = 0.03) while no statistical differences were observed in IPF (4397.1 ± 636.9 N to 4380.4 ± 432.9 N), IPFa (218.0 ± 25.5 N/kg^{0.67} to 215.5 ± 23.2 N/kg^{0.67}), or RFD90 (10155.6 ± 5511.3 N·s⁻¹ to 9208.3 ± 4547.3 N·s⁻¹) (p > 0.05). Percent change for BM, IPF, IPFa, and RFD90 were as follows: 1.9%, -0.4%, -1.2%, -9.3%, respectively. Effect sizes for BM (*d* = 0.15), IPF (*d* = 0.03), IPFa (*d* = 0.10), and RFD90 (*d* = 0.19) indicated trivial effects pre-post high volume training. **CONCLUSIONS:** High volume resistance training is often concomitant with reductions in strength performance. The results of the study indicate that force outputs were spared following 3-wks high volume training when employing heavy and light days. Although not significant, a

reduction in RFD90 of 9.3% is practically significant for athletes. It seems that while strength variables were largely unaffected, explosiveness (i.e. RFD90) may be more sensitive to high training volumes regardless the fatigue management strategies used.

470 Board #291 May 31 9:30 AM - 11:00 AM
Differences In Power And Velocity During The Back Squat In Resistance-trained Men And Women.

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Muscular power is vital to success across sport and competitive level. Determination of the load that optimizes power varies by exercise, gender, and training status. For example, the load that maximized peak power for the power clean in men has been proposed to occur at 80% one-repetition maximum (1RM); whereas the ideal load for the squat is equivocal. Further, one study reported differences between men and women in peak power at differing loads during ballistic exercise. However, few data exist on the differences in men and women relative to power and velocity, and no study has examined the differences in men and women relative to power and velocity, and no study has examined the differences in men and women relative to power and velocity development. **PURPOSE:** To determine whether differences exist between resistance-trained (RT) men and women in regard to the loads that maximize average power (AP), peak power (PP), average velocity (AV), and peak velocity (PV) in the back squat (BS). **METHODS:** Forty-one RT (n = 41) men (m = 20; 21 ± 1 y; 183.0 ± 7.8 cm; 82.5 ± 8.0 kg) and women (w = 21; 20 ± 1 y; 166.5 ± 6.9 cm; 63.1 ± 7.7 kg) had their 1RM determined (m: 147.0 ± 28.0 kg; f: 89.1 ± 12.3 kg). On a second day, they performed two repetitions at BS loads corresponding to 30%, 40%, 50%, 60%, 70%, 80%, and 90% 1RM as explosively as possible for determination of AV, PV, AP and PP. The repetition with the highest value was used for comparison. Repeated measures analysis of variance for AV, PV, AP, and PP were run. **RESULTS:** Men were older (p = 0.022), taller (p < 0.001), heavier (p < 0.001), stronger (p < 0.001), and had a greater 1RM to body weight ratio (m: 1.8 ± 0.3; w: 1.4 ± 0.1; p < 0.001). Men also produced higher velocities (PV, AV) and power (PP, AP) across all loads. The highest PP occurred at 90% 1RM for both, though no difference was noted between 80% 1RM and 90% 1RM in either sex. The highest AP occurred at 70% 1RM in men, though AP at 60% and 80% 1RM were not different. The highest AP in women was observed at 80% 1RM, though no difference was noted between that intensity and 50% - 70% 1RM. AV and PV occurred at the lowest intensity (30% 1RM) in both sexes. **CONCLUSION:** These data suggest that load for PP, PV, and AV does not differ. However, differences did exist in the load that resulted in the highest AP. Whether this would be observed across all sports is unknown. Further study is required to determine if sex differences exist in load among different sports and training status.

471 Board #292 May 31 9:30 AM - 11:00 AM
Effect of Different Types of Circuit Resistance Training on Total and Regional Muscle Mass

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PURPOSE: The purpose of this study was to compare the training effects on total and regional muscle mass with different types of circuit resistance training among sedentary healthy adults.

METHODS: 36 participants (18 female; 28.19 ± 5.30 yr; 168.50 ± 8.93 cm; 66.33 ± 14.17 kg) were randomly assigned to three groups: machine circuit training group (MCT, n = 12), dumbbell circuit training group (DCT, n = 12), and control group (n = 12). MCT and DCT performed 3 sessions per week for 8 weeks resistance-type circuit training (10 exercise x 30 sec x 3 set; 25-30 min). Muscle mass of trunk and limbs were measured pre and post intervention for all subjects using bio-electric analyzer. One-way ANCOVA and least significant difference (LSD) were used for the analysis. Significant level was set at α = .05.

RESULTS: There were no significant difference in body mass (MCT: -2.19%; DCT: -1.55%; CON: -0.43%) before and after 8-wk intervention in any group. Changes in total skeletal muscle mass (MCT: + 3.44%; DCT: +4.67%; CON: -1.18%) was not different between MCT and DCT. Both training groups demonstrated significant difference with control group (p<.05). Significant changes in arms and legs muscle mass were found after training in MCT and DCT. Upper limb showed higher rate of increase in both group. For trunk muscle mass (MCT: + 0.88%; DCT: +1.83%; CON: -0.53%), both training group were significant difference with control group after intervention (p<.05). DCT showed better training effect on trunk muscle mass than MCT (p<.05).

CONCLUSIONS: The findings of present study verify the effectiveness of 8-week circuit resistance training on body composition and muscle mass for sedentary healthy

adults. Training effects was equivalent using machine or dumbbell as equipment for limb muscle mass. Circuit training with dumbbell required core stability lead to more hypertrophy of trunk muscle than training with machine.

472 Board #293 May 31 9:30 AM - 11:00 AM
Effects of Different Resistance Training Protocols on Performance, Metabolic and Perceptual Responses in Trained Men

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 (No relationships reported)

Monitoring the intensity of resistance training (RT) is essential for the effectiveness of training periodization. Athletes have been using power, hypertrophic and strength trainings protocols to improve performance. However, the effects these protocols on physiological stress are still unknown. **PURPOSE:** To compare the effects of three different protocols of RT on total volume (TV), session rate perceived exertion (SRPE) and lactate concentration (LAC). **METHODS:** Nine resistance trained men (22 ± 3.87 years, 79.53 ± 13.28 kg and 176.59 ± 7.53 cm) performed three training sessions on different days separated by at least 72 hours in a counterbalance fashion. After determining one maximum repetition (1-RM) on a squat (SQ) and bench press (BP) exercises, each volunteer performed three different training protocols: 1) power training session (PTS, performed 6 sets of 6 reps on SQ and 6 sets of 6 reps on BP at 50% of 1-RM), 2) hypertrophy training session (HTS, performed 5 sets of maximum repetitions on SQ and 5 sets on BP at 75% of 1-RM) and 3) strength training session (STS, performed 5 sets of maximum repetitions on SQ and 5 sets on BP at 90% of 1-RM). The three sessions were performed with 2-min rest interval between sets and 5-min between the two exercises. The SRPE was measured 15-min after each training session by the CR-10 RPE scale. Statistical analysis was done by means of repeated measures ANOVA. The probability level of statistical significance was set at $p < 0.05$ in all comparisons. **RESULTS:** The STS showed lower TV (2493.00 \pm 948.79 kg) in comparison with HTS and PTS (5169.75 \pm 1340.20 and 4428.00 \pm 701.94 kg, respectively). However, the STS and HTS showed higher SRPE (6.33 ± 1.87 and 7.89 ± 1.17 , respectively) when compared to PTS (4.33 ± 1.66). In all protocols volunteers showed higher LAC at the end of the sessions ($p < 0.05$). Moreover, in the HTS the LAC was higher (1.15 ± 0.36 to 11.77 ± 2.07 mM) when compared to STS (1.02 ± 0.36 to 6.53 ± 2.87 mM) and PTS (1.10 ± 0.40 to 4.00 ± 2.47 mM). **CONCLUSION:** Our data suggest that the magnitude of physiological stress resulting from the exercise (internal load) is more dependent on the magnitude of the effort (maximum or submaximal repetitions) than the TV or load lifted (external load) in different protocols of RT. Further studies are needed to investigate the effects of other RT protocols.

473 Board #294 May 31 9:30 AM - 11:00 AM
Intra- And Inter-set Velocity Characteristics During High- And Low-load Resistance Training To Failure

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 (No relationships reported)

INTRODUCTION: Recent investigations have examined the effects of high- and low-load resistance training on skeletal muscle hypertrophy and strength. However, few investigations have examined the velocity parameters between these two conditions. **PURPOSE:** The purpose of this study was to examine the velocity characteristics during high- and low-load barbell back squatting to failure. **METHODS:** Eleven resistance-trained males (Age: 22 ± 3 years, Body Mass: 83.7 ± 10.5 kg, Squat 1RM: 157.1 ± 25.8 kg) were recruited to participate in this study. During the initial visit participants completed a one-repetition maximum (1RM) testing session to assess lower extremity muscular strength. Following 1RM testing, participants were asked to return for two additional sessions scheduled no more than eight days apart. Following a designated warm-up, subjects were randomly assigned to squat either 80% (high-load) or 30% (low-load) of their squat 1RM for three sets to failure with 3 minutes' rest between sets. Mean velocity (MV) was recorded during each set using a linear position transducer (GymAware, Canberra, Australia). **RESULTS:** Independent samples t-tests were conducted to assess differences between conditions. Initial analysis displayed a significantly higher MV for the low-load condition (0.66 ± 0.08 m/s) when compared to the high-load condition (0.40 ± 0.12 m/s; $p < 0.001$) across all time points. Follow-up analysis revealed a significant decrease in MV during each set during both conditions ($p = 0.000 - 0.008$), with no significant differences between groups ($p > 0.05$ for each set). No significant differences ($p > 0.05$) in percent decline of intra-set MV (Low-load: 30.3-34.8%; High-load: 30.4-37.4%) were observed between the conditions at each time point. Additionally, there were no significant differences in MV

between the first and last reps of each set in either condition ($p > 0.05$ for each time point). **CONCLUSION:** Although high-load resistance training leads to significantly higher MV's than low-load resistance training, percent decline during and between sets was similar in both conditions, indicating similar levels of fatigue were accumulated during the bouts. Given the vast difference in MV between conditions, future research into the mechanisms of fatigue during each condition may be warranted.

474 Board #295 May 31 9:30 AM - 11:00 AM
Percentage-based and Autoregulated-based Resistance Training Loading Produce Similar Lower Body Hypertrophy Outcomes

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Researchers and practitioners have used the resistance training-specific rating of perceived exertion (RPE) scale to individualize load prescription. **PURPOSE:** To compare changes in muscle thickness (MT) of the vastus lateralis at 50% (VL50) and 70% (VL70) and vastus medialis at 70% (VM70) femur length between percentage-based training (PBT) and autoregulated-based training (ABT) via RPE. **METHODS:** Eleven males (age: 23 ± 4 yrs, body mass: 77.4 ± 7.7 kg, body fat: $9.5 \pm 3.8\%$) with at least two yrs. of training experience and a minimum one-repetition maximum (1RM) of 1.5 and 1.25x bodyweight on the squat and bench press respectively, were assigned to one of two groups: PBT (n=6) or ABT (n=5) for 8 weeks. Forty eight hours following pre-testing MT via ultrasound, both groups performed the squat and bench press 3x/wk. on non-consecutive days (i.e. Mon., Wed., Fri.) using the same number of sets and repetitions following an undulating resistance training program, which linearly increased load and decreased repetitions throughout. Weeks 1-3 consisted of 8, 6, and 4 repetitions on Mon., Wed., and Fri., while weeks 4-5 consisted of 7, 5, and 3 repetitions, with 6, 4, and 2 repetitions being performed during weeks 6-7. Week 8 served as a taper with 4 and 3 repetition days on Mon. and Wed. and post-testing on Fri. Load increased during each week in PBT from 65, 70 and 75% in week 1 to 82.5-92.5% of 1RM in week 7. In ABT there was no prescribed load but subjects were instructed to select a load in which the set ended with a 5-7 RPE in week 1 and progressed to an 8-10 RPE in week 7. A 2x2 repeated measures ANOVA was used with significance set at $p \leq 0.05$. **RESULTS:** There was a significant time effect for VL50 (25.4 ± 3.28 to 28.1 ± 4.64 mm; $p=0.04$; $+10.42\%$) in PBT but not in ABT (26.72 ± 3.75 to 28.45 ± 3.42 mm; $p=0.16$; $+6.47\%$). The time effect for VL70 in PBT approached significance (23.69 ± 3.42 to 26.81 ± 2.89 mm; $p=0.06$; $+13.17\%$), and there was no significant change for VL70 in ABT (24.61 ± 3.59 to 26.31 ± 4.06 mm; $p=0.33$; $+6.91\%$). There was a significant time effect for VM70 in PBT (17.93 ± 3.25 to 19.25 ± 3.36 mm; $p=0.05$; $+7.36\%$), but not in ABT (19.63 ± 4.30 to 20.50 ± 4.00 mm; $p=0.17$; $+4.43\%$). Additionally, there were no group differences (VL50: $p=0.72$; VL70: $p=0.92$; VM70: $p=0.54$). **CONCLUSION:** Our findings indicate that PBT and ABT strategies produce similar lower body hypertrophy.

A-56 Free Communication/Poster - Running

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

475 Board #296 May 31 9:30 AM - 11:00 AM
Inter-limb Differences When Using A Passive-dynamic Ankle-foot Orthosis For Running

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 (No relationships reported)

Recent advancements in surgical care have improved the ability to salvage, versus amputate, severely injured limbs but many patients are still left with severe functional impairments. Passive-dynamic ankle-foot orthoses (PD-AFO) have enabled some injured individuals to regain many of their functional abilities, including a return to running. The PD-AFO's semi-rigid structure provides the external support that is essential for many of these activities, but it limits motion and affects movement mechanics. There is a paucity of information on running with PD-AFOs and how their use impacts the unaffected limb. **Purpose:** To identify limb loading and footstrike patterns during running in PD-AFO users. **Methods:** Fifteen male Service Members (29 ± 5 years, 1.8 ± 0.1 m, 84.3 ± 7.6 kg) who had undergone unilateral lower limb salvage and who were prescribed custom PD-AFOs (Intrepid Dynamic Exoskeletal Orthosis)

participated. Kinematic and kinetic data were recorded as subjects ran through a 17m data capture area at a self-selected speed (3.4±0.7 m/s). Between limb differences in footstrike patterns and loading rates were assessed between the PD-AFO and unaffected limbs via paired t-tests. **Results:** Mean loading rates were 43% greater on the unaffected limb than on the PD-AFO limb (60.4±25.6 vs. 34.6±11.8 BW/sec, p<0.001). These differences were largely due to distinct footstrike asymmetries. Eleven patients used a heel strike on the unaffected limb and a forefoot contact on the PD-AFO limb. One subject attempted to run with a heel strike on both limbs and 3/15 subjects were able to run with mid-forefoot footstrike classification on each limb. **Conclusion:** Participants were able to run with the PD-AFO following traumatic lower limb salvage, but distinct asymmetries were observed. Loading the forefoot of the PD-AFO creates a larger lever for patients to utilize its energy storage and return properties and is viewed as desirable. Heel strike and higher loading rates on the unaffected limb could contribute to overuse-type injuries if these running mechanics are maintained long term. Thus, training interventions that focus on achieving a forefoot strike pattern on both limbs may promote the desired changes in running mechanics for this patient cohort.

Supported by Center for Rehabilitation Sciences Research NF90UG (DHS-PHS)

476 Board #297 May 31 9:30 AM - 11:00 AM
Sport-specific Comparisons of Lower Extremity Joint Work during Running

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Running involves unique contributions of joint work in order to absorb forces and subsequently propel the body forward. When compared to the hip and knee, the ankle contributes the greatest negative (W^-) and positive (W^+) work during running. Changes in work have been linked to increases in velocity (sprinting) and intensity (incline). The mechanics of running has been examined primarily in athletes who are runners. However, other athletes utilize running during their practice and competition. The specific movements of these sports may result in different mechanical demands on the lower extremities and therefore different running mechanics. **PURPOSE:** To compare differences in individual joint work and total work (W^0) during steady state running in a group of female athletes from 3 different sports (running=RN, lacrosse=LX, basketball=BB). **METHODS:** Forty-eight female athletes volunteered (RN: n=12, ht=1.68±0.1m, mass=62.1±9.8kg; LX: n=24, ht=1.64±0.1m, mass=64.1±6.6kg; BB: n=12, ht=1.76±0.1m, mass=72.3±13.4kg). Sagittal plane kinematics and kinetics were assessed while running on an instrumented treadmill (Treadmetrix, Park City, Utah) at a constant speed using a 5 camera motion analysis system (Qualysis, Goteborg, Sweden). Joint powers and joint work for the hip, knee and ankle were calculated using Visual 3D (C-Motion Inc., Bethesda, MD). W^0 was defined the absolute value of $W^- + W^+$. Independent variables included W^- , W^+ , W^0 at the hip, knee and ankle. Two-factor analyses of variance (ANOVA) were employed using SPSS 24.0 for W^- , W^+ and W^0 . Post-hoc analyses (Tukey HSD) were performed as appropriate. All significance levels were set at $\alpha<0.05$. **RESULTS:** A significant interaction between sport and joint existed with W^- (p<0.01) and with W^0 (p=0.01) at the ankle. Specifically, RN had more W^- (0.71±0.29) than LX (0.50±0.12, p=0.02) at the ankle. W^0 at the ankle was greater in RN (1.31±0.05) compared to both LX (0.96±0.21, p<0.01) and BB (0.97±0.23, p=0.02). **CONCLUSION:** Overall, W^- and W^0 at the ankle is greater in RN compared to LX and BB. The contribution of the ankle to the lower extremity is 60% in RN compared to 54% in LX and 45% in BB. These differences in work may result in possible inefficient gait patterns. Implications of altered mechanics are possible increases in energy demand or neuromuscular fatigue.

477 Board #298 May 31 9:30 AM - 11:00 AM
Changes in Joint Work across Consecutive Seasons in Collegiate Cross Country Runners

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Running mechanics are known to change with age and years of experience, however the extent to which mechanics may change more acutely from one year to the next is uncertain. In particular, refinements of running mechanics may occur which benefit an individual's performance or reduce injury risk. **PURPOSE:** To assess changes in lower extremity joint work during running across two consecutive seasons among healthy collegiate runners.

METHODS: Pre-season data from the 2015 and 2016 cross country seasons were reviewed for 14 NCAA Division I runners (men, 7; age: 20.1±1.1 yr; height: 1.7±0.1 m; mass: 61.6±8.8 kg). Athletes were healthy at both testing sessions. Ground reaction forces and kinematic data were recorded during treadmill running (4.47m/s). Sagittal

plane positive (PW) and negative work (NW) were calculated for the hip, knee, and ankle during stance phase and averaged across gait cycles. PW and NW at each joint were then compared across seasons using paired t-tests. Training programs and injuries occurring between testing sessions were also reviewed.

RESULTS: No differences between limbs were observed (p > 0.13); analyses are reported for the right limb. At the start of the 2015 season, PW at the hip, knee, and ankle was 0.26±0.10, 0.33±0.08 and 1.31±0.21 J/kg, respectively, and NW was -0.04±0.04, -0.45±0.11, and -0.83±0.29 J/kg, respectively. At the start of the 2016 season, PW at the hip, knee, and ankle was 0.38±0.14, 0.25±0.25 and 1.30±0.23 J/kg, respectively, and NW was -0.05±0.05, -0.39±0.09, and -0.86±0.31 J/kg, respectively. Hip PW increased significantly and both knee PW and NW decreased significantly (p < 0.006) across seasons. No significant differences between seasons were observed in ankle PW or NW (p > 0.42) or in hip NW (p = 0.43). Results remained consistent when comparing those who did and did not sustain an injury between 2015 and 2016, and no changes in training programs were noted. **CONCLUSIONS:** Hip PW and knee PW and NW changed significantly between seasons, indicating an alteration in running mechanics that may affect performance. In the absence of injury and training-related modifications, the mechanism responsible for these changes requires further exploration.

478 Board #299 May 31 9:30 AM - 11:00 AM
The Effect of Small Perturbations in Running Velocity on Measures of Coordination Variability

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Running research aims to replicate movement that occurs outside the laboratory and may represent daily life. One factor commonly manipulated and constrained within the laboratory is running velocity. Outside the laboratory, velocity is often varied within a runner's training regimen. Though running velocity is regularly altered in both settings, little is known about how these small changes may affect the organization of movement. **PURPOSE:** This study aimed to determine whether small deviations from preferred velocity led to changes in coordination variability (CV). **METHODS:** Nine healthy runners (age 22 ± 2 years) were recruited from the Las Vegas community. Kinematic and kinetic analyses were performed while participants ran at 85%, 90%, 95%, 100%, 105%, 110%, and 115% of their preferred velocity. Movement CV was calculated for the segment couples of thigh-shank and shank-foot during early, mid, and late stance using a modified vector coding technique. The joint couples analyzed included: thigh flexion-shank rotation, thigh flexion-shank flexion, shank rotation-foot eversion, and shank flexion-foot flexion. CV values were averaged across trials and compared between conditions using repeated measures ANOVA ($\alpha<0.05$). **RESULTS:** No statistically significant differences in CV were found between velocity conditions for any couplings of interest during any phase of stance (Table 1). **CONCLUSION:** Small perturbations in running velocity from preferred do not influence CV of thigh-shank and shank-foot couplings during stance phase. It is possible that larger deviations from preferred velocity would result in changes, and this effect has been shown in previous research. However, the goal of this project was to assess how slight changes, such as what would be seen in day-to-day training or from constraints in the laboratory, would influence CV.

Table 1: Mean movement coordination variability of segment couples during early, mid and late stance

	Early Stance (0-20%)				Mid Stance (21-60%)				Late Stance (61-100%)			
	Thigh-Shank		Shank-Foot		Thigh-Shank		Shank-Foot		Thigh-Shank		Shank-Foot	
	XX	XZ	XX	ZY	XX	XZ	XX	ZY	XX	XZ	XX	ZY
Sig	0.40	0.66	0.95	0.96	0.86	0.44	0.39	0.97	0.10	0.08	0.48	0.72
85%	3.41	19.8	2.73	14.9	2.06	5.25	2.67	17.0	3.79	5.58	1.56	9.65
90%	3.07	19.0	2.43	15.3	2.25	5.23	2.46	19.5	3.01	4.65	1.54	8.78
95%	3.09	17.7	2.62	15.2	2.40	5.49	2.71	18.0	3.32	4.74	1.59	8.90
100%	3.19	17.1	2.68	16.0	2.12	5.64	5.25	19.1	3.61	5.10	1.86	9.27
105%	3.33	20.1	2.91	14.2	2.18	5.08	3.22	18.9	3.13	4.32	1.70	7.78
110%	3.46	19.9	2.91	15.1	2.18	4.94	2.86	18.9	2.49	4.27	1.45	8.82
115%	4.20	17.4	2.98	16.3	2.13	4.23	3.40	18.0	2.56	3.95	1.44	8.49

479 Board #300 May 31 9:30 AM - 11:00 AM
Maximalist Shoes Do Not Reduce Impact Loading During Level And Downhill Running

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A new running shoe design called 'maximalists', which claims to provide maximal cushioning with its oversized midsole and thus lower the impact loading, becomes more popular among trail runners. Downhill running is an essential component of trail races but it may lead to a greater loading than level running. However, the effects of maximalists on the running biomechanics, especially during downhill running, remain unexamined.

Purpose: To compare vertical loading rates, stride length and footstrike angle in runners with traditional running shoes (TRS) and maximalists (MAX) during level and downhill running. **Methods:** Twelve regular shod runners (9 males, 32.5±8.9 years) were asked to run on a self-paced instrumented treadmill at 0% and 10%-declination with TRS (Adizero boost, Adidas) and MAX (Clifton 3, Hoka) in a randomized sequence for 5 minutes. Kinematics and force data were sampled at 200 and 1,000 Hz respectively. The average (AVILR) and instantaneous vertical loading rates (VILR), along with the stride length and footstrike angle, were extracted and averaged over the last minute in each condition. **Results:** VALR, VILR, stride length, and footstrike angle were similar between TRS and MAX during both level and downhill running ($p>0.372$, Table 1). **Conclusion:** These findings suggest that additional cushioning of maximalist running shoes do not lower impact loading. In addition, maximalists do not change the stride length and footstrike pattern in shod runners.

	Level running				Downhill running			
	MAX Mean (SD)	TRS Mean (SD)	Cohen's d	P-value	MAX Mean (SD)	TRS Mean (SD)	Cohen's d	P-value
VALR (BW/s)	57.5 (16.5)	56.3 (18.3)	0.07	0.827	84.5 (21.6)	79.4 (18.8)	0.25	0.563
VILR (BW/s)	71.6 (18.5)	69.3 (19.2)	0.13	0.684	102.3 (23.2)	95.0 (19.3)	0.34	0.372
Stride length (m)	1.72 (0.14)	1.72 (0.14)	0.02	0.672	1.78 (0.13)	1.78 (0.13)	0.04	0.626
Foot-strike angle (degree)	7.7 (7.0)	7.6 (7.3)	0.02	0.949	14.6 (6.4)	14.0 (11.1)	0.07	0.819

480 Board #301 May 31 9:30 AM - 11:00 AM
Is Variability Of Stride Frequency A Factor That Determines Preferred Stride Frequency During Running?

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 (No relationships reported)

Purpose: The purposes of this study were 1) to quantify and describe variability of stride frequency during running, and 2) to determine if the variability of stride frequency is minimized at the preferred stride frequency. **Methods:** The participants (n=8; 24.88±4.16 years; 173.19±9.33 cm; 72.81±14.27 kg) performed seven 5-minute run conditions on an instrumented treadmill (Bertec FIT, USA). The seven runs were a function of their preferred stride frequency (PSF, PSF±5%, PSF±10%, PSF±15%). Participants matched each foot fall with a metronome set to the stride frequency for each condition. Data were collected during four 30-second trials per condition. Variability of stride frequency was determined using coefficient of variation ($CV_{SF} = \text{standard deviation}/\text{mean} \times 100$). CV_{SF} were each compared between conditions using a repeated measures ANOVA. **Results:** CV_{SF} was different across SF conditions ($F=14.672$, $p<0.001$). Using pairwise comparisons, it was determined that CV_{SF} at PSF (0.991) was significantly less than during PSF+10% (1.262; $p=0.016$), PSF+15% (1.454; $p<0.001$), PSF-10% (1.362; $p=0.028$), and PSF-15% (1.652; $p<0.001$). The CV_{SF} during PSF+5% (1.025) was different from all other SF perturbations ($p<0.05$). CV_{SF} during PSF+10% (1.262) was less than during PSF-15% (1.652; $p=0.025$). CV_{SF} during PSF+15% (1.454) was greater than PSF-5% (1.209; $p=0.016$). CV_{SF} during PSF-5% (1.209) and PSF-10% (1.362) were less than PSF-15% (1.652; $p=0.001$,

$p=0.028$, respectively). **Conclusion:** CV_{SF} was influenced by large changes in SF. Stride frequency variability increased as stride frequency increased further from the preferred stride frequency. It may be that decreased variability of SF is a factor determining the preferred stride frequency during running.

481 Board #302 May 31 9:30 AM - 11:00 AM
Influence Of Stride Frequency Manipulation On Muscle Activity During Running At Reduced Body Weight

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 (No relationships reported)

Running with body weight support (BWS) (e.g., running on a lower positive pressure treadmill) has been used for physical fitness enhancement. Nevertheless, gait mechanics of running with BWS is not fully understood. **Purpose:** To investigate influence of stride frequency (SF) manipulation on muscle activity during running at different BWS conditions. **Methods:** Nineteen subjects (23.8±4.1 years) ran on a lower body positive pressure treadmill at their preferred running speed (PS) for different BWS conditions (i.e., 0%, 50%, and 80% of BWS conditions). The SF conditions consist of running at preferred SF (PSF), PSF+10%, and PSF-10%. Muscle activity from the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius (GA) were measured. In addition, rating of perceived exertion (RPE) and SF were measured. Muscle activity, RPE, and SF were analyzed using a 3 (mode) x 3 (BWS) repeated measures analysis of variance (ANOVA) ($\alpha = 0.05$). PS was analyzed using a one-way repeated measures ANOVA ($\alpha = 0.05$). **Results:** Muscle activity (RF, BF, TA, and GA), RPE, and SF were not influenced by the interaction of BW support and SF ($P>0.05$). Muscle activity from the RF, TA, and GA were different between BWS conditions ($P<0.001$). Specifically, muscle activity from the RF, TA, and GA were lower with increasing BWS (e.g., a decrease of 26%~46% between 80%BWS and 0%BWS conditions). Muscle activity from the RF, BF, and TA were different between SF conditions ($P<0.05$). For example, RF muscle activity during running at PSF was 11%~18% lower than when running at PSF+10%. Additionally, BF muscle activity during running was higher with increasing SF (e.g., a 20% increase in SF resulted in 12%~27% increase in the BF muscle activity). RPE was not different between BWS conditions ($P>0.05$) and between SF conditions ($P>0.05$). SF was different between BWS conditions ($P<0.001$) and between SF conditions ($P<0.001$). For example, SF was lower with increasing BWS (e.g., a decrease of 15% between 80%BWS and 0%BWS conditions). PS was higher with increasing BWS (9.8±2.1 km/h, 11.0±2.6 km/h, and 11.8±2.8 km/h for 0%, 50%, and 80% of BWS conditions, respectively; $P<0.001$). **CONCLUSION:** These observations suggest that a change in SF may influence muscle activity (i.e., RF and TA) during running, regardless of BWS.

482 Board #303 May 31 9:30 AM - 11:00 AM
Smaller Compressive and Anteroposterior Joint Reaction Forces in Older Compared to Young Runners

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Age-related changes in bone structure and mechanics may increase the risk of injury when performing exercise such as running. Joint-related injury such as osteoarthritis is a primary concern for older runners. A contributing factor to bony injury is joint loading. However, it is not known whether increased loading exists in older runners. **Purpose:** To compare anteroposterior and compressive joint reaction forces (JRFs) in the lower extremities during running in healthy young and older runners. **Methods:** Nine healthy young runners (YA) and 10 healthy older adult runners (OA) performed fifteen over ground running trials at a fixed velocity (3.35 m/s). Running velocity was maintained (+5%) using an infrared timing gate. Three-dimensional kinematics and ground reaction forces were recorded simultaneously using an 8-camera motion capture system (240 Hz, Qualisys, Inc.) and force platform (960 Hz, AMTI, Inc.), respectively. Visual 3D was used to calculate ankle, knee and hip JRFs (compressive and anterior/posterior) during the stance phase of the gait cycle. Independent samples t-tests were used to compare mean JRFs in both directions. **Results:** YA exhibited significantly larger mean JRFs at the ankle ($p=0.04$; YA: -13.2±1.0 BW; OA: -12.6±0.7 BW) and knee ($p=0.04$; YA: -13.0±0.9 BW; OA: -12.3±0.9 BW) while no differences were observed at the hip ($p=0.08$; YA: -12.0±1.0 BW; OA: -11.1±1.4 BW). In the anterior/posterior direction, older adults had significantly smaller ankle JRFs compared to young adults ($p=0.01$; YA: 5.1±0.7 BW; OA: 4.5±0.4 BW) while no differences were observed at the knee ($p=0.20$; YA: -3.0±1.2 BW; OA: -2.7±0.8 BW) or hip ($p=0.37$; YA: 2.4±2.0 BW; OA: 2.2±1.9 BW). **CONCLUSIONS:** These data demonstrate that OA have smaller compressive JRFs and anteroposterior shear forces than YA. Therefore, it can be suggested that the greater incidence of bony and cartilage injuries experienced by older runners is not due to greater forces applied to the lower extremity joints during running.

483 Board #304 May 31 9:30 AM - 11:00 AM

Sagittal Plane Peak Knee Angle Variability During Distance Running Training And Race SpeedsChristopher T. Robertson, Jaclyn O'Loughlin, Jeffrey T. Wight.
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PURPOSE: To analyze peak knee angle variability during distance running to determine if significant differences exist between the stance and swing phases at training and race paces. **METHODS:** Twenty-six highly-trained (30-80 miles per week) adult runners participated in the study (9 females, 17 males, 36.1±10.8 years). For gait analysis, 9mm spherical retro-reflective markers were applied according to Pohl et al., (2010). Data were collected at 200 Hz for 25 seconds using 6 Vicon Bonita cameras. Ten strides were analyzed and normalized to 100 points for the both the stance and swing phases. To assess variability, standard deviation (SD) was calculated across the 10 strides for each of the 100 data points. Peak variability was identified by taking the maximum value of the 100 SDs. The occurrence of peak variability in each phase was extracted as a percentage of each normalized phase. A 2 by 2 repeated measures factorial ANOVA was used to test for main effects and interaction (phase x velocity) at $p=0.05$ for both variables. **RESULTS:** There were significant phase main effects ($p<0.001$) for both variables. Peak knee angle variability was significantly greater in the swing phase compared to the stance phase (7.88° vs 4.22° , respectively). Peak knee angle variability occurred at 74% of the swing phase compared to 19% of the stance phase. **CONCLUSION:** Peak knee angle variability is greater throughout the swing phase compared to the stance phase and this peak occurs at specific, but different, percentages of each phase regardless of running speed. Peak knee angle variability occurs just before and after foot contact so it is likely relevant to consistency of landing mechanics during running and therefore may be an important factor in the occurrence and/or prevention of running injuries.

484 Board #305 May 31 9:30 AM - 11:00 AM

Use Of Inertial Magnetic Sensors To Implement Kinematic Methods To Detect Foot Contact During RunningErik Maartens¹, Max Paquette², Jaap Buurke¹, Jasper Reenalda¹.
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Biomechanics of the stance phase of running is of interest in relation to injury development. Studying the stance phase requires proper detection of foot contact (FC). The onset of vertical ground reaction force (GRF) is considered the gold standard in a laboratory setting to detect FC. In the absence of GRF data, motion analysis can be used to measure peak downward velocity of the pelvis (PDVP) with a 15ms offset which showed good relation with FC during treadmill running at one speed (1). Inertial sensors can measure kinematic parameters like PDVP outside the laboratory setting. Peak tibial acceleration (PTA) is a parameter of interest in running injury development which can be measured with inertial sensors and may also be used to detect FC outside the laboratory.

PURPOSE: To assess the effectiveness of these kinematic methods using inertial measurement units (IMUs) to detect FC during running at different speeds. **METHODS:** 3 male runners (28 ± 8.5 yrs) ran on an instrumented treadmill at 6 speeds (10-15 km/h) for 1 minute each, wearing a suit equipped with IMUs at the tibia and sacrum. FC was determined based on GRF data of the treadmill (1000 Hz; threshold of 20N) and IMU data (240Hz). PDVP was obtained from a single integration of pelvic acceleration in the global frame. PTA was determined from the acceleration data measured in the local tibia frame. The 95% limits of agreement were used to compare each method to the gold standard (i.e., GRF).

RESULTS:**Table 1: The offset and 95% limits of agreement for the two kinematic methods with respect to the gold standard for 6 running speeds.**

Running Speed	Kinematic method	Offset		95% limit of agreement			
				Lower		Upper	
10 km/h	PDVP	5 frames	(21.0 ms)	1 frame	(4.2 ms)	6 frames	(25.2 ms)
	PTA	5 frames	(21.0 ms)	2 frames	(8.4 ms)	9 frames	(37.8 ms)
11 km/h	PDVP	6 frames	(25.2 ms)	1 frame	(4.2 ms)	8 frames	(33.6 ms)
	PTA	6 frames	(25.2 ms)	2 frames	(8.4 ms)	10 frames	(42.0 ms)
12 km/h	PDVP	7 frames	(29.4 ms)	1 frame	(4.2 ms)	7 frames	(29.4 ms)
	PTA	7 frames	(29.4 ms)	0 frames	(0 ms)	13 frames	(54.6 ms)
13 km/h	PDVP	8 frames	(33.6 ms)	1 frame	(4.2 ms)	8 frames	(33.6 ms)
	PTA	8 frames	(33.6 ms)	2 frames	(8.4 ms)	13 frames	(54.6 ms)
14 km/h	PDVP	6 frames	(25.2 ms)	1 frame	(4.2 ms)	7 frames	(29.4 ms)
	PTA	6 frames	(25.2 ms)	2 frames	(8.4 ms)	11 frames	(46.2 ms)
15 km/h	PDVP	6 frames	(25.2 ms)	2 frames	(8.4 ms)	6 frames	(25.2 ms)
	PTA	6 frames	(25.2 ms)	3 frames	(12.6 ms)	9 frames	(37.8 ms)

CONCLUSION: This study showed that a novel IMU-based method of detecting FC using PTA and PDVP showed good similarity with FC detection based on GRF at all running speeds. The different time offsets among running speeds should be considered when implementing these kinematic methods to detect FC. This opens up new possibilities for studying running mechanics outside the laboratory.

REFERENCES: 1. Milner CE, Paquette MR. A kinematic method to detect foot contact during running for all foot strike patterns. *J Biomech.* 2015. 18; 48(12): 3502-5

485 Board #306 May 31 9:30 AM - 11:00 AM

Superficial Sensory Feedback Is Not Responsible For Gait Alterations Associated With Barefoot RunningMelissa A. Thompson¹, Kristine M. Hoffman², ¹Fort Lewis College, Durango, CO. ²Denver Health Medical Center, Denver, CO.

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Of the many sensory modalities, cutaneous sensory feedback is thought to play a primary role in locomotor patterns. It has long been proposed that gait alterations, when changing from shod to barefoot, are mediated by alterations in sensory feedback. While the theory of sensory mediated gait adaptations associated with barefoot running is plausible, there has been no data to support this claim. **PURPOSE:** To examine the role of superficial plantar cutaneous feedback in barefoot and shod running in order to substantiate the claim that sensory feedback triggers the gait alterations associated with barefoot running. **METHODS:** 10 healthy active subjects (6 male, 4 female); mass: 65.2±9.7 kg; age: 27±7.1 years participated in this study. 10 over-ground running trials were completed in each of the following conditions: barefoot (BF), shod (SHOD), anesthetized barefoot (ANEST BF) and anesthetized shod (ANEST SHOD). For the anesthetized conditions 0.1-0.3 mL of 1% lidocaine was injected into the dermal layer of skin on the plantar foot below the metatarsal heads, lateral column and heel. 3-dimensional motion analysis and ground reaction force (GRF) data were captured as subjects ran over a 20m run way with a force plate at 12m. Kinematic and kinetic differences were analyzed via two-way repeated measures ANOVAs. **RESULTS:** The differences in gait between the BF and SHOD conditions were consistent with previous research with subjects exhibiting decreased stride length (BF: 2.07±0.24m, SHOD: 2.21±0.24m, $p<0.001$) and changing from rear footstrike when SHOD to fore/mid footstrike when BF (BF: -5.5±5.1°, SHOD: 7.5±3.8°, $p<0.001$). Similarly, BF running was associated with decreased peak vertical GRFs and impact peak magnitudes (vGRF BF: 2.19±0.24 BW, SHOD: 2.32±0.19 BW, $p=0.02$; impact peak BF: 1.65±0.22 BW, SHOD: 1.89±0.25 BW, $p<0.001$). Despite anesthetizing the plantar surface, there was no difference between the BF and ANEST BF conditions in terms of stride length (BF: 2.07±0.24m, ANEST BF: 2.01±0.27m, $p>0.05$), footstrike (BF: -5.5±5.1°, ANEST BF: -3.8±3.2°, $p>0.05$) or GRFs (vGRF BF: 2.19±0.24 BW, ANEST BF: 2.15±0.28 BW, $p>0.05$; impact peak BF: 1.65±0.22 BW, ANEST BF: 1.59±0.25 BW, $p>0.05$). **CONCLUSION:** Superficial cutaneous sensory receptors are not primarily responsible for the gait changes associated with barefoot running.

486 Board #307 May 31 9:30 AM - 11:00 AM

The Ability of Sagittal Plane Kinematic Variables to Predict Loading in Different Populations of RunnersKathryn Harrison, Bhushan Thakkar, Gregory Crosswell, Jacqueline Morgan. *Virginia Commonwealth University, Richmond, VA.* (Sponsor: D. S. Blaise Williams III, FACSM)
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It is known that sagittal plane kinematics are able to predict loading in runners. This may be of use to clinicians who don't have access to force measurement devices. However, running biomechanics differ between genders and age groups. Thus it may be that models used to predict loading in demographically distinct groups of runners need to be specific to age and gender. **PURPOSE:** To determine if kinematic predictors of kinetic variables during running apply across genders and age groups. **METHODS:** Sagittal plane kinematics and kinetics were assessed in young male (YM: n=13, age=23.1 ± 2.3 yrs, mass=77.0 ± 12.1 kg, height=1.79 ± 0.08 m, velocity=3.32 ± 0.48 m/s) and middle-aged female runners (MF: n=28, age=47.3 ± 7.0 yrs, mass=63.7 ± 7.8 kg, height=1.66 ± .07 m, velocity=2.55 ± 0.37 m/s) using a 5 camera motion analysis system (Qualysis, Goteborg, Sweden) running on an instrumented treadmill (Treadmetrix, Park City, Utah) at their preferred running pace. Kinematics (knee flexion at initial contact, foot angle at initial contact, step position, peak knee flexion and COM excursion) were the independent variables; kinetics (average vertical loading rate, braking impulse, knee power absorption and peak knee extension moment and peak vertical ground reaction force) were the dependent variables. Linear regression models were developed to predict loading in both groups ($\alpha=0.05$). **RESULTS:** In both YM and MF, sagittal plane kinematics were useful in predicting peak knee moment (YM: $R^2=0.56$, $p=.002$; MF: $R^2=0.47$, $p=.0002$), knee power absorption (YM: $R^2=0.78$, $p=.0002$; MF: $R^2=0.55$, $p<.0001$), braking impulse (YM: $R^2=0.66$, $p=0.01$; MF: $R^2=0.67$, $p<.0001$), and peak vertical ground reaction force (YM: $R^2=0.31$, $p=0.03$; MF: $R^2=0.23$, $p=0.02$). Peak knee flexion appeared in the most models (peak knee moment, knee power absorption and braking impulse for both men and women), and thus may be the most useful single kinematic variable to assess loading across age groups and genders. In all models, greater knee flexion was associated with increased magnitude of loading. Average vertical loading rate could not be predicted using the chosen kinematics in either group. **CONCLUSIONS:** When equipment for kinetic assessment is not available, sagittal plane gait analysis may be a useful tool for clinicians to estimate loading in runners.

487 Board #308 May 31 9:30 AM - 11:00 AM

The Differential Effects of Footwear on Sample Entropy of Ground Reaction Force during RunningShuqi Zhang¹, Yumeng Li², Li Li, FACSM³. ¹Northern Illinois University, Dekalb, IL. ²California State University Chico, Chico, CA. ³Georgia Southern University, Statesboro, GA.
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Maximum cushioned shoes could reduce the peak vertical Ground Reaction Force (GRF) during running, but it may increase the foot instability in horizontal directions, especially at the initial foot contact. Sample entropy (SampEn) has been adopted to define the irregularity to quantify levels of complexity of movement and examine the fluctuations in GRF within a time series. The foot instability would be better represented by the index of SampEn within a stance phase instead of variation among different stance phases viewing instability as errors. **PURPOSE:** this study was aimed at examining the complexity of GRF while running on the treadmill with different types of footwear through SampEn.

METHODS: 19 experienced runners were recruited and ran on the treadmill at 7.8 mph wearing different types of running shoes: max cushioned shoe, minimalist shoe, and regular shoe. GRF of 10 consecutive steps were collected by the instrumented Tandem treadmill. GRF data were further analyzed to calculate sample entropy for both the first 20% stance phase and entire stance phase. Two-way MANOVA was used to examine the effects of independent variables (shoe, step) on sample entropy measures at first 20% stance phase (SampEn_{20%-MI}, SampEn_{20%-AP}, SampEn_{20%-VT}) and entire stance phase (SampEn_{MI}, SampEn_{AP}, SampEn_{VT}). Post hoc Tukey test was applied as needed.

RESULTS: a significant shoe effect was observed on the association among dependent variables listed above ($P < .05$). Cushioned shoes displayed a higher SampEn_{AP} (.1162 ± .01558) than regular shoes (.1094 ± .0258) and a greater SampEn_{20%-AP} (.1953 ± .1556) than minimalist shoes (.1546 ± .0932). Minimalist shoe exhibited greater SampEn_{VT} (.0614 ± .01310) and SampEn_{20%-VT} (.0636 ± .0688) than cushioned shoes (.0577 ± .1002; .0448 ± .0305) respectively. No other significant difference was observed.

CONCLUSIONS: in general, cushioned shoes displayed more fluctuations of GRF in the anterior-posterior (AP) direction compared to minimalist and regular shoes, which indicates cushioned shoes may increase the foot instability in AP direction

during running. Greater fluctuations of vertical GRF when wearing minimalist shoes may indicate a reduced foot stability that could affect the impact absorption at foot touchdown and force generation in push-off.

488 Board #309 May 31 9:30 AM - 11:00 AM

Is Muscle Activity a Factor that Determines Preferred Stride Frequency During Running Outdoors?Krizzel Galvez, Jared Joerger, Kendell Galor, John A. Mercer, FACSM. *University of Nevada, Las Vegas, Las Vegas, NV.**(No relationships reported)*

Purpose: The purpose of this study was to determine if muscle activity is affected by different stride frequencies (SF) at preferred running velocity while running outdoors. **Methods:** Participants (n=10, 26.4±8.7 years, 72.6±18.3 kg, 170±8.7 cm) were given a self-selected warm-up after signing an informed consent. Wireless electromyography sensors (sample rate = 1926 Hz) were attached to four muscles on the right side: the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius (GA). Maximum voluntary contractions were performed for five seconds prior to moving outside for data collection. Preferred running velocity and preferred stride frequency (PSF) were determined outdoors. Participants performed seven randomized conditions, each at their preferred running velocity, consisting of a specific SF. The conditions were 115%, 110%, 105%, 100%, 95%, 90%, and 85% of their PSF. SF was controlled by having participants match a metronome. Absolute value of EMG were averaged across a 5-second window for each SF for each muscle. A repeated measures analysis of variance was used to compare muscle activity between SF conditions.

Results: There was no significant difference in BF between SF conditions ($p=0.352$). There was no significant difference in RF between SF conditions ($p=0.229$). There was no significant difference in TA between SF conditions ($p=0.342$). There was no significant difference in GA between SF conditions ($p=0.758$). **Discussion:** Despite large changes in SF, average muscle activity was not different for any of the muscles tested when running a set speed outdoors. It does not seem that average muscle activity is a factor determining preferred stride frequency.

This project was made possible by a grant from the National Institute of General Medical Sciences (P20GM103440) from the National Institutes of Health. This project's contents are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

489 Board #310 May 31 9:30 AM - 11:00 AM

Comparison Of Intrinsic Foot Muscle Size And Strength Between Gymnasts And Shod RunnersSarah Ridge, Mark Olsen, Kelsey Garner, J William Myrer, Dustin Bruening, A Wayne Johnson. *Brigham Young University, Provo, UT.* (Sponsor: J Ty Hopkins, FACSM)
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Purpose: Wearing supportive footwear during athletic activity may decrease the activity of the intrinsic foot muscles (IFM), leading to weaker muscles and suboptimal foot function. The purpose of this study was to compare the IFM size and strength of two athletic populations - gymnasts who train barefoot and runners who wear cushioned running shoes during training.

Methods: IFM size and toe flexor strength were measured from 13 female gymnasts (age: 19.8 ± .9 years; height: 158.9 ± 4.98 cm; weight: 56.9 ± 4.27 kg) and 21 female runners (age: 22.1 ± 2.95 years; height: 167.4 ± 8.88 cm; weight: 63.0 ± 9.38 kg). Strength was assessed from the big toe individually, and the 2nd, 3rd, and 4th toes together. During testing, the subject was seated with the knee flexed at 90° and the foot on the floor. The toes were aligned with a customized dynamometer. The subject gripped an S-beaner (great toe flexion) or a bar (lateral toe flexion) with their toe(s) and flexed to a maximal contraction for 3 seconds. The average of 3 trials was used for analysis. . Ultrasound images (10 MHz GE LogiqP6) were recorded of the abductor hallucis (ABDH), quadratus plantae (QP), flexor digitorum brevis (FDB) and flexor hallucis brevis (FHB). Measurements included the cross-sectional areas of the ABDH, QP, FDB and thickness of the FHB. ANCOVAs (with height and weight as covariates) were run to compare the IFM size and flexor strength between the groups of subjects. **Results:** Gymnasts had larger FDB and FHB, as well as stronger great toe flexion than runners (see table).

Conclusion: The IFM responsible for toe flexion and great toe flexion strength were greater in gymnasts than runners. Based on these data, training without cushioned footwear, in a task that requires finer control of the foot, has resulted in increased great toe flexion strength. Though it's difficult to separate training task from footwear in this study, these findings lend support to the idea that training in cushioned footwear may hinder optimal IFM function.

Group	Muscle Size				Muscle Strength	
	ABDH (cm ²)	QP (cm ²)	FDB (cm ²)	FHB (cm)	Great Toe (kg)	Lateral Toes (kg)
Gymnasts	2.16 ± .57	1.73 ± .26	1.87 ± .27	1.57 ± .07	5.44 ± 3.68	3.76 ± 1.41
Runners	1.82 ± .50	1.52 ± .35	1.62 ± .27	1.38 ± .17	4.34 ± 1.37	4.28 ± 2.05
p-value	.321	.061	.043*	.006*	.012*	.969

490 Board #311 May 31 9:30 AM - 11:00 AM
Relationship of Footstrike Pattern and Landing Impacts During a Marathon Race

Matthew Ruder¹, Steve T. Jamison¹, Adam Tenforde¹, Marian Hannan², Irene Davis, FACSM¹. ¹Spaulding National Running Center, Cambridge, MA. ²Institute for Aging Research, Hebrew SeniorLife, Boston, MA. (Sponsor: Irene Davis, FACSM)
 (No relationships reported)

Landing impacts during running are influenced by footstrike pattern (FSP) in rearfoot strikers (RFS) in laboratory studies. These impacts have been linked with running injuries. Landing impacts are highest in RFS, lower in midfoot strikers (MFS) and lowest in forefoot strikers (FFS). In RFS, impacts are positively correlated with speed. However, these relationships have only been examined in a laboratory setting, limiting the ecologic validity of the data.

PURPOSE: 1. To compare landing impacts between FSP during a marathon. 2. To assess the interaction effect of FSP and speed on landing impacts during a marathon.

METHODS: 226 runners (118 M, 108 F; 44.3±11.1 yrs) running a marathon were recruited for this study. Subjects were initially filmed running on a treadmill to determine their habitual FSP (169 RFS, 32 MFS, 23 FFS). During the marathon, an accelerometer, secured to the distal medial tibia, recorded continuous data. Average peak tibial shock (TS) was calculated for the first 10km of the marathon. An ANOVA (p<0.05) was used to determine FSP differences. The interaction effect of FSP and speed on TS was determined using an ANCOVA (p<0.05).

RESULTS:

Peak TS was significantly higher in the RFS compared with the FFS runners. TS in the MFS group was 20% higher than in FFS group. While not significant, this difference was associated with a large effect size, suggesting it is clinically meaningful. TS was positively correlated to speed for RFS and MFS groups (p<0.05), but not for the FFS group (p>0.05).

CONCLUSION: When running in their natural environment, FFS runners have the lowest impacts of all FSPs. In addition, unlike the RFS and MFS groups, FFS runners appear to have the ability to maintain lower impacts at faster speeds.

Supported by Vibram USA.

Table 1: Means and Standard Deviations for subject groups and intra-group comparisons

	FFS	MFS	RFS
Mean Peak Tibial Shock (g)	10.03	12.13	12.23
Standard Deviation	2.47	3.01	3.95
Number of Subjects	23	32	169
Standard Error	0.52	0.53	0.30
	FFS-MFS	MFS-RFS	FFS-RFS
Absolute Value of Average Difference	2.10	0.10	2.20
Pooled Standard Deviation	2.80	3.82	3.81
Effect Size	0.75	0.03	0.58
P-Value	0.095	0.99	0.021

491 Board #312 May 31 9:30 AM - 11:00 AM
Ground Reaction Forces During Running in Extreme Cushioning Running Shoes

Miles Mercer. University of Nevada, Las Vegas, Henderson, NV.
 (No relationships reported)

The extreme cushioning running shoe has recently emerged on the market and it is unclear whether this unique shoe design affects the way people move compared to a regular running shoe. **PURPOSE:** To compare ground reaction forces (GRF) while running in extreme cushioning shoes (ES) vs. normal cushioning shoes (NS) at different speeds. **METHODS:** Subjects (n=5, 1 Female and 4 Males; 74.11kg±11.8kg, BMI: 23.45±1.76 kg/m², 1.69m±0.050m) completed a 1 day testing session consisting of establishing the subject's preferred running speed (PRS) and running at three speed conditions: PRS, PRS+5%, PRS+10%. Subjects were instructed to run over a force platform embedded in the middle of a 5-m runway while wearing ES (Hoka, Bondi 4) or their self-selected shoes (SS) with three speeds (PRS, PRS+5%, PRS+10%)

per shoe condition. Running velocity was measured using infrared timing gates with velocity controlled within ±5% target velocity with three trials completed per condition. Discrete vertical GRF parameters of impact peak (F1), maximum peak (F2), and average (Favg) were recorded and averaged across the three trials per condition. A 2 (shoe) x 3 (velocity) repeated measures analysis of variance (α=0.05) was used for analysis. **RESULTS:** Neither F1, Favg, nor F2 were influenced by the interaction of shoe and velocity (p>0.05) and none had a main effect of shoe (F1: ES 1.78±0.4 BW, SS 1.85±0.3 BW; Favg: ES 1.57±0.1 BW, SS 1.55±0.1 BW; F2: ES 2.68±0.2 BW, SS 2.67±0.2 BW; p>0.05). Favg did increase with velocity (p<0.05) but F1 and F2 did not (p>0.05). **CONCLUSION:** F1 was observed less than 30% of the ES trials for two subjects. Nevertheless, as a group, there were no differences in GRF parameters analyzed between shoe conditions.

492 Board #313 May 31 9:30 AM - 11:00 AM
The Effect Of Speed, Incline, And Distance On Impacts During A Marathon Road Race

Steve T. Jamison¹, Matthew C. Ruder¹, Adam S. Tenforde¹, Marian T. Hannan², Irene S. Davis, FACSM¹. ¹Spaulding National Running Center, Cambridge, MA. ²Harvard University, Cambridge, MA. (Sponsor: Irene Davis, PhD, PT, FACSM, FACSM)
 (No relationships reported)

The majority of running studies are conducted in controlled laboratory settings. The advent of mobile technology has allowed the study of running impacts outside in a more natural environment enhancing the ecologic validity of these investigations. A marathon provides an excellent opportunity to examine the effect of a variety of naturally occurring, race-related factors on running impacts which have been related to injury.

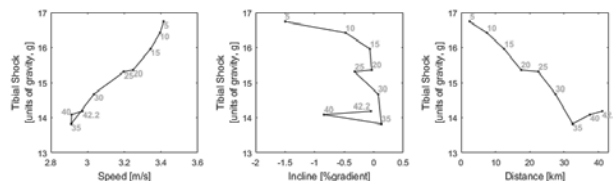
PURPOSE: To determine the association between course incline, speed, and race progression (an indication of fatigue) on running impacts (tibial shock) during a marathon.

METHODS: 226 individuals (118 males, 108 females; 44.3±11.1 yrs) running the same marathon (42.2km) were included. They each wore a triaxial accelerometer, recording at 1,000Hz, secured on their distal, medial tibia throughout the race. Peak resultant acceleration, tibial shock (TS), for each step was determined. Run times for each 5km, and the last 2.2 km, were provided by the race organizers. TS and course incline were averaged over matching race intervals. A linear mixed effects model was used to determine the relationship between tibial shock and the independent variables of course incline, speed, and race progression.

RESULTS: Mean resultant tibial shock was 15.2±1.1g. Course incline, speed, and distance were significantly related to TS (p<0.05). TS association between course incline was negative, while speed and distance were both positive.

CONCLUSIONS: Our results suggest that higher resultant tibial shock is associated with decreases in incline, increases in speed, and race progression (increased fatigue). Supported by Vibram USA.

Figure Caption: Population average resultant tibial shock [in units of gravity, g] relative to each independent variable (speed, incline, and distance). Grey numbers represent the total distance traveled after each race interval used [in km].



493 Board #314 May 31 9:30 AM - 11:00 AM
The Influence of Footwear on Running Mechanics, Impact, and Plantar Loading in Habitual Rearfoot Strikers

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 (No relationships reported)

Running overuse injuries are related to the magnitude of impact forces and shocks, loading rates, and the distribution of forces underfoot. Minimalist shoes and barefoot running might reduce or eliminate running impacts by encouraging softer landings. However, reduced cushioning could increase plantar loading and some runners may not alter their habitual running mechanics to account for less cushioning.

PURPOSE: To examine the acute effects of a cushioned neutral shoe (CN), minimal shoes (MN), and neoprene socks (BF) on running mechanics, impact, and plantar pressure.

METHODS Forty habitual rearfoot strikers ran on an instrumented treadmill while 3D kinematics, ground reactions forces (GRF), tibial accelerations (TA), and plantar pressure were recorded. Variables examined included: foot and knee angle at contact, vertical GRF loading rate (VLR), the isolated impact component of vertical GRF (IP), and the magnitude of peak positive to negative TA. Peak plantar pressure was compared for the forefoot (FFP), midfoot (MFP), and rearfoot (RFP). Differences were compared with a RMANOVA and post hoc t-tests ($\alpha=0.05$).

RESULTS With less cushioning the foot was less dorsiflexed at contact BF $8.6\pm 5.3^\circ < MN 11.30\pm 5.0^\circ < CN 16.0\pm 4.4^\circ$ ($p<0.01$). The knee was more extended at contact in CN $13.3\pm 6.6^\circ$ than MN $14.8\pm 5.9^\circ$ and BF $15.2\pm 5.8^\circ$ ($p<0.001$). VLR was less in CN 670 ± 212 N/kg/s compared to MN 980 ± 268 N/kg/s and BF 975 ± 371 N/kg/s ($p<0.001$) as was IP 4.1 ± 16 N/kg vs 6.8 ± 2.6 N/kg & 6.7 ± 3.2 N/kg ($p<0.001$). TA was lower in CN 9.4 ± 4.2 g than BF 12.6 ± 6.7 g and MN 11.4 ± 5.5 g ($p<0.01$). FFP increased with less cushioning: CN 330 ± 70 kPa $< MN 430\pm 87$ kPa $< BF 561\pm 76$ kPa ($p<0.001$). MFP was less in CN 144 ± 35 kPa compared to MN 212 ± 58 kPa and BF 224 ± 108 kPa ($p<0.05$). RFP was lower in CN 253 ± 52 kPa vs MN 272 ± 81 kPa and BF 396 ± 170 kPa ($p<0.001$).

CONCLUSION Less cushioning resulted in a more compliant configuration of the limb at ground contact, which agrees with previous research. However, the CN shoe reduced VLR, IP, and TA compared to MN and BF despite a more extended knee and dorsiflexed foot. Lower peak plantar pressures in CN suggest that cushioning better distributes plantar forces of a less compliant limb particularly in the rearfoot. These results highlight the importance of both cushioning and mechanics on injury related variables.

494 Board #315 May 31 9:30 AM - 11:00 AM
Six Week MFS Drill Training with Proprioceptive Resistance Device Influences Conversion of RFS to MFS

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 (No relationships reported)

Recent literature suggests a transition from rear-foot striking (RFS) to mid-foot striking (MFS) may lower injury potential; but transition is difficult. Using a resistive proprioceptive device may facilitate the change. No study has quantified the impact of such a device on foot-strike conversion. **PURPOSE:** To examine the effectiveness of a 6-week MFS drill training program in converting recreational RFS to MFS with and without the use of a proprioceptive resistive device (EZ Run Belt) using changes in cardiovascular, biomechanical, and neuromuscular assessments. **METHODS:** 19 RFS runners were randomly assigned to control (C: M4, F1), drills only (DO: M3, F4), or drills plus belt (DB: M6, F1) groups. Both DO and DB received drill sessions using MFS training over 6 weeks with DB using a resistive belt (EZRB) during training runs. Physiological (VO₂max, anaerobic threshold, heart rate, running economy, timed performance), biomechanical (knee flexion and dorsiflexion angles at initial contact (KFA, DFA), cadence (CAD), stride length) and electromyographic (EMG) measures of 5 right-leg muscles (rectus femoris (RF), vastus lateralis, biceps femoris (BF), semitendinosus (ST), and lateral gastrocnemius (LG), were recorded as subjects ran under 3 conditions: submaximal (85% lactate threshold heart rate) on a treadmill (TM85) and overground for 400m (OUT85), maximal overground (OUTMAX), before and after training. **RESULTS:** In all 3 conditions, outcomes reflected significant within-group increases for DO and DB in CAD and EMG and decreases in KFA, DFA consistent with an RFS to MFS conversion, but no significance was detected between DO and DB, except for the RF EMG during TM85 increasing for DO and decreasing for DB (-.014±.005 μV, $p<.05$). Greatest changes in DO were observed at OUT85: RF (+66%, $p=.045$), BF (+70%, $p=.008$), LG (+49.6%, $p=.05$), KFA (-3.9%, $p=.001$) and DFA (-34.3%, $p<.001$). Greatest changes in DB were observed at OUTMAX: BF (+84.4%, $p=.003$), ST (+85.5%, $p=.015$), CAD (+5.3%, $p<.001$), KFA (-4.9%, $p<.001$). **CONCLUSIONS:** Changes in biomechanics and muscle activation observed in DO and DB indicate a significant shift from RFS to MFS after 6 weeks of MFS drill instruction, unique effectiveness of the proprioceptive device could not be established, but differences warrant further investigation.

495 Board #316 May 31 9:30 AM - 11:00 AM
A Comparison Of The Effects Of Forefoot Striking And Cadence On Vertical Load Rates

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High vertical load rates have been linked to common running injuries. Interventions to reduce load rates have developed to reduce impact related injuries. Two popular approaches are increasing cadence (CAD) and using a forefoot strike (FFS) pattern. However, the effects of these interventions have not been compared in the same study. **Purpose:** To compare the effects of increasing CAD and transitioning to a FFS pattern to reduce impact loading in healthy recreational runners.

Methods: 35 habitual rearfoot strike runners, ages 19-42 yrs, running 5-15 mi/wk, with a CAD of < 170 steps/min were randomized to a FFS group ($n=16, 5M$) or increased CAD group ($n=19, 5M$). All subjects performed 4 wks of strengthening exercises. This was followed by 8 sessions of gait retraining (GR) over 3 wks using auditory feedback specific to each group. Run time was increased from 10-30 min over the 8 sessions, and feedback time was faded over the last 4 sessions. An instrumented treadmill assessment was done at baseline, at 1wk post GR, and at 1 mo follow-up. Variables of interest were vertical average and instantaneous load rates (VALR, VILR) measured in bodyweights (BW)/s.

Results: Groups were similar in all variables at baseline (Figure 1). FFS group reduced VALR by 58% and VILR by 44%. CAD group reduced VALR by 26% and VILR by 24%. At 1 mo, load rates for both groups were significantly lower than baseline, but FFS maintained reductions to a greater extent. A 5.6% increase in cadence occurred in both groups following GR. At 1 mo follow-up cadence remained higher in both groups, but to a greater extent in FFS group.

Conclusion: These data suggest that transitioning to a FFS results in greater reduction of vertical load rates and greater persistence of these changes over time.

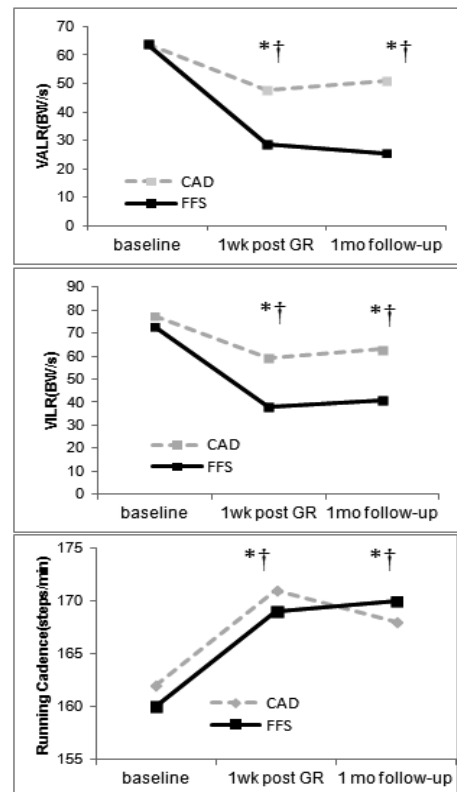


Fig 1. Comparison of results between groups across time from baseline. * significant difference for CAD group; † significant difference for FFS group

496 Board #317 May 31 9:30 AM - 11:00 AM
Perturbing Stride Frequency Has No Effect On Average Muscle Activity

Andrew Craig-Jones, Joshua Bailey, Kendell Galor, John A. Mercer, FACSM. *UNLV, Las Vegas, NV.* (Sponsor: Dr. John A. Mercer, FACSM)
 (No relationships reported)

Running is a popular and widely used mode of exercise in the world today. Preferred stride frequency (PSF) is the stride frequency (SF) a runner selects for a given speed. Changes in SF may influence metabolic costs while running (Meardon & Derrick, 2009, *MSSE*, 41, 512-513), but it is not clear if muscle activity is minimized at PSF compared to running with other SFs. **PURPOSE:** To determine if muscle activity is minimized while running at PSF. **METHODS:** 10 healthy participants (24.7±3.8 years; M=7, F=3) ran on a treadmill at PSF-15%, PSF-10%, PSF-5%, PSF, PSF+5%, PSF+10%, PSF+15%. Conditions were randomized for each subject to account for task adaptation. Treadmill running speed was determined initially by each participant instructing the tester to increase or decrease the speed until felt like a speed representative of a 30-minute run. During preferred running condition, PSF was calculated by visually identifying the time to complete 20 strides. Target SFs were then calculated for all other conditions. Participants ran for 5-minutes at each condition with 1-minute rest between conditions. SF was controlled by having the participants match foot strikes to the beat of a metronome set to each desired SF for 15 sec of every minute. Data were collected 4 times throughout each trial for 30s every minute of the condition. The first collection was used for this analysis. EMG sample rate was 2000Hz from the Rectus Femoris (RF), Biceps Femoris (BF), Tibialis Anterior (TA), and Gastrocnemius (GA). Average and root mean squared (RMS) EMG data were analyzed via repeated-measures ANOVA ($\alpha=0.05$). Data were normalized to %PSF to assess minimization. **RESULTS:** PSF RMS EMG were not minimized in any muscle across all SF conditions. Average EMG for BF ($F(1.24, 11.19) = 7.32, p>0.05, \eta_p^2 = 0.45$) and GA ($F(1.49, 1.71) = 21.38, p>0.05, \eta_p^2 = 0.70$) were both influenced by SF, but PSF EMG were not minimized for either of those muscles. Normalized EMG for BF were 103.90±27.02%, 90.83±26.02%, 98.37±16.19%, 104.20±29.61%, 103.42±42.59%, 109.48±48.37% and for GA were 112.73±25.02%, 90.77±24.90%, 95.33±27.33%, 108.35±36.24%, 90.89±19.40%, 106.68±20.33% for PSF -15%, -10%, -5%, +5%, +10%, +15% respectively. **CONCLUSION:** Muscle activity was not minimized while running at PSF compared across all conditions.
 Supported by NIH INBRE P20 GM103440 Grant

497 Board #318 May 31 9:30 AM - 11:00 AM
Does Preferred Running Velocity Vary with Variations in Running Condition?

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 (No relationships reported)

Running form is often studied within the laboratory. During these studies, researchers must make the difficult decision to capture runners at a set velocity, which allows for straight forward comparisons between participants, or at their preferred velocity (PRV). Although theoretically we are capturing natural movement when we ask runners to move at a PRV, it is unknown how a laboratory PRV over-ground or on a treadmill may differ from each other or from running on a longer course outdoors. **PURPOSE:** The purpose of this study was to determine a PRV for two groups of runners (recreational and competitive) over-ground in the laboratory, on a laboratory treadmill, and outside on a track. **METHODS:** Healthy competitive (n=10) and recreational (n=9) runners completed running trials in each of three conditions: (1) over-ground, where PRV was determined as the average of five trials; (2) on the treadmill, where PRV was determined over five trials where participants were blinded to the velocity but asked to alter the velocity until they were comfortable; and (3) around a track where the split times of two laps were taken as two separate trials. **RESULTS:** There was not a significant interaction between group and condition ($p=0.468$) but there were significant main effects for both group ($p<0.001$) and condition ($p<0.001$). The competitive runners had a faster PRV (3.1 m/s) than recreational runners (2.7 m/s). Treadmill PRV was significantly slower (2.5 m/s) than over-ground PRV (3.1 m/s; $p<0.001$) and track PRV (3.1 m/s; $p<0.001$), which were similar to each other ($p=0.618$). **CONCLUSIONS:** Environment can change a runner's perception of preferred velocity, which was demonstrated in this study with a significantly slower preferred velocity while running on a treadmill. Therefore, one should take caution when interpreting or collecting running data that utilizes a preferred running velocity, and the environment in which the data were collected should be considered.

498 Board #319 May 31 9:30 AM - 11:00 AM
Decreased Metabolic Running Efficiency After One Week Of Practicing Improved Running Mechanics

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 (No relationships reported)

PURPOSE: A more efficient runner is a more comfortable, prolific, and competitive runner. At the same work rate, more efficient running technique should lead to decreased respiratory exchange ratio (RER), oxygen consumption (VO₂), exercise intensity (MET), and rating of perceived exertion (RPE). Such physiological changes should lead to performance improvements such as delayed onset of fatigue and decreased recovery time. We analyzed how improving arm movement and cadence could increase running efficiency. **METHODS:** Seven novice runners, aged 18-50, participated in the study (5 males, 2 females). Thirty-nine 3D-reflective motion sensors were placed on the upper body of each subject. Movement was analyzed by Coaches Eye. Trial 1 consisted of an uncoached 5-minute running bout at a pre-determined heart rate (calculated using the Karvonen formula) that corresponded to 50% of VO₂max. Exercise intensity, VO₂, RER, and HR were measured. After the first trial, subjects were coached on proper running mechanics and were encouraged to practice employing their enhanced technique for one week. Trial 2 was similar to trial 1 except that participants ran with proper mechanics. Paired t-tests were performed for each set of values to compare trial 1 with trial 2. **RESULTS:** Exercise intensity, VO₂, RER, and HR were all significantly greater in trial 2 than trial 1. Shoulder movement decreased in all axes. **CONCLUSIONS:** While subjects reduced their upper body movement and reported working less intensely to run at the same rate with improved mechanics, greater VO₂, RER, HR, and MET indicated that, after only one week of familiarization with new mechanics, they were actually running less efficiently. This could be the case because runners didn't practice the new mechanics sufficiently, or because with any change in running technique, even improvements, temporary lack of coordination due to under-developed neural and muscular control, leads to temporarily-decreased running efficiency. Further research with longer study duration would likely show that increased cadence and decreased upper-body movement result in more efficient running.

499 Board #320 May 31 9:30 AM - 11:00 AM
Abstract Withdrawn

500 Board #321 May 31 9:30 AM - 11:00 AM
Effect of Running Speed on Achilles Tendon Injury Potential: Use of a Weighted Impulse Measure

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ABSTRACT
 Previous literature has suggested that increasing running speed is associated with a reduction in cumulative load per distance traveled and thereby a decrease in injury risk. However, the tissue damage incurred by a bout of loading is a function of its stress-life (S-N) behavior which describes the exponential relationship between loading magnitude and cycles to failure. Current cumulative loading measures do not consider the S-N relationship which may in fact lead to erroneous conclusions about tissue damage and injury risk. **PURPOSE:** The purpose of this study was to examine the influence of running speed on an S-N weighted impulse measure at the Achilles tendon. **METHODS:** Ten participants ran overground at 2.5, 3.5, and 4.5 m/s while force and motion capture data were recorded. An inverse dynamics analysis was used to calculate joint moments and AT force was calculated from the ankle joint moment and the AT moment arm which was a function of ankle joint angle. AT impulse per step was calculated as the time integral of the AT force curve. A weighted impulse measure was quantified where AT force was raised to the power of 9. This value was derived from *in vitro* tendon testing and describes the slope of the S-N tendon curve. Impulse and weighted impulse per km were calculated as the respective impulse per step measures multiplied by the number of steps necessary to run 1km. A Friedman test examined the main effect of speed followed by Bonferroni adjusted pair-wise comparisons. **RESULTS:** A significant main effect of speed was observed for impulse per step ($p=0.003$), impulse per km ($p<0.001$) and weighted impulse per km ($p<0.001$). In general, the impulse per step and impulse per km decreased with running speed ($p\leq 0.013$); however, no significant differences were observed between 3.5 and 2.5 m/s ($p\geq 0.047$). On the other hand, the weighted impulse per km increased with running speed ($p=0.005$). **CONCLUSION:** Using a traditional measure of cumulative impulse suggests that running faster may decrease the risk of Achilles tendon injury. This counterintuitive conclusion is not reached when using a weighted impulse measure that considers the S-N behavior of the tendon.

501 Board #322 May 31 9:30 AM - 11:00 AM
Risk Factors Associated With Foot Pain In Runners
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Purpose: Repetitive stresses of running can contribute to the onset of musculoskeletal pains, such as those in the foot. The presence of foot pain in one site along the kinematic chain may alter running motion and cause pain to develop in other areas but this is not well-studied. The purpose of this study was to determine the differences in key running motion parameters in runners with and without foot pain, and identify significant contributors to the onset of foot pain.

Methods: This was a cross-sectional study of runners with foot pain (n=24) and age-sex matched runners without foot pain (n=20). Runner characteristics were: 173cm±9 cm; 70kg±14.5 kg; 77.3% long-distance trained. Running experience, history of joint pain and recent changes in training and shoe wear were collected. Foot pain was reported as presence of pain of any severity. A 12 optical camera 3-dimensional motion capture system with a force-plated treadmill were used to collect running motions and forces. Key variables included cadence, stride length, stance time and ground reaction force, rate of development of impact forces.

Results: Foot pain was classified as 33% plantar fasciitis, 8% metatarsal stress fracture, 17% other and 42% had undiagnosed foot pain. In runners with foot pain, 62.5% started running in a new shoe type within the past 6 months (p<0.001). Compared to runners without foot pain, those with pain reported additional musculoskeletal pain at sites along the kinematic chain in the knee, hip, low back and shoulder pain (62.5% versus 15%; p<0.001). 46% of runners with reported foot pain attempted to run with a new foot strike, compared to 25% of runners without pain (p=0.10). Logistic regression revealed that the strongest contributor to onset of foot pain was the use of a new running shoe type within the previous six months (β coefficient=-2.265; p=0.003) Temporal spatial measures were not different in runners with without foot pain.

Conclusion: For injury prevention, proper adaptation to new shoes should be a priority. Running with a chronic foot pain can ultimately become a more systemic problem with the onset of other musculoskeletal pains. If a runner wishes to change shoe type, a slow proper introduction and progression of these changes over a period of time is recommended.

502 Board #323 May 31 9:30 AM - 11:00 AM
Preliminary Analysis: Variability Between Healthy and Injured Individuals during Running
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Reduced motor variability has been associated with increased risk of lower extremity running-related injuries, such as patellofemoral pain syndrome. Further investigation of lower extremity variability in populations with current lower extremity injury (LEI) is needed to determine the relationship between variability and running-related injuries.

PURPOSE: To compare lower extremity kinematic variability between healthy individuals (HE) and individuals currently experiencing LEI (knee, hip, pelvis, and thigh) during a running task.

METHODS: Thirty-four individuals (17 HE, 17 LEI) volunteered for this study. 3D kinematic data during running was captured at 200Hz using reflective markers placed on lower body. A single 25-second trial was collected. Variables of interest included knee flexion/extension angle, knee abduction/adduction angle, hip flexion/extension angle, and hip abduction/adduction angle; all were measured in degrees. Linear measures of variability including standard deviation (SD) and coefficient of variation (CV) were calculated for each dependent variable during the stance phase. A multivariate analysis of variance (MANOVA) was used to assess differences in SD and CV between the healthy and LEI groups.

RESULTS: The average running speed was 2.52±.24 m/s. There were no statistically significant differences between groups (injured and non-injured) when assessing linear measures of variability ($F_{1,32}=.624$, p>.05). Means and SD for each DV are as follows: knee FLEX SD (HE=6.48±13.07, LEI=1.83±.67), knee FLEX CV (HE=23.33±46.48, LEI=6.97±3.42), knee ABD SD (HE=1.06±1.52, LEI=.53±.18), knee ABD CV (HE=25.81±36.74, LEI=12.08±5.80), hip FLEX SD (HE=6.01±13.08, LEI= 1.39±.45), hip FLEX CV (HE=46.67±96.56, LEI=7.88±3.32), hip ABD SD (HE=1.37±1.60, LEI=.91±.34), hip ABD CV (HE=69.23±61.53, LEI=205.46±454.20)

CONCLUSIONS: Overall, no differences in lower extremity kinematic variability were found between groups. It is plausible that LEI is not manifested by significant changes in the amplitude of lower extremity kinematic variability demonstrated in the sagittal and frontal planes. Future studies should incorporate measures that capture the time-dependent nature in movement variability, rather than restrict analysis to simply assessing magnitude changes.

503 Board #324 May 31 9:30 AM - 11:00 AM
Is There a Predictable Value of the Drop Vertical Jump Test for Running Gait Injury Risk?
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Purpose: A three-dimensional (3D) motion analysis of running gait is often used to identify modifiable lower extremity biomechanical risk factors, but can be time consuming and costly. The Drop Vertical Jump (DVJ) test when combined with the Landing Error Scoring System (LESS) can easily be done in the field to assess lower extremity coordination and injury risk. The purpose of this study was to determine if correlations existed between biomechanical variables of the DVJ and a 3D gait analysis. Positive findings would indicate that the DVJ may serve as a simple surrogate for the running analysis to quickly screen for lower extremity injury risk.

Methods: 24 runners (26.1 ± 8.6 yrs; 27.7 ± 11.3 miles/wk; 16 Male, 8 Female) participated. During one testing session, a 3D motion analysis and an instrumented treadmill were used to capture and determine lower extremity kinematics, ground reaction forces (GRF) and knee moments during the gait cycle. Subjects completed five DVJs and a gait analysis at a self-selected running speed (6.7 ± 0.9 mph). Data were gathered on the dominant leg for both the DVJ and the gait analysis (1 left dominant). LESS scores were calculated through frontal and sagittal plane videos of the DVJ using a score from 22 items. Individual LESS items were selected based on similar measures that could be captured in the 3D gait analysis: asymmetric motion of feet and knees in the sagittal and frontal planes, foot contact patterns and overall impression.

Results: Significant associations existed between maximal knee flexion angle (sagittal plane 3D running) and overall LESS score (r=-.791; p<0.001). There were no other significant associations between lower extremity kinematics, GRFs and knee moments and LESS items and overall score. There were also no significant associations between DVJ biomechanical variables and the 3D gait measures.

Conclusion: Contrary to our expectation, associations between 3D gait, DVJ and LESS were minimal. A possible explanation could be that the dual-leg DVJ test may not be able to account for factors of balance and stability that are critical for the single-leg nature of running. A single-leg DVJ may be a more accurate field test when predicting running-related injuries.

504 Board #325 May 31 9:30 AM - 11:00 AM
Trunk Kinematics Displayed During Running By Individuals with Adolescent Idiopathic Scoliosis: A Pilot Study
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Decreased spinal motions in walking have been reported for Adolescent idiopathic scoliosis (AIS) individuals but how AIS produce the spinal rotations needed during high-effort running and thus compensate for the loss of spinal flexibility is not known.

PURPOSE: To compare trunk kinematics displayed by AIS and matched controls (CON) during a perceived maximal effort treadmill running.

METHODS: Five skeletally mature AIS individuals (thoracolumbar structural curve with neutral pelvis; primary Cobb angle = 35.3°±13.6°) and 5 CON (respectively: age: 21.3±1.3 yrs, 20.6±1.1 yrs; height 1.7±0.1m, 1.59±0.1m; mass 52.7±9.4 kg, 57.0±10.8 kg; level of physical activity (IPAQ SF): 7.3±2.6 hrs/wk, 6.67±3.06 hrs/wk) were recruited. Spatial locations of the 24 reflective markers on the trunk and pelvis were captured (Vicon®, 120 Hz) during self-selected maximal running speed for 15 sec on treadmill (BORG RPE > 13). Angular displacements (AngDisp) of the 3 trunk segments (upper trunk [UT: C7-T8], middle trunk [MT: T9-T12] and lower trunk [LT: L1-L5]) for each rotation plane were compared between the groups via Analysis of covariance (running speed = covariate, p<.05).

RESULTS: Running speeds were not different between the 2 groups (p=0.63). LT lateral flexion AngDisp relative to pelvis was significantly lower (p=.049) for AIS (7.7°±2.7°) compared to CON (14.0°±3.4°). AIS group (14.7°±5.0°) showed a tendency for clinical significance (p=.065) for greater sagittal plane AngDisp compared to CON (8.9°±2.8°) but no other significant differences were observed (p=.194-.814).

CONCLUSION: Minimal differences were observed between the groups contrary to those reported in literature for walking. One clinical explanation could be the presence of compensatory secondary spinal curve leading to a neutral pelvis. Magnitudes of the group differences observed were very low, and thus may not be clinically relevant when compared to the total available trunk ranges of motion. These could be a result of high inter-participant variability in running technique and low statistical power, and

not necessarily as an effect of scoliotic spine. Physically active AIS individuals have the potential to demonstrate typical trunk mechanics to achieve performance goals of high intensity physical activities like running.

505 Board #326 May 31 9:30 AM - 11:00 AM
A Prospective Study on Medial Tibial Stress Syndrome in Runners

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(No relationships reported)

Medial tibial stress syndrome (MTSS) is one of the most common overuse injuries in runners. Previous studies have indicated hip muscle strength, passive range of motion (ROM), and running kinematics as possible contributing factors. However, to date, no studies have combined measurements of all these areas into a single prospective study. **PURPOSE:** To prospectively examine differences in muscle strength, ROM, and kinematics between runners who do and do not develop MTSS. **METHODS:** 24 runners (sex: 13 male, 11 female; age: 20.1 ± 1.2 years; weekly mileage: 53.2 ± 20.8 miles) participated in this study. Participants underwent a clinical exam documenting lower limb alignment and ROM; were evaluated for hip abductor, external and internal rotator, and extensor strength using a hand held dynamometer; and completed a 3D running gait analysis during which a 12-camera motion capture system was used to record kinematics while they ran on a treadmill. Participants were followed for two years during which time any injuries were diagnosed and recorded by the teams' athletic trainer. Independent *t*-tests were used to compare differences between runners who did (INJ) and did not (CON) develop MTSS. Logistic regression was used to evaluate which variables were best predictors of group membership. **RESULTS:** After two seasons 8 of the 24 athletes developed MTSS. There were no differences in ROM measures between INJ and CON groups, however, the INJ group demonstrated weaker hip abductors than the CON group (16.0 ± 3.6 vs 21.9 ± 6.0 % body weight, *p* = 0.01, ES = 1.4). Compared to the CON group, the INJ group had higher contralateral pelvic drop (6.4 ± 1.4 vs. 4.5 ± 2.0°, *p* = .02, ES = 1.1), higher peak rearfoot eversion (8.2 ± 4.3 vs. 4.6 ± 1.9°, *p* = .02, ES = 1.1), and longer durations of rearfoot eversion (79.4 ± 8.5 vs. 55.5 ± 10.3 % stance, *p* < .001, ES = 2.5) during stance phase. The logistic regression ($\chi^2 = 18.1$, *p* < .001) revealed every 1% stance increase in duration of rearfoot eversion increased odds of being in the INJ group by 1.26 (*p* = .015, 95% CI 1.04 - 1.54). **CONCLUSION:** Both proximal and distal biomechanics appear to contribute to MTSS development. Thus, screening for individuals at risk of developing this common overuse injury should include evaluation of both regions, with particular attention to the duration of rearfoot eversion.

506 Board #327 May 31 9:30 AM - 11:00 AM
Do Female Runners with Large Peak Hip Adduction Angles Lack Hip Strength and Control?

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Large peak hip adduction angles in women are prospectively linked to patellofemoral pain and iliotibial band syndromes. Deficits in hip abductor eccentric strength and lower extremity neuromuscular control (NMC) may contribute to the large peak hip adduction angles in female runners. **PURPOSE:** To compare hip abductor eccentric strength and NMC between female runners with large and small peak hip adduction angles. **METHODS:** We recruited 11 female runners for this study (26 ± 4 years; 1.65 ± 0.06 m; 58.9 ± 4.0 kg; 19 ± 9 miles per week). Three-dimensional position data were collected during running. Hip abductor eccentric strength was measured using a hand held dynamometer during a break test. NMC was measured using the hip control test, based on Fitts law. A higher score on the hip control test indicated better NMC. Runners were separated into "large" and "small hip adduction" groups based on their peak hip adduction angle. Hip abductor eccentric strength and NMC were compared between groups and interpreted according to minimal detectable differences (MDD). Effect sizes (ES) were used to interpret the magnitude of differences. **RESULTS:** The large and small hip adduction groups were separated by more than the MDD in peak hip adduction angle (MDD = 2.7°), indicating a true difference (17.0° ± 0.9° and 12.6° ± 1.5°; ES = 3.7). The large hip adduction group had slightly less hip abductor eccentric strength (11.9 ± 1.7 (Nm/Bw*ht)*100⁻¹) than the small hip adduction group (12.4 ± 2.6(Nm/Bw*ht)*100⁻¹; ES = 0.2). Similarly, the large hip adduction group had less NMC (21 ± 2 taps) than the small hip adduction group (22 ± 4 taps; ES = 0.3). However, group differences did not exceed MDD for hip abductor eccentric strength (MDD = 2.5(Nm/Bw*ht)*100⁻¹) and NMC tests (MDD = 5 taps). **CONCLUSION:** Our findings suggest that female runners with large and small peak hip adduction angles have similar hip abductor eccentric strength and NMC. Thus, differences in peak hip adduction angle in female runners are not due to underlying hip abductor eccentric strength or NMC deficits.

Study funded by the American Society of Biomechanics Graduate Student Grant-In-Aid

A-57 Free Communication/Poster - Running and Swimming

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

507 Board #328 May 31 11:00 AM - 12:30 PM
Association of Body Composition with the Performance Level and Running Mileage among Long Distance Runners

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PURPOSE: To assess the association between leanness and running performance and training volume among highly trained Japanese long distance runners. **METHODS:** Body composition was measured by dual energy X-ray absorptiometry in 54 Japanese male long distance runners who belonged to a university track and field team (19.8 ± 1.3 yrs). The training volume was assessed by the average running mileage (km/month) during 5 months prior to the measurement. The runners were routinely divided into 4 categories by the coach of the team according to their performance level and the category of the period was used as the performance level of the runners; team A (n=15), B (n=17), C (n=11), and D (n=11) in the order of the level. Team D included runners who had injuries and restricted their training. Questionnaire survey was performed regarding weight control practices and complaints of fatigue. Written informed consent was obtained from each runner. **RESULTS:** The mean running mileage of the 54 runners was 606 km/month. Height, body mass, BMI, percent body fat, bone mineral density (BMD), z-score of BMD, and lean soft tissue mass were 172.0 ± 5.2 cm, 57.3 ± 4.4 kg, 19.4 ± 1.0 kg/m², 6.1 ± 1.3%, 1.175 ± 0.057 g/cm², -0.524 ± 0.677, and 51.1 ± 4.0 kg, respectively. The mean running mileage was not significantly correlated with any of those variables (*p* > 0.05). The mean running mileage of each category (A, B, C, & D) were 709, 600, 606, and 475 km/month, respectively (*p* < 0.01). Percent body fat were lowest in A (5.7%) and highest in D (6.4%) whereas z-score of BMD were -0.447 and -0.664, respectively. However, ANOVA showed no significant differences in those variables among the categories. Fisher's exact tests of questionnaire survey revealed significant between-categories differences in percentages of runners attempting weight reduction practices (8.3, 13.3, 53.8, and 38.5%, respectively, *p* < 0.05) and those complained of frequent fatigue (25.0, 53.3, 53.8, and 69.2%, respectively, *p* < 0.05). **CONCLUSIONS:** The runners had exclusively lean bodies regardless of their performance level and running mileage. The runners with the lowest performance level and the least training volume likely attempted weight reduction practice and complained of fatigue. It was concerned that they might pursue the lower level of percent body fat by restricting energy intake.

508 Board #329 May 31 11:00 AM - 12:30 PM
Ischemic Preconditioning Improves Marathon Trail Running Performance in Endurance-Trained Men

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PURPOSE: Muscle ischemia and reperfusion induced by ischemic preconditioning (IPC) has recently been demonstrated to improve performance across various physical activities; however, its effectiveness in real-world athletic settings is less understood. Therefore, the purpose of this study was to examine the effects of IPC on lactate and overall time during the Moab Trail Marathon. **METHODS:** Six (all men) well-trained and experienced trail runners (age = 22.4 ± 6.3 yr, ht = 173.4 ± 8.4 cm, body mass = 64.2 ± 7.4 kg, VO₂max = 56.5 ± 7.1 mL·kg⁻¹·min⁻¹) participated in this study. Participants were matched based on VO₂max and in randomized, single-blind fashion received either an IPC or sham treatment protocol 48 hours prior to a 26.2 mile trail marathon race in Moab, UT. Experimental procedures were performed bilaterally on the lower limbs with a treatment protocol of 4×5-min compression/5-min reperfusion cycles at 220 mmHg for IPC or the same procedure at 20 mmHg for the sham protocol. Blood lactate measurements were obtained at mile 9.7 and at the marathon finish. Probabilistic magnitude-based inferences were determined to assess the likelihood that the true value of the effect represents substantial change. **RESULTS:** Relative to the sham treatment, IPC produced likely beneficial effects for marathon run time (mean ± 90% confidence limits (CL): 1.7 ± 1.5%). Mean marathon times for IPC and sham treatment groups were 3hr 57min 34sec and 4hr 37min 7sec, respectively. Blood lactate values were significantly lower (*p* < 0.05) in the IPC vs. sham group at 9.7 miles (2.4 ± 1.7 vs. 3.3 ± 1.3 mmol·L⁻¹) and finish (2.2 ± 0.6 vs. 3.8 ± 1.6 mmol·L⁻¹).

CONCLUSION: IPC treatment elicited improvements in marathon trail running performance in experienced men trail runners. Moreover, we found that IPC was associated with an attenuated rise in blood lactate concentration. Therefore, utilizing IPC may allow for higher work rates and improved performance in trail marathon running.

509 Board #330 May 31 11:00 AM - 12:30 PM
Performance and Energy Balance during a 439 Mile Endurance Run

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Running for extreme distances or time has become increasingly popular, however, energy balance and its effect on performance is of great concern. **PURPOSE:** This case study examined the physical performance and energy balance in a 51 year old firefighter completing an 11-day, 439 mile solo run across Texas. **METHODS:** All food and drink consumed during the 11 day run were recorded to assess energy intake during the run. Energy expenditure and exercise data were recorded via a heart rate/GPS monitor during each run. Nude body weight was recorded each morning. **RESULTS:** Daily, the subject completed 39.98±2.61 miles (range 33.26-42.98 mi) in 11.2±1.2 hrs (range 9.74-12.97 hrs) at a 16.8±1.3 min/mi pace (range 15.17-18.45 min/mi). Subject consumed 4398±811 kcals per day (range 3280-5617 kcals/day) and expended 3804±271 kcals per run (range 3280-5617 kcals/run). Over the 11 days, the subject lost 2.6 kg of body weight. Total energy expenditure (5397 ± 271 kcal) was greater than energy intake (4398 ± 812 kcal; p=0.005). Over the 11 days, there was a trend towards a slower mile pace (r=0.832, p=0.001). Heart rate was also lower across the 11 days (range: 95 - 137 bpm; p=0.045). There was no change in core body temperature throughout each run (p=0.125 Time x Day interaction) or across the 11 days (p=0.078). On average, capillary lactate levels increased from 2.3 ± 1.3 mmol/L to 6.5 ± 2.3 mmol/L pre to post run (p=0.005). **CONCLUSION:** Energy balance is important for sustaining the high training and performance levels required for ultra-endurance events. However, the athlete was not able to consume enough calories to remain in energy balance. Nutritional needs assessments during training and competition should be an integral part of the preparation for participation in an ultra-endurance event. Supported by Valdosta State University Faculty Research Seed Grant

510 Board #331 May 31 11:00 AM - 12:30 PM
Assessment of Oxygen Deficit in Collegiate Runner during Steady State Exercise

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Oxygen deficit (OD) for the same absolute workload intensity decreases with aerobic training through improved aerobic metabolism and likewise increases with detraining. It is unclear if the amount of increase in OD with detraining is the same in middle distance (MD) and long distance (LD) runners and what training related OD changes occur in these groups with subsequent retraining.

PURPOSE: To compare and contrast the changes in OD values of collegiate MD and LD runners which accompany a post-competitive season cessation of training and subsequent endurance retraining. **METHODS:** Fourteen members of the collegiate track team (7 MD and 7 LD) runners completed a steady-state treadmill test (SS) at their gender-specific mean 5k velocity (15.3 kph for females and 18.5 kph for males) at the conclusion of their track season followed by 3 additional SS tests at 2-week intervals. Participants did not train between SS1 and SS2 and performed identical prescribed training programs between SS2 and SS4. VO₂ steady state was identified as the breakpoint of the second phase of the OD curve. OD area under the curve comparisons were made using a 2x4 repeated measures ANOVA. **RESULTS:** MD demonstrated a significant decrease in VO₂ at SS pace over the 6-week study resulting in a reduction in their mean OD (6.4%) versus LD (-0.5%) (P<.01). Mean anaerobic contributions to reach SS were greater in LD than MD (36.9% vs. 32.2%) at the end of 4-weeks of retraining (P<.01). **CONCLUSION:** There are differences in OD patterns that accompany both detraining and endurance retraining in collegiate MD and LD runners. LD runners were more aerobically challenged than MD to maintain SS velocity after detraining and may require a greater volume of anaerobic training than MD runners during the early retraining phase in order to retain a faster training pace.

511 Board #332 May 31 11:00 AM - 12:30 PM
Is There an Oxygen Pulse Threshold During Treadmill Running?

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It has been suggested there are two separate breakpoints in the oxygen pulse (O₂ pulse = VO₂/heart rate) versus workload relationship during incremental cycle ergometry, corresponding to the first and second turn points in the blood lactate response. It is still unclear if these O₂ pulse breakpoints can be detected during treadmill running, and if detected, where these thresholds may be located relative to the gas exchange threshold (GET) and respiratory compensation point (RCP). **PURPOSE:** This study examined the relationship between O₂ pulse and exercise intensity to determine if O₂ pulse thresholds could be detected during treadmill running, and, if detected, to compare these O₂ pulse thresholds to the GET and RCP. **METHODS:** Twelve, moderately trained runners (6 men and 6 women; age = 23 ± 3 years; height = 175 ± 8 cm; weight = 71 ± 12 kg) completed an incremental treadmill test to exhaustion for the measurement of gas exchange, ventilation, and heart rate parameters, as well as the determination of VO₂ peak. The GET and RCP were determined from the breakpoint in the VCO₂ versus VO₂ and V_E versus VCO₂ relationships, respectively. The O₂ pulse was plotted against VO₂ for each subject and the relationship between these two variables was examined using polynomial regression models (linear and quadratic) at an alpha level of p ≤ 0.05. **RESULTS:** The mean (± SD) VO₂ peak was 3.475 ± 0.959 L·min⁻¹ (48.33 ± 7.30 mL·kg⁻¹·min⁻¹). The GET (2.289 ± 0.617 L·min⁻¹) and RCP (3.029 ± 0.867 L·min⁻¹) occurred at 67 ± 5% and 88 ± 4% of VO₂ peak, respectively. The O₂ pulse versus VO₂ relationship was best explained by a linear fit (r² = 0.976 - 1.000) for 9 and a quadratic fit (R² = 0.985 - 0.996) for 3 of the 12 subjects. Only 1 of the 3 subjects with a quadratic fit for the O₂ pulse versus VO₂ relationship displayed a response consistent with a plateau in the O₂ pulse. **CONCLUSIONS:** The highly linear relationship between O₂ pulse and VO₂ for 75% of the subjects indicated that O₂ pulse thresholds could not be detected during treadmill running using the O₂ pulse versus VO₂ relationship. These findings do not support the use of the O₂ pulse as a non-invasive measure of fatigue thresholds.

512 Board #333 May 31 11:00 AM - 12:30 PM
Pre-season Maximum Oxygen Uptake of Female Division III Cross-Country Runners

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The mean maximum oxygen uptake (VO₂ max) from laboratory testing protocols of elite female long distance runners has been described as 68.4 ml·kg⁻¹·min⁻¹ for 3K to 10K runners (Daniels and Daniels, 1992) and 63.2 ml·kg⁻¹·min⁻¹ for elite female triathletes (Schabert et al, 2000). It is not known how NCAA Division III female cross-country runners compare to these groups.

PURPOSE: To describe the pre-season maximum oxygen uptake of NCAA Division III female cross-country runners
METHODS: Eighteen female cross-country runners were recruited from two NCAA Division III teams. After consenting to participating in the study, the subjects completed a progressive protocol to exhaustion. VO₂ max and respiratory exchange ratio (RER) were measured at peak.
RESULTS: Mean age of subjects was 19.4 years (SD=1.2) and mean VO₂ max was 52.2 ml·kg⁻¹·min⁻¹ (SD=5.9). The VO₂ max range was from 40.3 to 63.5 ml·kg⁻¹·min⁻¹ and the median was 52.4 ml·kg⁻¹·min⁻¹. The interquartile range was 49.6 to 56.8 ml·kg⁻¹·min⁻¹. Mean RER at VO₂ max was 1.08 (SD=0.06) and ranged from 1 to 1.21.
CONCLUSIONS: Mean pre-season VO₂ max of Division III cross-country runners was 23.7% lower than reported mean elite distance runners levels and 17.4% lower than mean elite triathlete levels. This is the first pilot study to describe NCAA Division III female cross-country runners, future studies should also describe ventilatory and anaerobic thresholds for this population.

513 Board #334 May 31 11:00 AM - 12:30 PM
Analysis of Critical Speed Derived from "All-Out" Shuttle and Continuous Running.

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Analysis of critical speed derived from "all-out" shuttle and continuous running
 Luke Krynski, Nicholas A. Jamnick, Mark Kramer, Robert W. Pettitt
Abstract

Time limits associated with short and middle-distance running performances are estimated validity using the critical speed (CS) concept; however, little is known about applications for shuttle running, a feature of team sports. **PURPOSE:** To evaluate the CS of shuttle versus continuous running. **METHODS:** A total of 20 varsity, male soccer players wearing global positioning sensors (GPS) engaged in a shuttle 3-min all-out running test (i.e., 70 m switch-backs) followed shortly by a 90 s continuous all-out running test on a 400 m track. Intermittent CS (CSi) and true CS were calculated using the last 30 s of each test and the running capacity at speeds exceeding CSi (D') was calculated using: (speed of 150 s - CS) * 150 s. **RESULTS:** There was a moderate effect size difference (Cohen $d = 0.72$) between true CS (3.78 ± 0.61) and CSi (3.40 ± 0.46) ($t = 6.44$, $p < 0.01$); however, the two parameters were positively, correlated ($r = 0.92$, $p < 0.01$), where true CS (m/s) could be predicted from $y = (CSi \times 1.24) - 0.43$ (standard error of estimate = 0.25 m/s). Poor correlations were observed between true CS and CSi versus D' (144 ± 46 m) ($r = -0.43$, $p = 0.07$ and $r = -0.32$, $p = 0.18$, respectively). **CONCLUSION:** Shuttle running evokes a consistent, predictable decline in CS. The CSi method likely reflects the same physiological variables mediating true CS, and the D' measure appears as a distinct metric.

514 Board #335 May 31 11:00 AM - 12:30 PM
Longitudinal Study of Changes in 1.5 Mile Run Times of Police Recruits Over 18 Years

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Cardiovascular endurance is an important aspect in the performance of police duties. Departments have a need to assess ability to run as it is important not only for the officer's health but also to protect citizens. **PURPOSE:** To evaluate patterns in cardiovascular fitness of police recruits upon entry into the police academy over 18 years including gender differences. **METHOD:** During the first week of police recruit training in a large southeastern metropolitan area, physical fitness levels were evaluated. This study's variable of interest was: 1.5 mile run. ANOVA, and Bonferroni post hoc procedures were used to evaluate data. **RESULTS:** Initial ANOVA comparisons were significant between years for both males and females ($p \leq 0.001$). The post hoc analysis of males indicated that in the first four years 1990 to 1994, there was a significant decrease in run times (min:sec) from ($12:32 \pm 1:30$ to $11:14 \pm 1:17$, $p < 0.05$). There was an increase in run times from 1994 to 2007, ($11:14 \pm 1:17$ to $12:11 \pm 1:38$, $p \leq 0.001$). As in the males, there was a significant decrease in run times for females from 1990 to 1996, ($15:15 \pm 2:32$ to $12:25 \pm 1:20$, $p \leq 0.01$). **CONCLUSION:** Overall, it appears in this metropolitan police department males are tending to have lower cardiovascular fitness levels as time progresses with little change in females. These recruits may be mirroring the lower cardiovascular fitness levels of the society from which they came.

515 Board #336 May 31 11:00 AM - 12:30 PM
Marathon Training Improves Aerobic Capacity, Running Performance, and Reduces Body Fat in Men and Women

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Introduction: Training for a 42.2-km marathon run consists of high volume aerobic training, which may increase VO_{2MAX} , reduce percent body fat (BF) and body mass (BM), and improve running performance. Previous research has produced mixed results with respect to sex differences in response to training. We hypothesize that in a

relatively large population following the same training program, men and women will see similar improvements in 2-mile time trial (2TT), reduce BF and BM, and increase VO_{2MAX} after completing a 20-week marathon training program, and that changes in all 4 variables will be significantly correlated with each other. **Purpose:** To assess sex differences in response to marathon training and to determine the relationship between changes in running performance, aerobic capacity, and body composition in this population. **Methods:** Students in a marathon training class ($n=147$, 111 females; 21.0 ± 1.7 years) completed the following before and after a 20-week marathon training program: 2-mile time trial (2TT) on an indoor 200-m track, underwater weighing (average of 3+ trials calculated with the Brozecz equation) for percent body fat (BF), and a VO_{2MAX} test using a graduated protocol on a treadmill with a Medgraphics Ultima system. Mixed-design ANOVA was used to assess changes and sex differences. Percent change was calculated for 2TT, BF, VO_{2MAX} , and BM, and Pearson's r was used to assess correlations between the changes. **Results:** Subjects improved in VO_{2MAX} (men: 54.0 ± 7.5 to 56.5 ± 7.0 ml \cdot kg $^{-1}$ \cdot min $^{-1}$; women: 46.8 ± 5.4 to 48.1 ± 5.3 ml \cdot kg $^{-1}$ \cdot min $^{-1}$; $P \leq 0.001$), and 2TT (men: 14.5 ± 1.8 min to 13.1 ± 1.6 min; women: 16.8 ± 1.6 to 15.5 ± 1.4 min; $P \leq 0.001$), reduced BF (men: 15.3 ± 5.2 to $14.3 \pm 5.6\%$; women: 25.0 ± 4.7 to $23.8 \pm 4.7\%$; $P \leq 0.001$), and did not change in BM (men: 75.0 ± 10.4 to 74.5 ± 10.3 kg; women: 63.1 ± 7.7 to 63.3 ± 7.8 kg; $P=0.378$). No sex-by-time interactions were found for any of the measures. Changes in all measures were significantly correlated with each other (VO_{2MAX} and BF: $r=-0.178$, $P=0.033$; VO_{2MAX} and 2TT: $r=-0.311$, $P \leq 0.001$; VO_{2MAX} and BM: $r=-0.279$, $P=0.001$; BF and 2TT: $r=0.341$, $P \leq 0.001$; BF and BM: $r=0.419$, $P \leq 0.001$; 2TT and BM: $r=0.208$, $P=0.012$). **Conclusion:** In a healthy, young population following the same marathon training program, both men and women improve 2TT and VO_{2MAX} and decrease BF with no change in BM.

516 Board #337 May 31 11:00 AM - 12:30 PM
The Effect Of ACTN3 Genotype On Self-reported One-mile Running Time In Young, Recreationally Active Women

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Alpha-actinins form a crosslink between actin filaments and adjacent sarcomeres, and play a role in signaling and energy metabolism. Alpha-actinin-3, is encoded by the ACTN3 gene and only presents in Type II muscle fibers. Homozygosity for the 577X allele (XX) results in complete deficiency of α -actinin-3 and a compensatory upregulation of α -actinin-2, whereas heterozygosity (RX) and homozygosity for the 577R allele (RR) provide for the production of α -actinin-3. Research has reported a greater proportion of elite female distance runners are homozygous for the 577X allele compared to controls. However, no study to date has examined that apparent relationship in recreational women runners. **PURPOSE:** To examine the effect of ACTN3 genotype on self-reported one-mile running personal records (PR) in young, recreationally active women. **METHODS:** Thirty nine participants, grouped by the presence (RR+RX: $n=27$, age: 21.7 ± 3.8 years, BMI: 22.9 ± 3.3 kg/m 2) or absence (XX: $n=12$, age: 21.2 ± 3.2 years, BMI: 21.5 ± 1.8 kg/m 2) of the 577R allele, reported one-mile running PR. Genotype effects were examined using independent-sample t-tests and magnitude-based inference (MBI). **RESULTS:** A trend ($p=0.065$) toward faster one-mile times was observed in XX genotypes (415.7 ± 78.9 s) when compared to the RR+RX group (480.3 ± 104.8 s). MBI revealed a mechanistically beneficial effect of XX genotype (mean difference; $\pm 90\%$ CI; -65 s, ± 57 s). Similar observations were made among a subset of thirteen faster runners, who reported a one-mile PR of less than seven minutes (RR+RX: $n=7$, age: 21.9 ± 5.0 years, BMI: 20.9 ± 3.4 kg/m 2 ; XX: $n=6$, age: 19.5 ± 0.5 years; BMI: 21.8 ± 1.5 kg/m 2). Though not statistically significant ($p=0.378$), those in the XX group (355.8 ± 46.5 s) reported 5.4% faster times than those in the RR+RX group (376.3 ± 33.6 s). MBI revealed a mechanistically beneficial effect of XX genotype (-20 s; ± 40 s). **CONCLUSION:** These findings suggest a potential benefit of XX genotype on middle-distance endurance performance. This is in agreement with prior investigations that have linked XX genotype to endurance capabilities in elite female athletes.

517 Board #338 May 31 11:00 AM - 12:30 PM
Performance Changes in Consecutive Day Marathon Runners

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Over the last five years, the popularity of marathon running to complete a marathon in each of the 50 states has grown. As such, new businesses have arisen to accommodate completing this faster. There are now multiday marathon series that cover two to seven

states (i.e. seven days, seven marathons, seven different states). There is currently very little in the literature about these types of events and a lack of analyses of the finish times for participants that complete multiple days of marathons. **PURPOSE:** To determine the performance changes across the multiday marathon events.

METHODS: 145 runners completed between one and seven marathons over a seven day period at the 2016 Mainly Marathons New England Series. Data for all finishers were retrieved after the completion of the series from the series website. Descriptive analyses and a comparison of means were performed on participants who completed one marathon (1MAR, n=63) and those that completed all seven marathons (7MAR) covering the seven different days (n=20).

RESULTS: Descriptive statistics, a paired t-test and independent t-test were performed using IBM SPSS version 21 with significance set at p<0.05. There was no significant difference in age between 1MAR and 7MAR (49.3±13.7 vs. 50.9±14.4 yrs, p=0.653). In addition, no statistically significant difference was found between 1MAR and day one of 7MAR finish times (350.4±96.7 vs. 362.1±80.0 min, p=0.625). However, 7MAR ran 11.7 minutes slower on average for day one. Finally, day one versus day 7 finish times for the 7MAR group were significantly different (362.1±80.0 vs. 390.8±60.2 min, p=0.006).

CONCLUSIONS: Even though the day one finish times were close to six hours on average, the toll of seven daily marathons still resulted in a significant decline in performance.

518 Board #339 May 31 11:00 AM - 12:30 PM
A Mile Trail Run Can Predict Performance for a 5K Trail Race

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PURPOSE: A common desire and strategy for many runners is to predict race time off of a shorter time trial. It is unknown whether these strategies apply to trail races. The purpose of this study was to determine if a 1-mile trail run could predict performance on a 5K trail race. It was hypothesized that a significant correlation would be present between a timed 1-mile run and 5K run time.

METHODS: Thirteen participants [Female: 3, Male: 10, Age:23±5 yr, Height:175±9 cm, Mass:74±12 kg, BMI: 24±4] reported to the trailhead (Practice Loop, Three Peaks Recreation Area, Cedar City, UT) and completed a 1-mile and a 5K timed trail run one day apart in a counterbalanced order. Elevation at the trailhead was 1,641 m (5,385 feet) with a rise of 17 m (56 feet) throughout the marked 1-mile course, and 61 m (201 feet) on the 5K course. Testing was completed between 1500 and 1700h on both days. Environmental measures of temperature (23.9°- 25.6° C; 75°-78° F), humidity (13%-15%), and wind speed (4-9 mph) varied throughout the testing days. Data were analyzed using a Pearson product moment correlation coefficient with significance accepted at the p<0.05 level.

RESULTS: A significant correlation was observed between 1-mile time and 5K performance (r=0.987, p=0.0001, R²=0.974). The equation to predict 5K time from the mile time trial was: 5K time (expressed as a decimal) = 4.2881*mile time (expressed as a decimal) - 4.5521. The average running velocity during the 1-mile trail run was 3.94±0.9 m.sec⁻¹, and 3.4±1.0 m.sec⁻¹ for the 5K.

CONCLUSIONS: Our results show that a 1-mile trail run time trial can be used to predict performance for a 5K trail race. Also, based on these data, 5K trail running velocity is approximately 15% less than during a 1-mile trail run bout.

519 Board #340 May 31 11:00 AM - 12:30 PM
Standardized MET Overestimates Resting VO₂ And Underestimates Energy Cost Of Running In Low Cardiorespiratory Fitness Men

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Multiples of the metabolic equivalent (MET) are widely used to prescribe exercise intensity and quantify the energy cost of physical activities. A growing body of empirical evidence, however, suggests the standardized 1-MET value, represented by a resting oxygen uptake (VO₂) of 3.5 mL.kg⁻¹.min⁻¹, significantly overestimates observed resting VO₂ in populations with lower cardiorespiratory fitness (CRF).

PURPOSE: Compare the standardized MET and resting VO₂ with respect to these two applications and explore the association between CRF and resting VO₂. **METHODS:** A heterogeneous cohort of 114 healthy men, aged 18 to 38 yr, volunteered to

participate in two studies. First, 100 men [lower CRF: n = 48, VO_{2max} < 50.0 mL.kg⁻¹.min⁻¹; higher CRF: n = 52, VO_{2max} ≥ 50.0 mL.kg⁻¹.min⁻¹] visited the laboratory twice to explore the association between directly assessed VO_{2max} and resting VO₂. Second, 14 men performed a 30-min bout of running at 8.0 km.h⁻¹ (8.3 METs according to the Compendium of Physical Activities) to investigate the use of the MET to quantify the energy cost of treadmill running. **RESULTS:** The VO_{2max} was strongly positively correlated with resting VO₂ (R = 0.68, P < 0.001). The mean observed resting VO₂ values of 3.28 (n = 100) and 3.07 (n = 14) mL.kg⁻¹.min⁻¹ were significantly lower than the standardized value of 3.5 mL.kg⁻¹.min⁻¹ (P < 0.001 and P = 0.005, respectively). When compared to the standardized value, groups with lower CRF demonstrated significantly lower mean observed resting VO₂ values of 3.06 (1st part of the study; P < 0.001) and 2.67 (2nd part of the study, P < 0.001) mL.kg⁻¹.min⁻¹. However, no significant difference was observed between standardized and observed resting VO₂ values for the groups with higher CRF (1st part of the study; P = 0.87; 2nd part of the study; P = 0.78). Hence the observed values for the energy cost of treadmill running were significantly underestimated when calculated using the standardized resting VO₂ value of 3.5 mL.kg⁻¹.min⁻¹ (P = 0.005 to P < 0.001) only for the groups with lower CRF. **CONCLUSION:** The standardized MET value considerably overestimated observed resting VO₂ in men with lower CRF. Direct determination of resting VO₂ is therefore preferred to improve the accuracy of the aforementioned applications in this population.

520 Board #341 May 31 11:00 AM - 12:30 PM
An Evaluation of Time-Trial Based Predictions of VO₂max and Recommended Training Paces For Collegiate and Recreational Runners

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PURPOSE: Determine the accuracy of Jack Daniels' VDOT Running Calculator for the prediction of VO₂max, and recommendations of interval and threshold training paces (pIN & pTH) in samples of NCAA Division I track athletes (ATH, n = 11) and recreational runners (REC; n = 9). **METHODS:** Predicted variable data were obtained using results from indoor 5km time-trials. Data from the VDOT calculator was compared to laboratory tested VO₂max, pace at VO₂max (VO₂max_{pace}), and lactate threshold pace (LT_{pace}). **RESULTS:** VDOT underestimated VO₂max in ATH (t (10) = -6.00, p <.001, d = 1.75) and REC (t (8) = -8.96, p <.001, d = 3.44). Follow up between-groups analysis indicated that the difference between VDOT and VO₂max was significantly greater in REC than ATH (p = .0031, d = 1.59). pIN was slower than VO₂max_{pace} in REC (t (8) = -4.26, p = .003, d = 1.76), but not different in ATH (t (10) = 0.52, p = .614, d = 0.14). Conversely, pTH was faster than LT_{pace} in ATH (t (8) = -4.17, p = .003, d = 1.49), but not different in REC (t (8) = 1.64, p = .139, d = 0.57). **CONCLUSIONS:** Practically, pTH can be confidently used for threshold training regardless of ability level. pIN also appeared to be accurate for ATH, but may be not be optimal for improving VO₂max in REC. Practitioners should interpret VDOT with caution as it may underestimate VO₂max.

Table 1. Descriptive characteristics of subjects.

Variable	Whole Group (n = 20)		ATH (n = 11)		REC (n = 9)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	21.44	2.21	20.96	0.92	22.78	2.64
Height (cm)	173.42	10.99	177.48	9.23	170.67	11.46
Body mass (kg)	67.06	8.98	67.46	8.31	66.63	10.20
5 km (interval) time	20.63	3.93	18.22	2.11	23.01	3.61

ATH = NCAA Division I track athletes; REC = recreational runners

Table 2. Predicted and actual test data and difference scores by group.

	Mean ± SD	p	Cohen's d
NCAA Division I Athletes (n = 11)			
VO ₂ max (mL.kg ⁻¹ .min ⁻¹)	61.05 ± 6.61		
VDOT (mL.kg ⁻¹ .min ⁻¹)	56.33 ± 7.17		
VDOT - VO ₂ max	-4.72 ± 2.61	<.001	1.754
VO ₂ max _{pace}	5.75 ± 0.77		
pIN	5.79 ± 0.64		
pIN - VO ₂ max _{pace}	0.04 ± 0.26	.614	0.037
LT _{pace} *	6.75 ± 0.94		
pTH*	6.37 ± 0.75		
pTH - LT _{pace} *	-0.38 ± 0.28	.003	1.480
Recreational Runners (n = 9)			
VO ₂ max (mL.kg ⁻¹ .min ⁻¹)	51.41 ± 6.83		
VDOT (mL.kg ⁻¹ .min ⁻¹)	42.17 ± 7.54		
VDOT - VO ₂ max	-9.24 ± 3.10	.001	3.437
VO ₂ max _{pace}	6.89 ± 0.84		
pIN	7.40 ± 1.08		
pIN - VO ₂ max _{pace}	0.51 ± 0.36	.003	1.762
LT _{pace} *	7.88 ± 1.38		
pTH*	8.03 ± 1.16		
pTH - LT _{pace} *	0.15 ± 0.27	.139	0.574

VDOT = predicted VO₂max; pIN = predicted interval pace; VO₂max_{pace} = pace corresponding with velocity at VO₂max; LT_{pace}* = pace corresponding with velocity at lactate threshold; pTH = predicted threshold pace
 Units for all pace times are in min/mile
 *n = 9

521 Board #342 May 31 11:00 AM - 12:30 PM
Effects of Footwear on Running Economy and Preferred Foot Strike Pattern in Collegiate Distance Runners
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 (No relationships reported)

The influence of foot strike pattern on running performance has produced inconsistent results (Kasmer et al., Int. J. Sports Physiol. Perform. 29:286-292, 2013; Larson et al., J Sports Sci 29:1665-73, 2011) as has the effect of footwear and foot strike pattern on running economy (Perl et al., Med. Sci. Sports Exerc. 44:1335-1343, 2012). **PURPOSE:** To examine the effects of varying footwear on running economy and preferred foot strike pattern in collegiate distance runners. **METHODS:** Ten (5 female, 5 male) healthy, trained National Collegiate Athletic Association Division II distance runners were randomly assigned to 3 footwear conditions: 1) barefoot (BF), 2) minimally shod (MS) and 3) traditionally shod (TS). For each condition, running economy (VO_2), heart rate (HR), rating of perceived exertion (RPE), and preferred foot strike (PFS) pattern (forefoot, mid-foot, rear foot) were measured between the 5th and 6th min of treadmill running at 0% grade, 3.35 m/s. **RESULTS:** Repeated measures ANOVA analysis revealed no significant difference ($p > 0.05$) across BF, MS and TS footwear conditions for VO_2 (41.2 ± 2.5 , 40.7 ± 1.9 , 41.6 ± 2.2 ml/kg/min), HR (168.6 ± 17.5 , 166.7 ± 15.8 , 168.6 ± 16.1 bpm) and RPE (9.6 ± 1.8 , 9.3 ± 2.1 , 9.5 ± 1.8). The PFS data were analyzed using a Friedman's test followed by a Wilcoxon signed rank test. The Friedman's test showed a significant difference ($p < 0.05$) in PFS patterns across footwear treatments. Subsequently, the Wilcoxon test indicated the PFS pattern for BF was forefoot and, in contrast, for both MS and TS conditions the PFS was rearfoot. **CONCLUSION:** There is no metabolic advantage to BF, MS, and TS footwear in collegiate male and female distance runners and, although PFS varies with footwear, it has no effect on running economy. This suggests collegiate distance runners can select footwear of their choice without sacrificing running performance.

522 Board #343 May 31 11:00 AM - 12:30 PM
Decreasing Total Training Time Efficient In Improving Speed and Aerobic Cost in Competitive Runners
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In addition to overall volume, an essential variable in an optimal endurance training program is the distribution of exercise intensity. Training intensity distribution (TID), which is the percentage of time an athlete spends training in low, moderate, and high intensity efforts, has been used to prescribe training programs and monitor athletes. Training based on a demarcation of high intensity at onset of blood lactate (OBLA) of 4mM has been suggested to provide a more precise stimulus to yield optimal metabolic and peripheral adaptations. Adaptations which shift OBLA allow an individual to exercise at higher work rates for longer periods, translating into better overall endurance performance. **PURPOSE:** Identify TID related factors that delay OBLA for competitive runners. **METHODS:** Sixteen University of Oklahoma Cross Country athletes (8 males and 8 females) initially performed two lactate threshold (LT) tests to determine training intensity zones (TIZ) based on heart rate (HR) and blood lactate. TIZ categories consisted of: low (Z1) = LA < 2 mM, moderate (Z2) ≥ 2 mM and ≤ 4 mM, and high intensity (Z3) > 4 M. Subjects subsequently wore GPS HR monitors (blinded) to practice every day for the next 5 weeks, including all training runs and races, while concluding the study with a final LT test. Total training time and TID parameters were recorded as well as the performance metrics of both running speed and aerobic cost at OBLA (S4 and AC4). Correlational analysis and multiple regression estimation were used to analyze the data. **RESULTS:** Bivariate correlations were not significant between most TID variables and the performance variables. However, when using multiple regression ($\alpha = 0.05$) to control for gender differences, total training time emerged as having a statistically significant ($p < 0.01$) negative relationship with performance changes ($\Delta S4$, $\Delta AC4$) over the time frame examined. Additionally, the coefficient analysis suggested that the proportion of training time in Z3 might be positively related to $\Delta S4$ ($p = 0.089$) and $\Delta AC4$ ($p = 0.062$). **CONCLUSION:** This study shows that improvements in an athlete's S4 and AC4 may be achieved by decreasing overall training time and potentially increasing the proportion of time in Z3. From a practical point of view, this could be achieved by elimination of training time in Z1 and/or Z2.

523 Board #344 May 31 11:00 AM - 12:30 PM
Effect of Short-term Altitude Training on Sprint Running Performance
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It is suggested that intermittent hypoxic training (IHT) improved repeated sprint ability and maximal 30-s cycling sprint (Faiss et al., 2013; Hamlin et al., 2010; Kasai et al., 2015). Therefore, IHT may be suitable for enhancing sprint performance. However, IHT and/or altitude training have not yet been conducted in track events sprinters. **PURPOSE:** The purpose of the present study was to determine the effects of short-term altitude high intensity training on sea level sprint running performance in well-trained 400-m runners. **METHODS:** Eighteen college male 400-m runners were assigned to either a Hypoxic group ($n = 9$) or a Normoxic group ($n = 9$) and performed high intensity running training twice a day for 5 days. Both groups trained same high intensity training program in all weather running track. Hypoxic group trained and rested in Hida-Ontake Kogen Highland Training Area (1,700-1,800m). Before and after the training, subjects were completed 60-m and 400-m maximal running test, and vertical jump test. The post-training test periods were conducted 2, 7, 14, 21, 28 days after the final training session. **RESULTS:** After the 5 days of high intensity training, no significant changes in 400-m running time in both groups. However, percentage changes of 400-m running time were significantly higher in Hypoxic group (2.1 ± 1.0 %) than in Normoxic group (1.0 ± 0.9 %). 30-m time during the latter half of 60-m running was significantly increased in 7-days after training (Hypoxic: 3.15 ± 0.04 vs 3.23 ± 0.03 sec, Normoxic: 3.16 ± 0.03 vs 3.22 ± 0.03 sec) and significantly decreased in 21-days after training (Hypoxic: 3.08 ± 0.03 sec, Normoxic: 3.11 ± 0.03 sec) compared to before training. There were no significant changes in vertical jump in both groups. **CONCLUSIONS:** These results suggest that altitude high intensity training is effective for 400-m runners.

524 Board #345 May 31 11:00 AM - 12:30 PM
The Effects of a Medicine Ball Training Program on Running Economy
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Running economy (RE) has been shown to improve with the addition of concurrent explosive strength training, plyometrics, and heavy load resistance training. However, there is little research to date on the effects of RE with functional resistance training. **PURPOSE:** To determine the effect of a medicine ball training program on running economy. **METHODS:** At this time, 7 runners (age = 22.86 ± 6.23 years) have completed the pre- and post push-up, curl-up, running economy at 187 m/min and 204 m/min, and a maximal oxygen consumption test, with 10 additional runners in the process of completing the protocol. Following the pre-test, participants were matched for gender and $\text{VO}_{2\text{max}}$ and randomly assigned to either the intervention (I) or control (C) group. The intervention group completed a 6-week progressive medicine ball training program. Statistical analysis was performed using independent t-tests and Pearson product-moment correlations. Significance was set to $p < 0.05$. **summary of RESULTS:** The following is preliminary data on the 7 participants (4 I, 3 C) that have completed the protocol. The number of push-ups completed following the post testing increased by 6.8 ± 4.1 for the I group and 6.3 ± 9.5 for the C group. The I group increased the number of curl-ups completed by 21.0 ± 19.0 while the C group decreased by 3.3 ± 10.2 . Running economy at 187 m/min, decreased by 2.07 ± 1.0 ml/kg/min and 0.7 ± 0.4 ml/kg/min for the I and C groups, respectively. At 206 m/min running economy, decreases by 1.9 ± 1.3 ml/kg/min for the I group and increased by 0.5 ± 2.4 for the C group. $\text{VO}_{2\text{max}}$ decreased by 0.2 ± 1.2 ml/kg/min for the I group and increased by 0.8 ± 0.7 ml/kg/min for the C group. Independent t-test analyses are not currently showing statistically significant changes in the preliminary data ($p < 0.05$). Although not statistically significant, the Δ in push-ups and Δ in curl-ups are showing a positive correlation with RE at both speeds (187m/min: $r = 0.762$, $p = 0.238$; 204 m/min: $r = 0.871$, $p = 0.129$; 187 m/min: $r = 0.262$, $p = 0.738$; 204 m/min: $r = 0.420$, $p = 0.580$, respectively). **CONCLUSION:** These preliminary data suggest that the inclusion of a medicine ball training program may help improve abdominal endurance (curl-up) and running economy in trained endurance runners.

525 Board #346 May 31 11:00 AM - 12:30 PM
Effects of Replacing Run Training with Elliptical Bicycle Training in Experienced Runners
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 (No relationships reported)

Run training can improve fitness and performance. Many runners have seen high rates of injury, which can lead to detraining. Cross-training methods attempt to attenuate detraining. A novel outdoor elliptical bicycle (EBIKE) has been designed to emulate the running motion without impact forces. **PURPOSE:** To determine the effectiveness of replacing 50% run training with elliptical bicycling on maximal oxygen consumption ($\text{VO}_{2\text{max}}$), ventilatory threshold (VT), respiratory compensation point (RCP), and 5,000 m time trial (TT) over a 4-week training period. **METHODS:** Fourteen male ($n=9$) and female ($n=5$), experienced runners (age=22.1 \pm 3.6 y, running experience=9.6 \pm 4.2 y) were classified as healthy and experienced via a health history screening, body composition assessment (skin fold method), and a graded $\text{VO}_{2\text{max}}$ test (GXT) on a treadmill during an initial testing session. The TT was performed on an indoor 300m track 24-72 hours following the GXT. Each participant was then randomly assigned to either the RUN group (100% normal run training) or COMBINED (COM) group (50% normal run training/50% elliptical bicycle training). An identical testing session was conducted following the 4-week training period. **RESULTS:** All results are reported as mean \pm SD. Paired *t*-tests ($\alpha<0.025$) were utilized to compare the physiological variables before and after training separately for each group. A Bonferroni correction was performed in order to adjust the alpha value to avoid statistical error. Before training values for $\text{VO}_{2\text{max}}$ (ml/kg/min) (RUN [59.94 \pm 3.92] and COM [62.67 \pm 6.41]) were not significantly different ($p>0.025$) compared to after training values of $\text{VO}_{2\text{max}}$ (RUN [60.59 \pm 4.61] and COM [63.17 \pm 7.97]). There also were no significant differences for VT, RCP, or TT values ($p>0.025$) before and after training for both the RUN and COM groups. No significant differences were seen when VT and RCP were expressed as a percent of relative $\text{VO}_{2\text{max}}$. **CONCLUSIONS:** In this novel investigation replacing 50% of run training with elliptical bicycle training over a 4-week period was able to maintain physiological and performance variables similar to 100% run training in this population of experienced runners. Coaches and runners should consider the EBIKE as a viable cross-training option for replacing up to 50% of run training.

526 Board #347 May 31 11:00 AM - 12:30 PM
Improvement in 3200-m Running Performance following Acute Inspiratory Muscle Training
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 (No relationships reported)

Prior high-intensity exercise has been shown to augment the oxidative energy contribution to subsequent exercise and enhance competitive performance. Inspiratory muscle training (IMT) is a form of resistance training for the muscles primarily involved in the processes of breathing using a resisted respiratory breathing trainer, which has also been shown to modify VO_2 kinetics and enhance performance. The potential impact of acute IMT as part of a warm-up on competitive performance, however, has not been investigated. **PURPOSE:** To compare the effects of acute resisted IMT (EXP) to sham IMT (CON) as part of a warm-up on running performance. **METHODS:** In a randomized cross-over design, 17 trained distance runners (age 20.1 \pm 1.4 yr, body mass 62.2 \pm 8.1 kg, height 1.73 \pm 0.09 m) completed two 3200-m performance trials on separate days, preceded by two different warm-up procedures. Prior to each 3200-m trial, subjects performed a warm-up which consisted of a 20 min self-paced run and standardized mobility drills, followed by either EXP or CON in a randomized order and 4x 80m strides. Inspiratory muscle function was measured pre and post IMT. Heart rate (HR), rating of perceived exertion (RPE), rating of perceived dyspnea (RPD) and expired gases were collected using a metabolic analyzer during each trial. **RESULTS:** 3200-m run performance was significantly faster after EXP (11.3 \pm 1.1 vs. CON 11.8 \pm 1.5 min, $p = 0.01$). Baseline inspiratory muscle function characteristics were not different between groups. Following each warm-up condition peak volume (EXP, 3.30 \pm 0.85 vs CON 2.99 \pm 0.68 L, $p < 0.01$), peak flow (EXP, 7.20 \pm 1.77 vs CON 6.81 \pm 1.73 L, $p = 0.03$), and peak strength index (EXP, 134 \pm 39 vs CON 127 \pm 34 cmH₂O, $p = 0.03$) were significantly higher after EXP. HR was not different between conditions (EXP, 183 \pm 9 vs CON 182 \pm 11), but VO_2 at each 800-m interval (EXP, 800-m 3.55 \pm 0.65, 1600-m 3.63 \pm 0.67, 2400-m 3.72 \pm 0.70 vs CON 800-m 3.43 \pm 0.66, 1600-m 3.54 \pm 0.67, 2400-m 3.64 \pm 0.70 L/min, $p > 0.05$) as well as peak VO_2 attained (EXP, 3.83 \pm 0.73 vs CON 3.74 \pm 0.76 L/min, $p = 0.25$) tended to be greater after EXP. RPE (EXP, 14.6 \pm 1.1 vs CON 14.8 \pm 0.9, $p > 0.05$) and RPD (EXP, 5.1 \pm 1.2 vs CON 5.7 \pm 1.6, $p = 0.06$) tended to be lower following EXP. **CONCLUSION:** These data indicate that acute resisted IMT as part of a warm-up enhances 3200-m time-trial performance in trained runners.

527 Board #348 May 31 11:00 AM - 12:30 PM
Body Composition, Bone Density, Metabolic Rate and Dietary Intakes of Collegiate Synchronized Swimmers
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 (No relationships reported)

Synchronized swimming is a physiologically demanding sport that requires strength, endurance, power, and artistic grace. Currently, limited information exists that outlines various physiological and dietary attributes surrounding the sport. **PURPOSE:** This study's aim was to identify physiological characteristics and dietary habits of collegiate synchronized swimmers. **METHODS:** Twenty-one female collegiate synchronized swimmers (20.4 \pm 0.3 yrs, 168.0 \pm 1.1 cm, 64.4 \pm 1.9 kg) were tested. Maximal oxygen uptake ($\text{VO}_{2\text{max}}$) was measured using indirect calorimetry during a graded treadmill exercise test. Resting metabolic rate (RMR) was assessed using indirect calorimetry with standardized criteria. Body composition was determined using skinfolds (4-site and 7-site) and dual-energy X-ray absorptiometry (DEXA). Dietary intake was assessed using four-day dietary records using Vitabot software. Data is presented as means \pm SD. Pearson correlation coefficients were used to determine significant relationships. **RESULTS:** $\text{VO}_{2\text{max}}$ was 43.8 \pm 1.0 mL/kg/day while absolute and relative (normalized to body mass in kg) RMR values were determined to be 1,702 \pm 52 kcal/day and 26.5 \pm 2.5 kcal/kg/day, respectively. DEXA determined fat mass (17.7 \pm 5.3 kg), lean mass (43.0 \pm 4.4 kg) and percent body fat (28.7 \pm 4.8 % fat) were computed. Percent fat values using 4 and 7-site skinfolds (25.7 \pm 4.8 % fat and 25.3 \pm 4.7 % fat, respectively) were similar but both values were different from DEXA determined percent body fat values ($p>0.05$). Total lumbar (1.03 \pm 0.11), trochanteric line (0.79 \pm 0.08), intertrochanteric line (1.14 \pm 0.12), femoral neck (0.96 \pm 0.12) and Ward's triangle (0.91 \pm 0.24) bone mineral density values were determined (in g/cm²) using DEXA. Relative daily calorie (29.0 \pm 10.1 kcal/kg), carbohydrate (3.6 \pm 1.1 g/kg), protein (1.3 \pm 0.4 g/kg) and fat (1.2 \pm 0.5 g/kg) were computed. No significant correlations were reported between any of the bone mineral density, body composition and dietary intake data ($p>0.05$). **CONCLUSION:** Synchronized swimmers have similar aerobic fitness, body composition and training habits as other competitive aquatic athletes. Reported energy intakes indicate low levels of energy availability; future work should explore menstrual complications and female athlete triad development.

528 Board #349 May 31 11:00 AM - 12:30 PM
Gender Differences in Water-Based Aerobic Capacity During Freestyle Swimming to Exhaustion
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Aerobic capacity plays an essential role in physical performance. Females have been shown to have lower aerobic capacity during land-based incremental testing when compared to their male counterparts. However, there have been few studies on gender differences in aerobic capacity during water-based incremental swimming. Understanding the gender differences is an important step in coaching/training. **PURPOSE:** The purpose of this study was to examine aerobic capacity gender differences. **METHODS:** A total of 15 males (23.6 \pm 6.7yrs, 179.3 \pm 6.4cm, 75.2 \pm 11.5kg) and 15 females (22.6 \pm 6.3yrs, 167.6 \pm 6.4cm, 65.7 \pm 9.5kg) participated in the study and completed an incremental swimming test to exhaustion. The protocol involved swimming a minimum of 250 meters (10 lengths) using the freestyle stroke. Rest periods following each 22.9 meter length decreased from 10 seconds to 3 seconds throughout the test. Following 9 lengths, subjects continuously swam at maximal velocity until $\text{VO}_{2\text{max}}$ had been achieved or until exhaustion occurred. Aerobic capacity was measured with a portable metabolic system suspended above the swimmer using a cable pulley system, enabling a standard freestyle stroke with continuous measure of VO_2 . Ratings of perceived exertion (RPE), blood lactate (BLA), and maximal heart rate (HR_{max}) were also measured at the end of the test. Data were tested for normality, and independent samples *t*-tests or Mann-Whitney *U* tests were used, as appropriate ($p<0.05$). **RESULTS:** Males had significantly higher aerobic capacity (males: 48.4 \pm 7.4ml/kg/min, females: 39.8 \pm 5.3ml/kg/min, $p=0.001$) and lower HR_{max} (males: 173.3 \pm 6.9bpm, females: 180.7 \pm 7.7bpm, $p=0.032$) compared to females. There were no gender differences in RPE (males: 9.6 \pm 0.7, females: 9.5 \pm 0.7, $p=0.689$) or BLA (males: 11.3 \pm 3.5mmol/L, females: 9.9 \pm 2.9mmol/L, $p=0.269$). **CONCLUSIONS:** The current results have revealed significant gender differences in aerobic capacity at the maximal effort (with similar RPE scale and BLA values). These findings are in accordance with other land-based gender studies on aerobic capacity,

largely due to smaller stature/lung in females. Future studies should examine the effects of gender-specific and customized land/water-based training on their aerobic capacity. Supported by ONR: N00014-14-1-0022/N00014-15-0069

529 Board #350 May 31 11:00 AM - 12:30 PM
Gender Differences In Mean And Peak Swimming Force, Validity, Reliability, Of A Tethered Swimming Test

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Consistent differences between males and females have been shown in land based measurements of anaerobic performance. Evidence shows that a 30-second max tethered swim (TST) is a valid and reliable measure of anaerobic power (F_{peak}) and capacity (F_{mean}) in swimmers. However, gender differences have not been investigated. **PURPOSE:** To explore gender differences for anaerobic performance, reliability, and validity of a TST. **METHODS:** 14 males and 14 females completed 4 sessions: Wingate cycling anaerobic test (WAnT), a performance swim (PS) session, and 4 TST over 2 sessions. Gender differences were determined using independent t-tests. Reliability was determined using an ICC (2, 1) for F_{peak} and F_{mean} . Criterion validity of the TST was determined using Pearson's Correlation analysis among F_{peak} and F_{mean} obtained during the TST and WAnT, and the swim velocity obtained during the PS. **RESULTS:** Gender differences are shown in Table 1. For males/females respectively, intercession for F_{peak} (0.764/0.696) and for F_{mean} (0.965/0.985), and intrasession for F_{peak} (0.645/0.786) and F_{mean} (0.920/0.990), were statistically significant ($p < 0.05$). Criterion validity is shown in Table 2.

Table 1.

	Males		Females		T-test
	Mean	SD	Mean	SD	
TST F_{peak}	277.43	54.51	191.58	37.56	0.000
F_{mean}	99.31	24.58	74.30	19.67	0.006
WAnT F_{peak}	1005.53	188.89	724.87	104.12	0.000
F_{mean}	707.47	99.81	443.27	96.42	0.000

Table 2.

Criterion Validity: TST F_{mean}	Pearson	Criterion Validity: TST F_{peak}	Pearson
Males:			
WAnT F_{mean}	0.280	WAnT F_{peak}	0.396
PS 25yd	0.666*	PS 25yd	0.636*
PS 50yd	0.746*	PS 50yd	0.336
PS 100yd	0.763*	PS 100yd	0.566
Females:			
WAnT F_{mean}	0.775**	WAnT F_{peak}	0.698*
PS 25yd	0.931**	PS 25yd	0.679*
PS 50yd	0.906**	PS 50yd	0.710*
PS 100yd	0.869**	PS 100yd	0.684*

CONCLUSIONS: Although gender differences exist for anaerobic performance of swimmers, the TST is still considered a reliable method with moderate/strong association with swim velocity. Results of this study further solidify the need for a mode specific measure of anaerobic power and capacity, due to the lack of association between the TST and land based measures in males. Supported by ONR: N00014-14-1-0022/N00014-15-0069

530 Board #351 May 31 11:00 AM - 12:30 PM

Reliability and Validity of Swimming Pool Protocol to Measure Maximal Aerobic Power of Healthy Adults

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A modality specific swimming protocol to assess maximal aerobic power (MAP) is essential to accurately prescribe and monitor swimming conditioning programs. However, variable hydrodynamics properties can alter propulsive forces of a freestyle swimming stroke, and consequently impede the ability to consistently and accurately perform a MAP swimming protocol. **Purpose:** To assess: 1) reliability of a swimming pool maximal oxygen consumption ($VO_{2max_{sw}}$) (i.e. MAP) protocol; and 2) validity of a $VO_{2max_{sw}}$ test using swimming pool performance swim (PS) tests as the criterion. **Methods:** Thirty healthy males (n=15) and females (n=15) (age, 23.1+6.5 yrs; height, 173.4 + 8.6 cm; weight, 70.4 + 11.4 kg) performed two swimming pool $VO_{2max_{sw}}$ tests ($VO_{2max_{sw_A}}$ and $VO_{2max_{sw_B}}$), and two PS tests [50 yard (31.20 + 4.5 seconds) and 200 yard (159.2 + 25.5 seconds)]. Test-retest reliability of $VO_{2max_{sw}}$ ($ml \cdot kg^{-1} \cdot min^{-1}$), HRMax ($b \cdot min^{-1}$), cardiorespiratory efficiency (O₂ pulse) ($VO_{2max_{sw}} / HRMax$), maximal respiratory exchange ratio (RERMax), and ventilation (VeMax) ($L \cdot min^{-1}$), data was assessed calculating ICC's (2,1). Test validity was determined by correlating $VO_{2max_{sw_A}}$ with PS swims using Pearson's coefficients. **Results:** Intra-subject reliability (ICC) cardiorespiratory responses during the $VO_{2max_{sw_A}}$ and $VO_{2max_{sw_B}}$ tests are presented in Table 1.

Table 1.

Variable	N	$VO_{2max_{sw_A}}$	$VO_{2max_{sw_B}}$	ICC	p-value
$VO_{2max_{sw}}$ ($ml \cdot kg^{-1} \cdot min^{-1}$)	29	44.2 + 7.7	42.9 + 8.5	0.899**	<0.001
HRMax, ($b \cdot min^{-1}$)	19	177.5 + 8.5	178.1 ± 9.0	0.586**	.004
O ₂ pulse($ml \cdot b^{-1}$)	19	0.2 + 0.0	0.2 + 0.0	0.833**	<0.001
Peak RER	29	1.0 ± 0.1	1.0 ± 0.1	0.538**	.001
VeMax ($l \cdot min^{-1}$)	29	95.2 + 20.7	94.3 + 21.2	0.785**	<0.001

**p<0.01

For validity, moderately strong correlations were found between $VO_{2max_{sw_A}}$ and 50 (r = -0.543; p<0.05), and 200 (r=-0.486; p<0.05) swim performance time. **Conclusions:** The $VO_{2max_{sw}}$ test employed presently was found to be a reliable and functionally valid test of MAP. Future studies should consider the suitability of a pool-based $VO_{2max_{sw}}$ test for military, clinical populations, or injured athletes. Supported by ONR: N00014-14-1-0022/N00014-15-0069

531 Board #352 May 31 11:00 AM - 12:30 PM

Empirical Model Of Lane Bias Suggests Different Finish Order At 2016 Olympic Swimming Competition

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Distance freestyle (FR) swimmers at recent elite-level competitions were shown to be faster swimming in one direction versus the other dependent on lane assignment (LA). These observations were consistent with a subsequent analysis of the 50-m FR events in that the change in performance from prelim (p) to semifinal (sf) to final (f) was also dependent on the swimmers' LA. Although some swimmers were concluded to have been advantaged over others, the extent to which the race outcomes were affected was not quantified.

PURPOSE: To determine if the 2016 Olympic swim performances were biased due to LA, and if so, to quantify the effect of the bias on 50-m FR race outcomes. **METHODS:** 800-m, 1500-m, and 50-m FR results from the 2016 Olympic Games were obtained from online sources. A linear model estimated the interaction effects between distance FR swimmers' LA and their Direction (toward or away from finish end) on 50-m splits. Each 50-m FR performance was adjusted using model estimates of the Direction effect for each lane, and the change in adjusted performance from p to sf to f heats calculated. Linear regression with the change in adjusted 50-m performances (input) and the change in actual 50-m performances (response) was used to re-adjust sf and f 50-m performances. Actual ranks minus ranks based on re-adjusted performances in a given lane was tested using the Wilcoxon signed-rank test.

RESULTS: The change in adjusted 50-m FR performance significantly predicted the actual change ($F(1,46) = 186, p < .01, R^2 = .79$). Corrected rank was different than

actual rank for lanes 1-3 and 6-8 ($p < .05$); median difference in rank (interquartile range) for Lanes 1-8 was 1 (0.5 to 1.5), 1 (0.5 to 1.5), 3 (2.5 to 3.5), 0.5 (0.5 to 1), 0 (0.5), -1.5 (-2 to -1), -2 (-2.5 to -1.5), and -3 (-3.5 to -2.5), respectively.

CONCLUSIONS: This analysis provides evidence that 2016 Olympic swimmers' performances were affected by their LA. Use of model estimates of the effects of LA and Direction on distance FR splits to estimate unbiased 50-m FR performances is a practical, post-hoc tool to quantify the lane bias effect on race outcomes. 50-m swimmers in Lanes 6-8 benefitted the most, finishing 1 to 3 places higher than they would have without the bias. That some athletes may have won medals simply due to factors of the pool environment should be very alarming to all swim stakeholders.

532 Board #353 May 31 11:00 AM - 12:30 PM
Maturational Timing and Performance in Collegiate Female Swimmers

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Although it's well documented that top-performing swimmers are relatively late maturers, it's not well understood why this is so. One explanation is that there are certain physical traits common to later maturers that contribute to better swim performance. And as a result, later maturers are more likely to be 'selected' for continued sport participation. **PURPOSE:** To determine if: (1) top-performing swimmers are later maturers than lower-performing swimmers; (2) later-maturing swimmers perform better than earlier-maturing swimmers; and (3) there are physical traits common to both top performers and later maturers. **METHODS:** Maturational timing was estimated using age at menarche (AaM), which was determined retrospectively in collegiate swimmers ($N = 273$). Each swimmer's best performance during the 2015-2016 NCAA season was obtained from the USA Swimming database and selected based on Power Point Score (PPS), a standardized score given to all performances in the database. Independent samples t tests were used to compare (1) AaM and BMI (from self-reported height and weight) between bottom-performing (lowest 25% of PPS) and top-performing (highest 25% of PPS) swimmers and (2) PPS and BMI between earlier-maturing (youngest 25% of AaM) and later-maturing (oldest 25% of AaM) swimmers. **RESULTS:** The top performers were later maturers than the bottom performers (AaM 14.0 vs. 13.4 years, $t = 2.48$, $P = 0.02$, $d = 0.46$) and had lower BMIs (22.5 vs. 23.5 kg/m², $t = 2.30$, $P = 0.02$, $d = 0.41$). The later maturers performed better than the earlier maturers (PPS 802.6 vs. 753.4, $t = 2.11$, $P = 0.04$, $d = 0.39$) and had lower BMIs (22.5 vs. 23.4 kg/m², $t = 2.29$, $P = 0.02$, $d = 0.40$). **CONCLUSION:** Previous research has shown that top-performing swimmers and later-maturing women are more linear in body shape than their low-performing and earlier-maturing counterparts. Our results pertaining to weight per height (i.e., BMI) are consistent with these reports. And taken together, they provide evidence that there are physical traits common to top-performing swimmers and later-maturing women. So it's certainly possible that later maturers are being selected (by themselves or others) for continued swim participation on the basis of these traits. But additional longitudinal research is required to determine the extent to which this is the case.

533 Board #354 May 31 11:00 AM - 12:30 PM
Age-associated Changes In Training Volume And Athletic Performance: Cross-sectional and Longitudinal Analyses of Masters Swimmers

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Masters athletes make every effort to maintain or even improve the athletic performance they accomplished when they were young. However, a decline in athletic performance is one of the inevitable consequences of aging. Precise physiological mechanisms of age-related decrease in athletic performance are not known but it is thought to be driven by decreases in exercise training stimuli. **PURPOSE:** We determined the influence of changes in training volume with aging on swimming performance by using both cross-sectional and longitudinal approaches. **METHODS:** Competitive swimmers who were members of the US Masters Swimming association were included if they had logged their yearly training volume and had participated in 50m freestyle events at a USMS meet between 2011 and 2015. A total of 692 and 98 swimmers aged 20-88 years were studied in the cross-sectional and longitudinal analyses. Multiple regression and mixed effects multiple regression models were used with gender as a covariate. The longitudinal data was then centered around different ages to find the age at which training is a significant predictor of performance. **RESULTS:** Both cross-sectional and longitudinal analyses showed no significant

associations between swimming training volume and age. In the longitudinal analyses, training volume was not significant as a predictor in swimming performance for younger swimmers (53 years and younger). In middle-aged swimmers (54-79 years), increases in training volume resulted in mildly better swimming performance (i.e., 3 miles/month increases in training volume were related to .05 sec better swimming time). Increases in training volume with advancing age had more significant effects on swimming performance in older swimmers (80 years and older) (i.e., 3 miles/month increases in training volume were associated with .27 sec better swimming time). **CONCLUSION:** In younger swimmers, changes in training volume did not have any significant impact on swimming performance. However, in middle-aged and older swimmers, there was a graded relationship between yearly increases in training volume and swimming performance such that the impact of training volume on swimming performance appears to become greater with advancing age.

534 Board #355 May 31 11:00 AM - 12:30 PM
Associations between Land-Based Laboratory Measures and Freestyle Swimming Performance: A Comparison between Males and Females

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Swimming requires technical proficiency to perform effectively and efficiently. Directly analyzing technique and performance is expensive and time consuming. Understanding underlying factors and characteristics which relate to swimming performance is of benefit. To quantify, land-based laboratory measures (LM) can be used, but associations between the LM and swimming times must be established. Further, it is unknown if technique and performance characteristics are equal in both sexes. **PURPOSE:** To examine associations of LM to swimming performance (SP) in female and male swimmers. **METHODS:** Fifteen female (22.6 ± 6.3 years, 167.6 ± 6.4 cm, 65.7 ± 9.5 kg) and 15 male (23.6 ± 6.7 years, 179.3 ± 6.4 cm, 75.1 ± 11.5 kg) recreational and competitive swimmers completed LM (body anthropometrics/composition, passive shoulder range of motion, shoulder laxity, and isokinetic scapular strength), and 50 and 200 yd freestyle SP. Spearman correlations were performed comparing LM with SP for each female/male group. Females and males were then split by a median cut point (fastest and slowest) for the 50 (Female = 32.6s; Male = 30.5s) and 200 (Female = 168.6s; Male = 159.3s) yd swims. After testing for normality, Mann-Whitney tests compared group means ($p < 0.05$). **RESULTS:** Correlations were found between female fat free mass (FFM) and 50 yd (-0.713; $p = 0.003$) and 200 yd (-0.724; $p = 0.002$) freestyle SP. Compared to the slower female, the faster female had greater height ($p = 0.021$) and leg length ($p = 0.015$) in relation to 50 yd SP, and greater FFM for both 50 yd ($p < 0.001$) and 200 yd ($p = 0.005$) SP. Males showed no sig. correlations in LM, nor sig. associations in LM between the faster and slower swimmers during the SP tests. In both sexes, shoulder girdle LM were not associated with SP. **CONCLUSION:** Time to completion was the only measure of SP. Therefore, an increase in relative female height may act to reduce the magnitude of wave drag encountered, allowing for faster speeds in relation to a specific propulsive impulse. Correlation between FFM and faster SP demonstrates that females with more muscle mass can compete at higher levels. To predict capabilities for future SP, and assess associations between LM and SP, studies should examine shoulder biomechanical measurements during the freestyle stroke. Supported by ONR: N00014-14-1-0022/N00014-15-0069

535 Board #356 May 31 11:00 AM - 12:30 PM
Predicting Performance: The use of Nonlinear Regression Models to Predict Olympic Performance in Swimmers

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PURPOSE: Due to recent external biases shown to have influenced the ability of a nonlinear regression model to predict Olympic performance, the purpose of this study was to employ additional statistical analytics as a means to characterize the progression of performances at future Olympic swim competitions. **METHODS:** Nonlinear regression models were fit for each swimming event for men (m) and women (w) at the Olympic Games ($n=26$) from 1948 to 2012. From these, and based upon predicted and observed performances, a 'best fit' model including 7 Olympic Games from 1988 to 2012 was selected. To predict future performances (2016), 1454 championship finals swim performances from this time frame were utilized. The mean time of the 8 swimmers in each final was used as the dependent variable to fit the model [$\text{time} = a \times \text{year}^b$]. A 95% percent confidence interval was

calculated using a Monte Carlo simulation method. Residual squared error (RSE), r-squared (r^2), confidence interval (CI) length, and absolute difference between observed and predicted of each regression model were compared.

RESULTS: Average RSE_m (1.24 ± 1.25), RSE_w (1.39 ± 1.15). Average r^2_m (0.76 ± 0.09), r^2_w (0.72 ± 0.12). There were no statistically significance differences in average RSE ($p=0.35$) or average r^2 ($p=0.35$) between sex models. Average length of the 95% CI_m (3.07 ± 3.13), CI_w (3.44 ± 2.86). No difference existed between length of CI between sex ($p=0.76$). Absolute difference in time between observed and predicted for men (0.79 ± 0.73 s), women (1.56 ± 1.89 s). No differences existed between the absolute difference in observed and predicted between the men and women models ($p=0.19$). 92.3% ($n=12$) of observed men and 69.2% ($n=9$) observed women mean performances for 2016 fell within the 95% confidence interval of the predicted model value.

CONCLUSIONS: In general, the nonlinear regression prediction models produce a valid and accurate approximation of Olympic performance progression as reflected by the 2016 Games. However, it is unclear why there is a different accuracy of 'fit' for the men and women predictions. Further study is needed to evaluate the potential factors apparently allowing the women to out-perform the 'best fit' model.

536 Board #357 May 31 11:00 AM - 12:30 PM
Nutrition and Physiological Recovery in Smith College Swimmers
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(No relationships reported)

Nutrition and Physiological Recovery in Smith College Swimmers
 Devi Dearmon-Moore¹, Barbara Brehm-Curtis²
 Smith College, Northampton, MA

Athletes have an increased requirement for nutrients such as protein and carbohydrates in order to facilitate recovery. However, female athletes don't often receive a thorough nutritional education and often focus on maintaining a specific body weight to ensure peak performance. As a result, many women and girls do not consume enough food to satisfy the physical demands of their sports, increasing their risk of long term health problems later in life.

PURPOSE: To determine if members of the Smith College swim team meet their recommended dietary intake guidelines, and to explore the relationship between dietary intake, non-nutritional requirements, and physiological recovery. **METHODS:** Participants filled out an anonymous questionnaire daily for 7 days. The questionnaire included questions regarding daily food intake, total hours of sleep, any changes in caffeine intake and/or health, and their level of fatigue. Recovery was evaluated using the REST-Q, a 7-question survey that attempts to measure perceived exertion, perceived recovery and recovery effort in order to determine if the athlete is exhibiting signs of overtraining. Each question on the REST-Q is evaluated based on a scale from 0-6. Dietary intake was evaluated using MyFitnessPal, a free online website that allows the user to enter the name of a food item into a database and determine its nutritional content. Nutritional analysis was restricted to four nutrients: protein, carbohydrates, fat and calories. Recommended intake guidelines for each athlete were based on the values described in the literature and calculated by hand. **RESULTS:** Less than half of the participants met guidelines for the intake of at least two of the four nutrients studied. The two most common deficit nutrients were carbohydrates and calories. All but one participant met or exceeded guidelines for protein consumption. All participants reported on average low recovery scores and workouts that required significant effort to complete. **CONCLUSION:** Based on average dietary consumption during this study, none of the participants met all of their recommended dietary intake guidelines.

537 Board #358 May 31 11:00 AM - 12:30 PM
Role of Dryland Resistance Training on Musculoskeletal Injuries and Healthcare Costs in Masters Swimmers
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An increased incidence of orthopedic injuries with age interfere with Masters athletes to pursue better performance and place economic burden on these athletes. **PURPOSE:** We determined the prevalence and economic impact of swimming-related musculoskeletal injuries in Masters swimmers. **METHODS:** A comprehensive questionnaire was administered to the United States Masters Swimming (USMS) membership. A total of 498 swimmers (304 female and 194 male) aged 20-86 years responded. The swimmers had been swimming for 13.3 ± 11.5 years, and 67% of them participated in resistance training. Economic impact was determined by their total healthcare costs. Healthcare costs were costs associated with a doctor's visit, healthcare visit or another healthcare professional. Binary logistic and linear multiple regression tests using age, sex and years of swimming as covariates were run to

determine predictors for both injuries and healthcare costs. **RESULTS:** Thirty one % of the swimmers reported swimming-related musculoskeletal injuries. Prevalence of swimming-related injuries and healthcare costs were not different between females and males and was not related to aging. Accumulating years of dry-land resistance training were significantly associated with reductions in the prevalence of injuries. Yet they were also related to increases in healthcare costs ($p<0.05$). Resistance training participation was associated with an increase in the length of injuries ($p<0.05$), which predicted an increase in healthcare costs ($p<0.05$). **CONCLUSIONS:** Years of dry-land resistance training are associated with lower prevalence of swimming-related injuries but act to increase healthcare costs with elevating major injuries requiring lengthy recovery.

538 Board #359 May 31 11:00 AM - 12:30 PM
Ergogenicity Of Inspiratory Muscle Training Is Affected By Weekly Training Distance In Swimmers
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PURPOSE. The aim of this study was to examine the impact of weekly swimming training distance on the ergogenicity of inspiratory muscle training (IMT). **METHODS.** Thirty-three well trained youth swimmers were recruited and separated into a LOW (age: 16 ± 3 years; mass: 65.9 ± 6.6 kg; stature: 1.76 ± 0.12 m; $n = 18$) and HIGH (age: 16 ± 1 years; mass: 65.2 ± 8.3 kg; stature: 1.75 ± 0.11 m; $n = 15$) group based on weekly training distance (LOW: $15\text{-}31$ km \cdot wk $^{-1}$; HIGH: $42\text{-}56$ km \cdot wk $^{-1}$). The LOW and HIGH groups were further subdivided into control and IMT groups for a 6-week pressure-threshold IMT intervention giving a total of four groups: LOW_{con}, LOW_{IMT}, HIGH_{con}, HIGH_{IMT}. Before and after the intervention period, swimmers completed maximal effort 100 m and 200 m front crawl swims, with maximal inspiratory and expiratory mouth pressures (P_{imax} and P_Emax, respectively) assessed before and after each swim. **RESULTS.** Before IMT, 100 m and 200 m swimming times were on average 19.1 s and 20.8 s faster, respectively, in the HIGH_{con} and HIGH_{IMT} groups than the LOW_{con} and LOW_{IMT} groups ($P < 0.001$). IMT increased P_{imax} (but not P_Emax) by 36% in LOW_{IMT} and HIGH_{IMT} groups ($P < 0.001$) but 100 m and 200 m swims were faster only in the LOW_{IMT} group (3% and 7% respectively, $P < 0.05$). **CONCLUSION.** Performance benefits only occurred in those training between $15\text{-}31$ km \cdot wk $^{-1}$ and indicate that the ergogenicity of IMT is affected by weekly training distance. Consequently, current/anticipated training distances are important considerations when deciding whether or not to supplement swimming training with IMT.

539 Board #360 May 31 11:00 AM - 12:30 PM
Muscle Damage, Soreness And Stress Over 6-weeks Of Pre-season Training In Ncaa D1 Male Swimmers
 Mario Rusnak¹, Melissa VanderMeulen¹, Brigid Byrd², Gregory Byrd³, Raychel Rusnak¹, Tamara Hew-Butler, FACSM¹.
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In 2014, three of our male swimmers were hospitalized for symptomatic exertional rhabdomyolysis (Stanfa M et al 2016). **PURPOSE:** To serially monitor and assess relationships between skeletal muscle damage, upper and lower body soreness, and physiological stress during the first six weeks of high volume training in collegiate male swimmers. **METHODS:** Seventeen male NCAA D1 swimmers presented to the lab six times during pre-season training. Blood was drawn weekly for measurement of serum creatinine kinase (CK), myoglobin (MYO) and a complete metabolic panel. Serum cortisol (C), testosterone (T) and T/C ratio were assessed at Weeks 1 (baseline), 4 and 6. Upper body soreness (US) and lower body soreness (LS) were assessed weekly via a visual analogue scale (0-10-inch unmarked scale). Repeated measures ANOVA with a Bonferroni correction were performed, with data reported as means \pm SD. Correlation analyses performed with significance set at $p<0.05$. **RESULTS:** Weekly training load consisted of: 88% swimming, 6% running, and 6% weight training which gradually increased from 16 hours to 20 total training hours/week over the first six weeks of training. Significant changes in CK (174 ± 2 ; 438 ± 259 ; 358 ± 309 ; 274 ± 112 ; 276 ± 127 ; 301 ± 126 U/L; $p<0.0001$), MYO (38 ± 16 ; 47 ± 18 ; 38 ± 18 ; 33 ± 12 ; 31 ± 10 ; 30 ± 7 ng/mL; $p=0.001$), US (1.5 ± 1.6 ; 3.5 ± 2.0 ; 3.7 ± 2.2 ; 5.1 ± 1.7 ; 5.4 ± 2.5 ; 4.8 ± 2.5 ; $p<0.0001$), LS (1.7 ± 2.0 ; 5.5 ± 2.5 ; 3.9 ± 2.0 ; 4.9 ± 1.7 ; 4.6 ± 2 ; 5.5 ± 2.2 ; $p<0.0001$), cortisol (15 ± 6 ; 10 ± 3 ; 9 ± 4 ng/dL; $p=0.0004$), and T/C ratio (37 ± 17 ; 48 ± 21 ; 58 ± 32 ; $p=0.04$) were noted while

changes in testosterone were not significant over time (456 ± 127 ; 438 ± 119 ; 416 ± 111 ng/dL; $p=0.38$). Significant correlations noted between CK vs. MYO ($r=0.36$), cortisol ($r=0.39$), alanine aminotransferase ($r=0.22$), and aspartate aminotransferase ($r=0.48$) when all data were combined. **CONCLUSION:** Muscle damage in collegiate male swimmers was modest despite cumulative training which peaked at 20hrs/week. A disconnect was noted between muscle damage (CK, MYO) and (upper and lower) body soreness, at moderate (~5/10) degrees of muscle soreness. Serum cortisol decreased over time, while testosterone remained unchanged, which promoted an anabolic hormonal environment despite gradual increases in high volume training at the commencement of the new (Fall) academic year.

540 Board #361 May 31 11:00 AM - 12:30 PM
Muscle Damage, Soreness, and Stress Over 7-weeks Of Pre-season Training In Ncaa Female Swimmers

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(No relationships reported)

In 2014, three female swimmers were hospitalized with symptomatic exertional rhabdomyolysis (Stanfa M et al 2016). **PURPOSE:** To serially monitor and assess relationships between skeletal muscle damage, upper and lower body soreness, and physiological stress during the first seven weeks of high volume training in collegiate female swimmers.

METHODS: 23 female NCAA D1 swimmers presented to the lab six times during 7-weeks of pre-season training. Blood was drawn at six timepoints for measurement of serum creatinine kinase (CK), myoglobin (MYO) and a complete metabolic panel. Serum cortisol (C), testosterone (T) and T/C ratio were assessed at Weeks 1 (baseline), 4 and 7. Upper body soreness (US) and lower body soreness (LS) were assessed, at the six timepoints that blood was drawn, using a visual analogue scale (0-10-inch unmarked scale). A repeated measures ANOVA with a Bonferroni correction were performed, with data reported as means \pm SD. Correlation analyses performed with significance set at $p<0.05$. **RESULTS:** Weekly training load consisted of: 88% swimming, 6% running, and 6% weight training which gradually increased from 16 hours to 20 total training hours/week over the first seven weeks of training. Significant changes were noted in CK (135 ± 68 ; 446 ± 723 ; 171 ± 83 ; 202 ± 80 ; 180 ± 100 ; 206 ± 170 U/L; $p=0.01$), US (1.5 ± 1.8 ; 3.9 ± 1.7 ; 3.3 ± 1.8 ; 5.4 ± 1.6 ; 6.1 ± 1.8 ; 3.7 ± 2.0 ; $p<0.0001$), LS (1.3 ± 1.5 ; 5.0 ± 2.2 ; 3.4 ± 1.8 ; 5.0 ± 1.9 ; 4.8 ± 1.8 ; 4.1 ± 2.0 ; $p<0.0001$), cortisol (19 ± 10 ; 15 ± 6 ; 11 ± 5 ng/dL; $p<0.0001$), and T/C ratio (2.4 ± 2.3 ; 3.0 ± 1.8 ; 4.1 ± 2.8 ; $p=0.0003$) but not in MYO (39 ± 20 ; 63 ± 141 ; 29 ± 18 ; 30 ± 17 ; 24 ± 4 ; 29 ± 14 ng/mL; $p=0.32$) or testosterone (33 ± 14 ; 37 ± 14 ; 36 ± 14 ng/dL; $p=0.29$). Significant correlations noted between CK vs. MYO ($r=0.84$), alanine aminotransferase ($r=0.21$), and aspartate aminotransferase ($r=0.49$) when data were combined, but largely driven by an outlier with CK= 3558 U/L and MYO= 691 ng/mL at Week 2 (first training week). **CONCLUSION:** Muscle damage in collegiate female swimmers remained largely within the normal range (CK <200 U/L) on average, but was highly variable between individuals. No correlations noted between muscle damage (CK, MYO) and (upper and lower) body soreness, at moderate (2-6) ratings of muscle soreness. Serum cortisol declined over training, promoting an anabolic hormonal environment.

541 Board #362 May 31 11:00 AM - 12:30 PM
Strenght Of Shoulder Rotators After A Swimming-training (inside And Outside Of The Pool) And Detraining

Stephane M. Ribeiro, Manoela S. Machado, Dênis B. da Silva, Elisângela da Silva, Wagner Z. de Freitas, Wonder P. Higino, Renato A. de Souza, Daniela G.M. Bueno. *IFSU/LEMINAS, Muzambinho, Brazil.*

(No relationships reported)

It is known that in the same way the training provide several adaptations, the interruption or change the types of physical activities can lead to the decline of skills developed. However, there are limited researches that indicate these effects on swimmers. **PURPOSE:** To evaluate the strenght of shoulder rotators of recreational swimmers after a swimming activities program, after a similar swimming-training program outside of the pool and after 8-week detraining. **METHODS:** Ten recreational swimmers (age: 44.0 ± 19.0 years) were evaluated using isokinetic dynamometry applied to dominant shoulder rotators: peak torque (PT) for external and internal rotation at velocity of 60°/s and 180°/s. The evaluations were performed after a swimming activities program inside of the pool (SWI: 28 weeks); after a swimming activities program outside of the pool (OUT: 8 weeks); after 8 weeks detraining (DET). These three experimental moments happened sequentially over the time. Both programs consisted of 60-minute sessions twice a week targeted mainly

upper limb strenght muscles. For statistical analysis a two-way ANOVA with repeated measures with Tukey-Kramer post hoc was carried out. **RESULTS:** It was showed a PT-decrease ($p<0.05$) after OUT (22.3 ± 7.7 N.m) and DET (21.1 ± 7.1 N.m) when compared with SWI (25.4 ± 7.7 N.m) for external rotation at 60°/s; Only DET (16.9 ± 5.7 N.m) showed significant difference when compared with SWI (21.4 ± 7.7) for external rotation at 180°/s. No significant differences were showed for internal rotation. **CONCLUSION:** Swimming activities program outside of the pool did not produce positive effects to maintain strenght level acquired after a swimming activities program inside of the pool only for external rotation at 60°/s, indicating that decline of skills previously developed may be muscle and velocity-dependent. Also, 8 weeks detraining was deleterious for strenght profiles of the shoulder rotators in recreational swimmers.

542 Board #363 May 31 11:00 AM - 12:30 PM
The Influence of an Educational Intervention on Hydration Status in Collegiate Swimmers.

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Much research and many guidelines exist relating hydration and sport, yet many athletes don't understand the role it plays with training and performance. Athletes often come to practice or competition dehydrated. Hydration education has been shown to reduce dehydration in land-based athletes, but hasn't been studied in swimming. **PURPOSE:** The purpose of this study was to determine if an educational intervention improves the hydration status of collegiate swimmers.

METHODS: Participants (N=14) were collegiate level swimmers (n=6 female, n=8 male). Hydration status was determined using urine specific gravity (USG), urine osmolality (UO), and change in body mass. Measurements were taken before and after practice during week one. Athletes deemed dehydrated by any of the measures (n=9) were given an educational intervention during week two. The intervention provided information based on position statements from the American College of Sports Medicine and the National Athletic Training Association. The same hydration measures were made in week three after the educational intervention. A dependent t-test was used to determine any significant differences in pre-post intervention hydration measurements using the dehydrated swimmers to determine the program's effectiveness.

RESULTS: There was no significant difference in USG or UO ($p>0.05$). Pre and post-practice USG and UO values from week one were compared to week three.

CONCLUSIONS: While no significant differences were present as a result of the educational intervention, previous research has suggested educational interventions can improve the understanding of hydration and how it impacts performance and elicits positive performance outcomes. (Cleary et al., 2012; McDermott et al., 2009) In the present study, daily fluctuations in hydration and practice time, subjects misunderstanding/disregarding information provided during the intervention, or using a single determinant of hydration status, may be possible reasons for no change. Further investigations may want to both account for these variables and extend the educational intervention.

B-07 Thematic Poster - Cardiac Physiology

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
Room: 304

573 **Chair:** Serge P. von Duvillard, FACSM. *University of Salzburg, St. Cloud, MN.*

(No relationships reported)

574 **Board #1** May 31 1:00 PM - 3:00 PM

Associations Of Heart Rate Variability Measured During Orthostatic Test And During Daily Routine Activities

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(No relationships reported)

Measuring resting heart rate variability (HRV) indices constitutes an interesting, non-invasive and simple tool to monitor fatigue and performance responses. The orthostatic test (OT) where heart beat-to-beat (RR) intervals are measured is widely used to measure HRV. The feasibility in daily use would, however, increase considerably if vagal related HRV indices could be analysed from free living physical activity. **PURPOSE:** To determine the reliability and validity of HRV indices during daily routine situations. **METHODS:** Eight white-collar workers were recruited to participate in this study. RR intervals were recorded using a personal HR monitor (V800, Polar Electro Oy, Kempele, Finland). Data was collected every morning at home upon awakening and at work during routine situations on 16 different days. A total amount of 127 cycles of sitting periods followed by walking breaks were included for consecutive pairwise analysis of trials for reliability[SD1] (coefficient of variation (CV) and typical error (TE) with confidence limits of 95% were calculated). When reliability was found, the values from the morning OT were plotted against the corresponding routines at work. **RESULTS:** Mean RR-interval and HR values at work showed high levels of repeatability [CV during sitting and walking was 4.71 and 3.99, respectively, with a TE of 3.73 (3.34-4.25) and 3.65 (3.31-4.09)]. Although reliable, HR data recorded in the morning did not correlate with the corresponding routines at work ($r = 0.28$ for supine vs. sitting and $r = 0.05$ for standing vs. walking, $p > 0.05$). The root-mean-square difference of successive normal RR (RMSSD) was revealed not to be repeatable in those routine situations [CV during sitting and walking was 19.99 and 29.05, respectively, with a TE of 7.9 (7.15-8.85) and 9.43 (8.53-10.57)]. Furthermore, RMSSD values analyzed from the HRV recordings during standing did not correlate ($r = 0.138$, $p > 0.05$) with the respective values during walking in the morning upon awakening. **CONCLUSION:** Analyzing RMSSD from daily routine activities was not reliable or valid. To monitor training status, RMSSD should therefore be calculated from recordings in standardized conditions such as the OT in the morning. It would be much more feasible to get this information from free living activities but it does not seem to be a valid procedure.

575 **Board #2** May 31 1:00 PM - 3:00 PM

The Relationship Between Lifelong Exercise Volume and Coronary Atherosclerosis

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(No relationships reported)

Higher levels of physical activity are associated with a lower risk of cardiovascular events. Nevertheless, there is debate on the dose-response curve of exercise and cardiovascular outcomes and whether high volumes of exercise may accelerate coronary atherosclerosis. **PURPOSE:** To determine the relationship between lifelong exercise volumes and atherosclerotic coronary artery disease (CAD) characteristics. **METHODS:** Middle aged men engaged in competitive or recreational leisure sports underwent a non-contrast and contrast-enhanced computed tomography scan to assess coronary artery calcification (CAC) and plaque characteristics. Participants reported lifelong exercise history patterns. Exercise volumes were multiplied by Metabolic Equivalent of Task (MET) scores to calculate MET-min/week. Participants were allocated to <1000 MET-min/week, 1000-2000 MET-min/week or >2000 MET-min/week. **RESULTS:** 284 participants (55±7 years) were included. CAC was present in 150/284 (53%) participants with a median CAC score of 35.8 [9.3-145.8]. Athletes

with a lifelong exercise volume >2000 MET-min/week (n=75) had a significantly higher CAC score (9.4 [0-60.9] versus 0 [0-43.5], $p=.02$) and prevalence of CAC (68%, OR=3.2 (95%CI: 1.6-6.6)) and plaque (77%, OR=3.3 (95%CI: 1.6-7.1)) compared to <1000 MET-min/week (n=88, 43% and 56% respectively). Among participants with CAC>0, there was no difference in CAC score ($p=.20$), area ($p=.21$), density ($p=.25$) and regions of interest ($p=.20$) across exercise volume groups. Among participants with plaque, the most active group had a lower prevalence of mixed plaques (48% versus 69%, OR=0.35 (95%CI: 0.15-0.85) and more often had only calcified plaques (38% versus 16%, OR=3.57 (95%CI: 1.28-9.97)) compared to the least active group. There was no difference in location of CAC or plaque. **CONCLUSION:** Participants in the >2000 MET-min/week group had a higher prevalence of CAC and atherosclerotic plaques. The most active group did however have a more benign composition of plaques, with fewer mixed plaques and more often only calcified plaques. These observations may explain the increased longevity typical of endurance athletes despite the presence of more coronary atherosclerotic plaque in the most active participants.

576 **Board #3** May 31 1:00 PM - 3:00 PM

High Intensity Interval Training in a Rat Model of Severe, Angioproliferative Pulmonary Arterial Hypertension

Mary Beth Brown¹, Gary Long¹, Andrea Frump², Andrew Wiseman¹, Matthew Owens¹, Jamie Blessinger¹, Taylor Kurzhall¹, Spenser Studebaker¹, Kelly Jay¹, Ashley Troutman¹, Tim Lahm². ¹Indiana University, Indianapolis, IN. ²Indiana University School of Medicine, Indianapolis, IN.
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(No relationships reported)

PURPOSE: We previously demonstrated superior benefit of high intensity interval training (HIIT) over continuous exercise training (CET) in a monocrotaline rat model of mild pulmonary arterial hypertension (PAH). Here we investigate HIIT in a model that elicits a more severe, angioproliferative PAH. **METHODS:** SD rats (~200g, male) received Sugden5416 (20mg/kg), followed by 3 wks of hypoxia ($P_{\text{atm}} = 362$ mmHg) and 4 wks of room air to induce PAH (SuHx, n=33). Subgroups of SuHx then underwent 6 wks of treadmill training performed as either HIIT (2 min at ~80-90% $\dot{V}O_{2R}$ reserve [$\dot{V}O_{2R}$] + 3 min at 30% $\dot{V}O_{2R}$, for 4-5 cycles, n=12), or low intensity CET (45-60 min at 50% $\dot{V}O_{2R}$, n=11), with the remainder untrained (SED, n=10). Values are mean±SE. **RESULTS:** Mortality in SuHx was unexpectedly worse for HIIT (4 deaths at 56, 60, 68, and 71 days), vs. CET (2 deaths at 60, and 73 days), and SED (2 deaths at 66 days). While all animals had similar baseline echocardiographic measures of cardiac output (CO, in μL) and stroke volume (SV, in mL/min), SuHx that died prematurely (n=8) had greater impairment in CO (141±19) and SV (424±52) following PAH induction (at pre-training) compared to surviving SuHx (n=25, 235±26, 598±38). Final CO and SV were higher for both HIIT (239±49, 540±58) and CET (207±41, 529±51) vs. SED (122±12, 405±35) SuHx rats, and were similar to untrained healthy controls (CON, n=6, 268±59, 548±71). SuHx-induced elevation in right ventricular (RV) systolic pressure (mmHg) and RV hypertrophy (as RV mass/LV+septum mass, and as RV thickness on echo in mm) were not improved by training with HIIT (61±7; 0.60±0.07, 2.2±0.2) or CET (60±8; 0.47±0.04, 2.0±0.2), vs. SED (55±8; 0.52±0.06, 2.2±0.2), and were higher than CON (28±3; 0.24±0.01, 1.3±0.1). Final $\dot{V}O_{2\text{max}}$ (mL/kg/min) in SuHx was also not improved for either HIIT (44±1.9) or CET (46±1.7) vs. SED (46±3.8). **CONCLUSION:** Both HIIT and CET promoted better RV function in SuHx rats despite no amelioration of RV hypertrophy, PAH, or exercise impairment. However, in contrast to previous findings in a mild PAH rat model, exercise training, particularly with HIIT, increased mortality for animals with poorer cardiac function prior to training onset and suggests that further investigation is needed to optimize training approach for patients with more severe RV dysfunction.
Funding: NIH-NHLBI R-15 (to MB Brown)

577 **Board #4** May 31 1:00 PM - 3:00 PM

The Impact of Menopausal Status on Cardiac Responses to Exercise Training and Acute Moderate-Intensity Exercise

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(No relationships reported)

The menopause is generally associated with lower cardiovascular function. However, most investigations have only assessed resting function, and the impact of the menopause on functional capacity and cardiac plasticity is poorly understood. **PURPOSE:** To investigate the impact of menopausal status on left ventricular (LV) function and rotational mechanics in response to exercise training and acute exercise.

METHODS: Eleven pre-menopausal (Pre-M) and 14 post-menopausal (Post-M) middle-aged women (age 45–58 years) completed 12 weeks of exercise training (3 sessions/week consisting of 4 × 4 min intervals at 90–95% maximum heart rate). Maximal aerobic capacity on an upright cycle ergometer was assessed before and after exercise training. LV function was assessed via echocardiography at 20, 40 and 60% peak power output during supine cycling. Due to poor image quality, data on LV rotational mechanics are only reported for 8 pre- and 10 post-menopausal women. **RESULTS:** Peak power output and maximal aerobic capacity increased after exercise training ($P < 0.01$), but this increase was greater in pre-menopausal than post-menopausal women (mean±SD; Pre-M-before 147±29 vs. after 179±28, Post-M-before 145±26 vs. after 169±24 W; Pre-M-before 29±5 vs. after 37±5, Post-M-before 29±6 vs. after 34±5 mL/min/kg; respectively, both $P < 0.05$). General hemodynamics, and LV function and rotational mechanics both at rest and up to 60% exercise were mostly similar in pre- and post-menopausal women in response to training (interaction effects $P > 0.1$). Specifically, the increase in peak basal rotation during exercise was smaller in post-menopausal women after training (three-way interaction $P < 0.01$; mean increase from rest to 60%: Pre-M-before 4.0; Pre-M-after 3.9; Post-M-before 3.7; Post-M-after 2.6°).

CONCLUSION: Middle-aged pre-menopausal women showed greater adaptability to 12 weeks of interval training than middle-aged post-menopausal women. The functional cardiac reserve up to 60% exercise was largely similar in pre- and post-menopausal women. Future work investigating LV function and mechanics at higher exercise intensities will likely provide further insight into the impact of menopausal status on training adaptations.

Amanda Nio is the beneficiary of a doctoral grant from the AXA Research Fund.

578 Board #5 May 31 1:00 PM - 3:00 PM

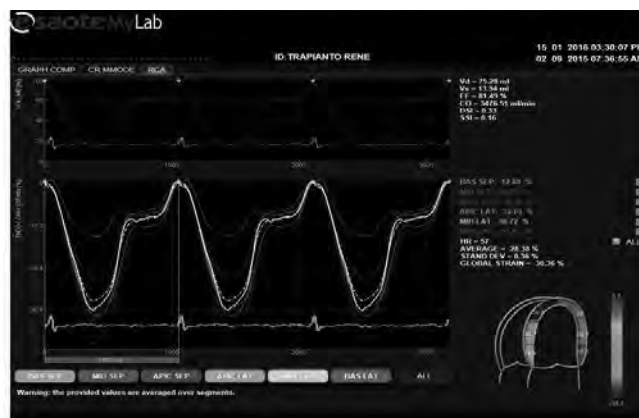
Assessment Of Myocardial Mechanics In Renal Transplant Recipients Using Speckle Tracking Echocardiography

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(No relationships reported)

PURPOSE: Renal transplant recipients (RTR) have a high risk of cardiovascular mortality, despite surgical treatment and physical exercise is normally allowed to reduce the global morbidity risk. Quantitation of myocardial function by Global Longitudinal Strain (GLS) from 2-dimensional images based on speckle tracking echocardiography plays an important role in detecting the early myocardial dysfunction in many diseases. The aim of this study was to analyze the changes in myocardial strain during 12 months of exercise as prescription model. **MATERIALS AND METHODS:** We studied 17 renal transplant recipients, mean age 56 ± 8 y, submitted to the exercise prescription model followed ACSM guidelines. Longitudinal peak systolic strain were determined by velocity vector imaging from apical 4- and 2-chamber views (MyLab seven -Esaote). All the other standard 2D echo parameters (LVDD, LVSD, CMI, IVS, PW; EF) and the diastolic parameters were evaluated. **RESULTS:** Mean heart rate and systolic and diastolic blood pressure and the LV systolic and diastolic parameters maintain normals during the follow up. After training, GLS and Longitudinal peak systolic strain at basal and mid-segments of the lateral wall were significantly higher after 6 months (GLS^{TO} -20.7±4% vs GLS^{T6} -23.7 ±4.1% with $p < 0.05$) and after 12 months of exercise (GLS: -24.4±3%) in RTR with respect of the values of the onset of the protocol ($p < 0.01$). Average longitudinal systolic strain from the 4-chamber view and GLS was normal in controls (-22.3±2.6%^{TO}; -21.8±3.6%^{T6}; -23.4±4.2%^{T12}) and not significantly different if compared to RTR during all the time of the protocol. **CONCLUSIONS:** Differences in myocardial function in patients renal transplant recipients submitted to the exercise prescription can be found and it can be quantified by strain imaging. Any possible other differences comparing subjects with end-stage renal or before the transplantation and RTR will need further studies.



579 Board #6 May 31 1:00 PM - 3:00 PM

Non-targeted Metabolomics Identifies Exercise-induced Cardioprotective Metabolic Pathways That Negate Ischemia Reperfusion Injury.

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The effects of exercise on the heart and its resistance to disease are well-documented. Recent studies have identified exercise-induced resistance to arrhythmia is due to the preservation of mitochondrial membrane potential. **PURPOSE:** To identify novel metabolic changes that occurred parallel to these mitochondrial alterations, we performed non-targeted metabolomics analysis on hearts from sedentary (Sed) and exercise-trained (Ex) rats challenged with isolated heart ischemia-reperfusion injury (I/R). **METHODS:** Eight week old Sprague-Dawley rats were treadmill trained five days/week for six weeks (exercise duration and intensity progressively increased to 1 hour at 30 m/min up to 10.5% incline, 75-80% VO₂mx). **RESULTS:** The recovery of pre-ischemic function for sedentary rat hearts was 28.8±/5.4% (N=12) compared to exercise trained hearts which recovered 51.9%±/5.7 (N=14, $p < 0.001$). Non-targeted GC-MS metabolomics analysis of 1) Sedentary rat hearts; 2) Exercise-trained rat hearts; 3) Sedentary rat hearts challenged with global ischemia-reperfusion (I/R) injury; and 4) Exercise-trained rat hearts challenged with global I/R (10/group) revealed 20 statistically significant metabolites between groups by ANOVA using Metaboanalyst ($p < 0.001$). Enrichment analysis of these metabolites for pathway-associated metabolic sets indicated a >10 fold enrichment for ammonia recycling and protein biosynthesis (L-Glutamic acid; L-Proline; L-Histidine; L-Serine; L-Aspartic acid; L-Glutamine) ($p < 4.05E-05$, FDR=0.0024). Subsequent comparison of the sedentary hearts post-I/R and exercise-trained hearts post-I/R further identified significant differences in metabolites related to Aminoacyl-tRNA biosynthesis and nitrogen metabolism (4) ($p < 1.24E-05$, FDR≤5.07E-4). **CONCLUSION:** These studies shed light on novel mechanisms in which exercise-induced cardioprotection occurs in I/R which complement both the mitochondrial stabilization and antioxidant mechanisms recently described. These findings also link protein synthesis and protein degradation (protein quality control mechanisms) with exercise-induced cardioprotection and mitochondrial susceptibility for the first time in cardiac I/R.

B-08 Thematic Poster - Exercise, Obesity, and Diabetes

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
Room: 404

580 **Chair:** Ann M. Swartz, FACSM. *University of Wisconsin-Milwaukee, Milwaukee, WI.*
(No relationships reported)

581 **Board #1** May 31 1:00 PM - 3:00 PM
Maximal Fat Oxidation: Optimal Exercise Intensity for Weight Management and Its Dissociation from Anaerobic Threshold

Livia P. Carvalho¹, Renata G. Mendes¹, Luciana Di Thommazzo-Luporini¹, Renata P. Basso-Vanelli¹, Paula A. Ricci¹, José C. Bonjorno-Junior¹, Rafael L. Luporini¹, Cláudio R. Oliveira¹, Renata Trimer¹, Shane A. Phillips², Ross Arena², Audrey Borghi-Silva¹. ¹Universidade Federal de Sao Carlos, Sao Carlos, Brazil. ²University of Illinois Chicago, Chicago, IL.
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Maximal fat oxidation (FOX_{Max}) is the exercise intensity at which the highest caloric expenditure is attributed to fat metabolism and appears to be influenced by aerobic capacity and obesity. Determining, directly or indirectly, FOX_{Max} holds relevance with respect to optimal intensity for exercise prescription for weight loss and maintenance. **Purpose:** To determine if FOX_{Max} is sex-dependent and its agreement with the anaerobic threshold (AT), another intensity at which exercise can be prescribed to improve aerobic conditioning. **Hypothesis:** We hypothesized that: 1) FOX_{Max} in obese men and women is similar; 2) FOX_{Max} is not concordant with AT; and 3) heart rate (HR) at FOX_{Max} relative to real peak HR (HR_{pk}) is equivalent to that relative to HR_{pk} predicted from a recognized prediction formula ($208-0.7 \times \text{age}$). **Methods:** Forty obese adults (BMI: $40.3 \pm 1.1 \text{ kg} \cdot \text{m}^{-2}$), women (OW, $n=20$) and men (OM, $n=20$), aged 20 to 45 years, underwent a cardiopulmonary exercise test (CPX). Oxygen uptake (VO_2), carbon dioxide production (VCO_2), respiratory exchange ratio (RER) and heart rate (HR) were measured at FOX_{Max} , AT and at the peak of the test (HR_{pk}). Fat oxidation rates were calculated ($FOX-R = 1.67 \times VO_2 - 1.67 \times VCO_2$) and the highest value was set as the FOX_{Max} . AT was defined according to the V-Slope method. T-test, MANCOVA and partial correlations were applied. α level was set at 0.05. **Results:** VO_2 at AT and FOX_{Max} were identified at 77.4 ± 1.4 and $58.6 \pm 1.2\%$ of VO_{2pk} and HR at $80.5 \pm 1.2\%$ and $68.6 \pm 1.0\%$ of HR_{pk} , respectively. Although VO_2 and HR at FOX_{Max} differed from AT for both groups ($p < 0.01$), sex-adjusted positive correlations between them were observed (FOX_{Max} vs AT for VO_2 [$r = -0.78$] and for HR [$r = -0.61$], < 0.01). Sex-based comparisons showed that OW had higher $FOX-R$, and at the AT higher HR, VO_2 percent of HR_{pk} and VO_{2pk} ($p < 0.05$). However, OM had a higher percent of VO_{2pk} at FOX_{Max} . Similar HR_{pk} , HR at FOX_{Max} and percent of HR_{pk} were observed in both groups. HR at FOX_{Max} relative to the predicted HR_{pk} from the formula $208-0.7 \times \text{age}$ were $66 \pm 1\%$ in OM and $67 \pm 1\%$ in OW. **Conclusions:** Sex differences exist at AT and FOX_{Max} for VO_2 . Meanwhile, chronotropic responses (HR) at FOX_{Max} are equal for both and can be inferred from a usual formula when CPX is unavailable. **Funding:** Fundação de Amparo à Pesquisa do Estado de São Paulo (2009/01842-0, 2013/15681-3), SP, Brazil.

582 **Board #2** May 31 1:00 PM - 3:00 PM
The Combined Effects Of Regular Activity Breaks And Physical Activity On Postprandial Metabolism

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(No relationships reported)

Regularly interrupting sedentary behavior with short bouts of activity lowers postprandial glycemia, however, the effects on lipid responses are inconsistent. Additionally, little is known about how the effects of regular activity breaks and continuous physical activity may combine to affect postprandial metabolism. **Purpose:** To compare the effects of prolonged sitting and regular activity breaks with or without 30 min of continuous physical activity on postprandial metabolism. **Methods:** A randomized, crossover study was conducted; 36 adults (mean age 25 y (SD 3.9), BMI 23.9 (SD 3.9), VO_{2max} 36.2 (SD 9.2) $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) completed the following four two-day interventions: Prolonged sitting on both days, without (SED+SED) or with (PA+SED) a 30 min bout of continuous walking ($60\% VO_{2max}$) at the end of day 1; sitting on both days interrupted with regular activity breaks (2 min walking every thirty minutes at $60\% VO_{2max}$), without (RAB+RAB) or with (PA+RAB) a 30 min bout of continuous walking ($60\% VO_{2max}$) at the end of day 1. Postprandial metabolic responses to a standardized test meal (0.71 g/kg CHO, 0.70 g/kg FAT, 0.32 g/kg PRO,

43.24 kJ/kg) were measured in venous blood samples over 5 h on day 2 - at baseline, 30 and 45 min, and then hourly. Plasma glucose, insulin, and triglycerides were used to calculate total area under the response curve (AUC). Mixed model regression was used to compare the effects of interventions on AUC.

Results: There was no effect of intervention on glucose AUC ($p=0.26$). Compared to SED+SED, insulin AUC was significantly lower in PA+SED (-15%; 95% CI -4, -24%; $p=0.01$), RAB+RAB (-11%; 95% CI 0, -20%; $p=0.05$) and PA+RAB (-23%; -12, -31%; $p<0.001$). PA+RAB lowered insulin AUC more than PA+SED (-13%; 95% CI -4, -22%; $p=0.01$). Neither PA+SED nor RAB+RAB alone affected triglyceride AUC. However, PA+RAB significantly lowered triglyceride AUC compared to both SED+SED (-0.74 $\text{mmol} \cdot \text{L}^{-1} \cdot 5\text{h}$; 95% CI -1.28, -0.20; $p=0.01$) and PA+SED (-0.67 $\text{mmol} \cdot \text{L}^{-1} \cdot 5\text{h}$; 95% CI -1.15, -0.19; $p=0.01$). **Conclusions:** The results indicated that all patterns of physical activity cause an acute improvement in insulin sensitivity. Regular activity breaks and physical activity combined provides the greatest improvements in insulin sensitivity, while also lowering postprandial lipids. Support: Heart Foundation, Lotteries, & University of Otago

583 **Board #3** May 31 1:00 PM - 3:00 PM
Influence of Aerobic Exercise on Ghrelin-o-Acyltransferase in Normal Weight and Obese Adults: A Pilot Study

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(No relationships reported)

Obesity is a major public health issue in the United States (US), affecting an estimated 78 million US adults. Aerobic exercise (AE) is recommended by the American College of Sports Medicine to prevent and treat obesity, yet the effect of AE on circulating hunger hormones, including ghrelin and its biological catalyst, ghrelin-o-acyltransferase (GOAT), are less known. **PURPOSE:** To determine the influence of AE on circulating GOAT in normal-weight (NW) and obese (OB) adults. **METHODS:** A preliminary power analysis was performed to detect a medium to large effect size with 80% power. A sample size of nine was determined to be able to detect a medium effect size of 0.50 with 84% power and was used as the pilot sample for this study. Of the pilot sample, four were NW (body mass index [BMI] = $21.3 \pm 1.3 \text{ kg/m}^2$) and five were OB (BMI = $38.9 \pm 6.2 \text{ kg/m}^2$). Physical characteristics were measured at baseline with a health fitness assessment. Participants then returned to the laboratory on three separate occasions, separated by 48 hours to perform AE and control sessions in a randomly counterbalanced order. AE sessions were performed on cycle ergometers at 30% and 60% oxygen uptake reserve for 40 minutes. Control sessions were performed with seated rest and no AE for 40 minutes. Fifteen mL of blood was taken pre-and-post-AE and pre-and-post-control and were assayed in duplicate. Mixed factorial analysis of variance (ANOVA) was used to determine whether mean differences existed between NW and OB for GOAT in response to AE and control. Alpha levels were set *a priori* at $p < 0.05$. **RESULTS:** No significant mean difference was found between NW and OB ($F[1, 4] = 0.66, p = 0.44$) AE and control ($F[2, 4] = 0.05, p = 0.96$), or the interaction between body weight and treatment condition ($F[1, 8] = 0.75, p = 0.49$). **CONCLUSION:** We found the change in GOAT to be similar between NW and OB across treatment and control conditions in this pilot study. Our findings indicate that further investigation of GOAT is warranted in combination with other appetite regulating hormones in response to exercise. Such investigations should expand upon our findings and implement study designs that include larger samples of men and women to better understand the role GOAT may play as a biological catalyst in the suppression of hunger. Supported by the Graduate Student Research Fund at Springfield College.

584 **Board #4** May 31 1:00 PM - 3:00 PM
Two Weeks of Interval Training Improves Metabolic Flexibility and Glucose Tolerance in People with Prediabetes

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(No relationships reported)

PURPOSE: Impaired metabolic flexibility is associated with hyperglycemia. Although exercise improves metabolic flexibility, the optimal exercise dose is unclear. Thus, we tested the effect of a 2-week interval (INT) vs. continuous (CONT) training intervention on fuel selection in relation to glucose tolerance in adults with prediabetes.

METHODS: Subjects (Age: 57.8±2.2y, BMI: 34.5±2.2kg/m²) were screened for prediabetes using the American Diabetes Association criteria (75g OGTT and HbA_{1c}). Subjects were randomized to 60 min/d of supervised INT (n=7; 90% HRmax for 3 min and 50% HRmax for 3 min) or work matched CONT (n=6, 70% HRmax) exercise for 12 bouts. Fitness (VO_{2max}), body composition (BIA), and glucose tolerance (180 min 75g OGTT) were assessed pre- and post-intervention. Respiratory exchange ratio (RER; indirect calorimetry) was measured at 0, 60, 120 and 180 min of the OGTT to assess fasting and post-prandial (average of 60-180 min) metabolic flexibility. **RESULTS:** INT and CONT training increased VO_{2max} (+2.06±0.53 vs. +0.48±1.06 mL/kg/min, P=0.04), decreased skeletal muscle mass (SMM; -0.51±0.12 vs. -0.33±0.15 kg, P=0.001), and reduced fasting RER (-0.05±0.02 vs. -0.03±0.01 a.u., P=0.01). However, only INT exercise lowered 2-hr plasma glucose (-10.43±6.10 vs. +9.50±12.55 mg/dL, P=0.03) and increased post-prandial RER (+0.003±0.02 vs. -0.051±0.02 a.u., P=0.10) when compared with CONT training. Decreased SMM was significantly correlated with increased 2-hr glucose (r=-0.59, P=0.04) and enhanced post-prandial RER (r=-0.61; P=0.04). **CONCLUSION:** Independent of fitness and despite reductions in muscle mass, INT training favorably shifts fasting fat oxidation and post-prandial carbohydrate use in people with prediabetes. This suggests that exercise dose may be important for glycemic control and type 2 diabetes prevention.

585 Board #5 May 31 1:00 PM - 3:00 PM
Rate of Response in Insulin and Glucose Measures to Different Exercise Amounts and Intensities

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Variability in glucose and insulin response to exercise is a largely neglected phenomenon. Here we analyze this variability by measuring the rate of response, defined as the number of individuals with an improvement in glucose and insulin values beyond the day-to-day variability of measurement.

Purpose: To determine the separate effects of exercise amount and intensity on the rate of response for glucose and insulin variables.

Methods: Participants were 171 sedentary, middle-aged abdominally obese adults who completed at least 90% of 5 weekly exercise sessions prescribed over a 24-week intervention. Participants were randomly assigned to (1) no-exercise control (n=51), (2) low-amount, low-intensity exercise (LALI; n=38), (3) high-amount, low-intensity exercise (HALI; n=52), or (4) high-amount, high-intensity exercise (HAHI; n=30). Two-hour glucose level, insulin area under the curve (AUC), and fasting insulin were measured at 16 and 24 weeks in response to a 2-hour, 75g oral glucose tolerance test. Biological variability for these measures was calculated to be ±2.2 mmol/L, ±940.2 pmol/L, and ±38.9 pmol/L, respectively.

Results: At 24 weeks, the rate of response for 2-hour glucose was 2.0%, 13.2%, 5.8%, 13.3% in the control, LALI, HALI, and HAHI groups, respectively. The rate of response for insulin AUC was 12.0%, 21.6%, 25.0%, 20.0% in the control, LALI, HALI, and HAHI groups, respectively. The rate of response for fasting insulin was 11.8%, 15.8%, 15.4%, 6.7% in the control, LALI, HALI, and HAHI groups, respectively. The rate of response was not different between control and any of the exercise groups for 2-hour glucose, insulin AUC, and fasting insulin (p>0.05). Exposure to exercise did not affect the rate of response for 2-hour glucose or fasting insulin between 16 and 24 weeks (p>0.05). Exposure data was not available for insulin AUC.

Conclusion: There was substantial variability of response for all measures of insulin and glucose that was not reduced by increasing exercise amount or intensity, where a maximum of 25% of participants improved in these measures beyond the day-to-day variability. This observation underscores the importance of accounting for the variability of measurement when interpreting treatment efficacy for a given individual.

586 Board #6 May 31 1:00 PM - 3:00 PM
Interventions to Change Physical Activity Behavior in Type 2 Diabetes: A Systematic Review and Meta-analysis

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 (No relationships reported)

Low physical activity (PA) is a modifiable risk factor for health outcomes in individuals with type 2 diabetes (T2D). Sustained increases in PA are required to improve metabolic health and cardiovascular risk in this cohort, but have been difficult to achieve or poorly measured.

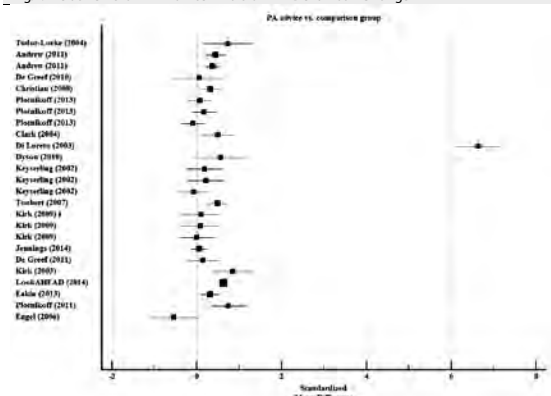
Purpose: To systematically review the effects of supervised exercise or lifestyle intervention including PA advice on long term PA in individuals with T2D.

Method: An electronic search of the literature was performed from earliest record to September 2016. Eligible trials were RCTs in T2D which included an objective or subjective measure of PA at baseline and at least one follow-up time point ≥ 6 months after enrolment. Mean differences, relative effect sizes (ES; Hedge's) and heterogeneity statistics (I²) were calculated using a random effects model.

Results: Among 107799 citations retrieved, 23 RCTs (including 18 RCTs of lifestyle advice and 5 RCTs of exercise) met the inclusion criteria (n=11673, 46.1% men, age 60.0 ± 4.0). All 5 exercise trials demonstrated increased PA relative to control [2/5 reported stable habitual PA plus an additional 3 d/week structured exercise; 3/5 reported moderate to large increases in total PA (relative ESs 0.6 to 1.5)]. The relative ESs for PA advice trials are shown in Fig 1 (pooling not appropriate; I² = 96%). Only 10/18 trials demonstrated significantly increased total PA (ES ranging from 0.3 to 0.8 and one very large ES of 6.6.) Subjective PA measurement was used in 60% of trials that reported significant increases in PA, vs. only 12.5% of non-significant trials.

Conclusion: Supervised exercise was associated with increased overall PA (inclusive of study-related and habitual activity levels) in T2D in 5/5 trials. By contrast, only 55% of PA advice trials reported significant increases in PA. This heterogeneity, plus reliance on subjective reporting methods, limits confidence in the efficacy and consistency of unstructured/unsupervised PA advice in T2D.

Fig.1. Relative ES of PA Advice Trials on PA Behaviour Change



587 Board #7 May 31 1:00 PM - 3:00 PM
Power Training In Older Adults With Type 2 Diabetes; Outcomes From The Great2do Study.

Guy Wilson¹, Yorgi Mavros¹, Shelley Kay¹, David Simar², Kylie Simpson¹, Michael Baker³, Yi Wang⁴, Renru Zhao¹, Jacinda Meiklejohn¹, Nathan De Vos⁵, Mike Climstein, FACSM¹, Anthony O'Sullivan⁶, Bernhard Baune⁷, Steven Blair, FACSM⁸, Nalin Singh¹, Maria Fiatarone Singh¹. ¹University of Sydney, Sydney, Australia. ²University of New South Wales, Sydney, Australia. ³Australian Catholic University, Sydney, Australia. ⁴University of California, California, CA. ⁵Balmain Hospital, Sydney, Australia. ⁶University of New South Wales, Sydney, Australia. ⁷University Of Adelaide, Adelaide, Australia. ⁸University of South Carolina, Columbia, SC. (Sponsor: Mike Climstein, FACSM)
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 (No relationships reported)

PURPOSE: Muscle power declines with age and disease and predicts functional impairment. Although effective in some other cohorts, the benefits of high intensity, high velocity progressive resistance training (power training) on muscle strength, power, contraction velocity and lower limb function in older adults with type 2 diabetes has not been investigated.

METHODS: 103 overweight/obese older adults (>60 years) were randomized to receive high intensity power training [80% peak strength (1RM)] or sham-exercise, 3 days per week for 1 year. Peak muscle power, peak contraction velocity and 1RM were measured on Keiser knee extension (KE) and chest press (CP) machines before and after the intervention. Lower limb function was assessed using habitual and maximal gait speed, repeated chair stand and stair climb power. **RESULTS:** KE and CP 1RMs significantly increased following power training compared to sham-exercise [mean difference (CI) = 28.97 (5.17, 52.77) Nm and 75.99 (40.25, 111.74) N respectively]. Similar results were observed for KE and CP peak power [mean difference = 75.83 (35.82, 115.84) W and 26.77 (6.30, 47.24) W, respectively]. No effects were observed for changes in contraction velocity for KE or CP (p<0.05). Both groups showed similar improvements in habitual and maximal gait speed and chair stand time (p<0.05). Increases in KE peak power were explained by increases in KE 1RM (r=0.32, p=0.003), but not changes in KE contraction velocity (r=0.12,

$p=0.26$). In contrast, increases in CP peak power were explained by increases in CP contraction velocity ($r=0.52$, $p<0.001$) but not increases in CP 1RM ($r=0.17$, $p=0.26$). Neither changes in KE 1RM nor peak power were associated with changes in lower limb function. **CONCLUSIONS:** 1 year of power training significantly improved upper and lower body strength and power in older adults with type 2 diabetes. Improvements in lower limb power were associated with increases in strength but not contraction velocity. Conversely, improvements in upper limb power were associated with increases in contraction velocity but not strength. Unexpectedly, improvements in lower extremity function were not associated with changes in lower leg strength or power, suggesting that unaddressed factors such as obesity may have attenuated the benefits of power training on functional performance.

588 Board #8 May 31 1:00 PM - 3:00 PM
Randomized Controlled-Trial of Milk and High-Intensity Interval Training on Metabolic Health in Type 2 Diabetes

Monique E. Francois, Cody Durrer, Jonathan P. Little. *University of British Columbia, Kelowna, BC, Canada.*
 (No relationships reported)

Milk consumption post-exercise may provide additional lean mass gains and body fat loss. Such favorable body composition changes could promote further improvements in glycemic control and quality of life (QoL) in exercising older adults with type 2 diabetes (T2D).

Purpose: To determine if the addition of post-exercise low-fat milk to high-intensity interval training (HIIT) improves metabolic health more than HIIT and isolated milk-protein, or HIIT alone.

Methods: In a proof-of-concept, randomized double-blind controlled trial, 47 adults with physician-diagnosed T2D (58 ± 10 y, A1c: $7.1 \pm 0.8\%$, BMI: 35 ± 7 kg/m²) were randomly assigned to one of three nutritional beverages (500 mL skim-milk, milk-protein isolate or flavored water placebo) after HIIT exercise (2x cardio- and 1x resistance-based / wk) for 12 weeks. Body composition (dual-energy X-ray absorptiometry), glycemic control (hemoglobin A1c, continuous glucose monitoring) and QoL (SF-36) were measured before and after the intervention. Inferential analyses for clinical chances were performed using the spreadsheet at www.newstats.org.

Results: There were main effects of time but no group X time interactions. All results are therefore presented as main effects of time with groups collapsed, with probability of change being clinically beneficial shown for select variables. Body mass was unchanged (-0.8 ± 3.2 kg, $p=0.13$), however, lean mass ($+1.3 \pm 2.9$ kg, $p<0.01$, *likely beneficial*) and percent body fat ($-0.85 \pm 1.6\%$, $p<0.01$, *possibly beneficial*) were improved in all groups. Hemoglobin A1c ($-0.2 \pm 1.6\%$, $p<0.01$, *most likely trivial*), 24-h mean glucose (-0.4 ± 1.2 mmol/L, $p=0.04$) and glycemic variability (MAGE: -1.1 ± 2.9 , $p=0.02$) were reduced. QoL also increased (95%CI: $+5.3-17\%$, *most likely beneficial*) after HIIT.

Conclusion: The consumption of milk or protein after HIIT does not result in additional benefits for metabolic health compared to HIIT alone. In line with current evidence, HIIT is a potent stimulus for improving several aspects of metabolic health in patients with type 2 diabetes.

B-09 Thematic Poster - Exercise Psychology and Clinical Populations

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
 Room: 403

589 **Chair:** Melanie Poudevigne, FACSM. *Clayton State University, Morrow, GA.*
 (No relationships reported)

590 Board #1 May 31 1:00 PM - 3:00 PM
Leisure Time Physical Activity Among U.S. Adults with Elevated Symptoms of Attention Deficit Hyperactivity Disorder

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 (No relationships reported)

Physical activity in adults with elevated ADHD symptoms is understudied. **PURPOSE:** This study surveyed U.S. adults with elevated ADHD symptoms for the purpose of (i) describing their leisure time physical activity (LTPA) and (ii) quantifying relationships between LTPA and ADHD symptoms. **METHODS:** 3,111 Amazon Mechanical Turk workers reported their age online and completed the six-item Adult ADHD Self-Report Scale-V1.1 Screener (ASRS). 228 adults screened positive for ADHD and completed

45 questions about demographics, health and physical activity. 221 individuals were included in the final analysis because 7 were excluded as outliers (≥ 5 SD above mean) or for responding incorrectly on the Godin. **RESULTS:** The sample was 56% female and 82% Caucasian with 83% between the ages of 18 and 59 years; 33% had some college and 30% were college graduates. Most respondents reported no current ADHD diagnosis (75%) or medication use to treat ADHD symptoms (83%). ADHD medication use was unrelated to the LTPA (all p values $> .40$). Past week physical activities were: walking (88% of sample), home activities (63%), stretching (35%), jogging (34%), weight lifting (30%), yardwork (27%), bicycling (22%), home repair (20%), yoga/mind-body (19%), gardening (16%), swimming (15%), sports (14%), playing music (9%), social dance (5%), aerobic dance (4%) and fishing/hunting (4%). Compared to men, women reported significantly less strenuous ($t=3.43$, $p=.001$) and overall LTPA ($t=2.886$, $p=.004$), including less engagement in home repair activities ($t=2.493$, $p=.014$), jogging ($t=2.204$, $p=.029$), sports ($t=2.188$, $p=.03$), music ($t=2.119$, $p=.036$) and bicycling ($t=2.012$, $p=.046$). Log transformed total LTPA scores were significantly ($p<.05$) related to ASRS question 2 (difficulty getting organized, $r=-.18$), the inattention subscale ($r=-.18$) and total ASRS scores ($r=-.17$). **CONCLUSION:** In a sample of U.S. adults with elevated symptoms of ADHD, LTPA is low and physical activity modes are similar when compared to U.S. samples of adults without ADHD. ADHD symptoms are negatively related to LTPA and unrelated to ADHD medication use.

591 Board #2 May 31 1:00 PM - 3:00 PM
Effects Of Aerobic Exercise Intensity On Acute Serum Levels Of Bdnf In Patients With Depression

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Serum level of brain-derived neurotrophic factor (BDNF) is reduced in patients with depression and improved BDNF has been linked to antidepressant response. Aerobic endurance training increases BDNF levels but it is unknown whether this response is intensity dependent in patients with clinical depression.

Purpose: To examine the changes in serum BDNF levels after high aerobic intensity training (HIT) compared to long slow distance training (LSD). **Methods:** In an intraindividual design, 16 patients (6 women/10 men; 36 ± 11 yrs) with depression (ICD-10: F32-F33) performed the LSD and HIT with an interval of one week. HIT was warm up at 60-70 % of HR_{max} for 10 min, followed by 4x4 min intervals at 85-95 % of maximal heart rate (HR_{max}), intermitted by 3 min active rest periods at 60-70 % of HR_{max}. LSD was continuous running or walking for 45 min at 60-70 % of HR_{max}, with similar caloric expenditure as HIT. Blood samples were taken 5-10 min before each training session and within 3 min after completing the last 4 min interval (HIT) or upon completion of the LSD session. **Results:** Increase in serum BDNF after HIT was more pronounced compared to LSD ($p < 0.001$; Cohen's $d = 2.81$). Baseline BDNF levels were 32.11 ± 6.24 ng/mL and 30.62 ± 5.61 ng/mL in LSD and HIT, respectively. **Conclusion:** The serum BDNF response to aerobic exercise is intensity dependent in patients with clinical depression.

592 Board #3 May 31 1:00 PM - 3:00 PM
The Effects of Exercise Training on Anxiety in Fibromyalgia Patients: A Quantitative Synthesis

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 (No relationships reported)

Physical inactivity and comorbid anxiety symptoms are prevalent among fibromyalgia (FM) patients. Exercise training may be an effective alternative therapy to reduce these symptoms. **Purpose:** To evaluate the effects of exercise training on anxiety symptoms in patients with FM, and to examine whether variables of theoretical or practical importance moderate the estimated mean effect. **Methods:** Twenty-five effects were derived from 10 articles published before June 2016 located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 2,914 patients with FM and included both randomization to exercise training or a non-active control condition and an anxiety outcome measured at baseline and during and/or after exercise training. Hedges' d effect sizes were computed, data for moderator variables were extracted, and random effects models were used to estimate sampling error and population variance for all analyses. Meta-regression quantified the extent to which patient and trial characteristics moderated the mean effect. **Results:** Exercise training significantly reduced anxiety symptoms by a mean effect Δ of 0.28 (95%CI: 0.16-0.40). No significant heterogeneity was observed ($Q_w=30.79$; $P=0.16$; $I^2=25.29\%$). Program duration ($\beta=1.44$; $z=2.50$; $p \leq 0.01$) was significantly related to the overall effect, with significantly larger anxiety improvements resulting from programs lasting greater

than 26 weeks ($\Delta=0.35$; 95%CI, 0.05-0.66) compared with those lasting less than 26 weeks ($\Delta=0.26$; 95%CI, 0.13-0.39). Session duration ($\beta=-0.53$), frequency ($\beta=-0.25$), intensity ($\beta=0.23$), control ($\beta=0.66$), anxiety recall time frame ($\beta=0.07$), and exercise setting ($\beta=0.45$) were not significantly related to effect size (all $p \geq 0.07$). **Conclusion:** Exercise training improves anxiety symptoms among FM patients. Thus, in addition to the physical benefits of exercise, persons with FM should be encouraged to exercise as a potential low-risk, adjuvant treatment for anxiety symptoms. The findings also suggest that larger anxiety symptom reductions will be achieved by focusing on longer exercise programs while promoting long-term adherence. Future well-designed investigations are required to examine the potential moderating effect of pain-related improvements in FM patients.

593 Board #4 May 31 1:00 PM - 3:00 PM
Comparison of Physical Activity and Sports Participation in Children With and Without Autism Spectrum Disorder

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PURPOSE: To compare psychosocial factors associated with physical activity and participation in sports between children with Autism Spectrum Disorder (ASD) and typically developing (TD) children.
METHODS: The sample consisted of 49 nine-year old children with ASD (85% male) and 70 nine-year old TD children (85% male) who were part of a large, national study, the Growing Up in Ireland Study, which examined a series of demographic, behavioral, and psychosocial variables in children. Children and parents completed questionnaires that asked about their physical activity (PA), participation in sports, social factors (friends, bullying), and psychological variables (perception of intelligence, popularity, happiness, anxiety). T-tests compared differences between activity and psychosocial variables in children with ASD and TD children, while multiple regression examined which factors were associated with PA and sports participation.
RESULTS: Independent samples t-tests revealed that children with ASD had lower amounts of PA ($p=.01$), spent less time with friends ($p=.0001$), had fewer close friends ($p<.0001$), viewed themselves as less popular ($p<.0001$), reported greater feelings of anxiety ($p=.01$), and were less likely to participate in sports ($p=.002$). Regression analyses indicated that being a victim of bullying ($\beta=-.28$, $p=.03$) was associated with lower levels of PA in TD children, with a trend towards greater perceptions of popularity ($\beta=.1$, $p=.08$) associated with greater levels of PA. Children who were victims of bullying also reported less sports participation ($\beta=-.23$, $p=.03$). In children with ASD, greater time spent with friends ($\beta=.45$, $p=.0006$) and greater perceptions of intelligence ($\beta=-.2$, $p=.004$) were associated with greater levels of PA, while none of the psychosocial variables were associated with sports participation.
CONCLUSIONS: Children with ASD have lower levels of PA and sports participation than TD children. Interventions aimed to increase PA in children with ASD need to take into account differences in psychosocial factors associated with PA compared to TD children.

594 Board #5 May 31 1:00 PM - 3:00 PM
Exercise Induced Analgesia in Survivors of Cancer

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 (No relationships reported)

PURPOSE: Chronic pain of varying origins is experienced by potentially greater than 50% of cancer survivors. Associated with reduced physical function and reduced health-related quality of life, it is a significant barrier to initiating and continuing exercise for cancer survivors. Aerobic exercise has been shown to have an acute analgesic effect demonstrated by a reduction in subjectively reported pain, or an increase in pain thresholds, for 10 to 30 minutes immediately following exercise. The hypoalgesic effect of exercise has been well demonstrated in healthy populations as well as some chronic diseases, but has not yet been investigated for cancer survivors. The aim of the current study is to investigate if cancer survivors experience an analgesic response to an acute bout of exercise, and if this response changes after repeated exercise sessions.
METHODS: Participants ($n = 6$) who had a diagnosis of breast, colorectal or prostate cancer who were 3-12 months post completion of primary treatment (hormone therapy excepted) were included in this study. Six participants completed individualised test bout of exercise (30-70% HRR, duration 15-20min). Pain thresholds were measured using an algometer over the rectus femoris muscle of the leg before and after the exercise. Five participants repeated the test exercise bout following a 2-week training period of 6 exercise sessions. Questionnaire measures of pain were also recorded using pain specific subscale from the SF-36 (0-100, 100=best).

RESULTS: The participants variously reporting being impacted by pain (SF-36 bodily pain 59.4 ± 8.1 range: 22.5 - 100) during the 4 weeks before testing commenced. Following two weeks of training, bodily pain was reported as 41.9 ± 23.8 out of 100. Pressure pain thresholds increased after exercise on day 1 (Mean diff \pm SD: 0.54 ± 0.40 kg/cm²; Cohens d (95% CI): 0.2 (0.04 - 0.49), $p<0.05$), indicative of exercise-induced hypoalgesia. This response was similar following 2 weeks of training (mean \pm SD: 0.52 ± 0.09 kg/cm²; Cohens d (95% CI): 0.43, $p<0.001$). **CONCLUSIONS:** Cancer survivors experienced an analgesic response to a single bout of exercise. This response was stable across a 2 week training period, despite higher levels of self-reported bodily pain.

595 Board #6 May 31 1:00 PM - 3:00 PM
Physical Activity and Brain Responses during Pain Modulation in Gulf Veterans with Chronic Muscle Pain

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 (No relationships reported)

Chronic medically unexplained muscle pain (CMP) is a primary complaint among the more than 200,000 US Gulf War Veterans (GVs) currently suffering from debilitating multisymptom illnesses. Veterans of the more recent Iraq War are also dealing with CMP. Previously our lab demonstrated a positive relationship between physical activity (PA) and brain responses to pain modulation (PM) in civilian CMP patients. We also reported significant correlations between PA and behavioral indices of PM in healthy GV's. The relationship between PA and the underlying brain responses during PM, however, has not been thoroughly explored. **PURPOSE:** To examine the association between brain responses during PM and objectively-measured PA in GV's with and without CMP. **METHODS:** Twenty two GV's (12 CMP; 10 healthy) underwent thermal pain testing with and without distraction during an fMRI scan. Veterans were exposed to 15 heat stimuli (20 s) relativized to 'slightly intense' pain. Stimuli were administered alone or with distraction (i.e., congruent [CS] and incongruent versions [IS] of the Stroop Task). Pain intensity and unpleasantness ratings were collected for each stimulus. PA was assessed with hip-mounted accelerometers worn for a week. Brain responses during PM were modeled using SPM12 and correlated to six PA indices derived from the PA data. Voxel-level significance was set to 0.005 with a minimum cluster size of 330 mm³. **RESULTS:** Ratings of pain with distraction, CS and IS, were significantly ($p<0.01$) reduced compared to without for both groups. During CS, healthy GV's exhibited a positive correlation between activity in the right precentral gyrus during PM and sedentary minutes, while activity in the middle and prefrontal cortices was negatively related to PA at light, moderate and vigorous intensities. For IS, positive correlations were found between activity in the contralateral insula and indices of low intensity PA. GV's with CMP had only a negative correlation between activity in the right anterior cingulate cortex during CS and minutes spent in activities of daily living. **CONCLUSIONS:** Pain modulation during distraction appears uncompromised in GV's with CMP. However, the influence of PA on modulatory responses seems diminished in GV's with CMP compared to their healthy peers. Supported by Dept. of Veterans Affairs grant: 561-00436

596 Board #7 May 31 1:00 PM - 3:00 PM
Associations Between Physical Activity, Flourishing, Bullying And Emotional Difficulties In Children Autism

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 (No relationships reported)

Physical activity (PA) is a significant indicator of present and future health in adolescents. However, it is unknown whether engaging in regular PA is associated with measures of child flourishing as well as bullying and emotional difficulties in children with autism spectrum disorder (ASD). **PURPOSE:** To examine associations between physical activity levels and measures of child flourishing as well as bullying and emotional difficulties. **METHODS:** Analyses include 1,363 (82% male) aged 6-17 (mean 11.54 ± 3.29 years) with ASD from the 2011-12 National Survey of Children's Health. Adolescents were grouped into two categories: those who engaged in regular PA (≥ 3 days/week) and those who did not engage in regular PA. Outcomes included emotional difficulties (excessive arguing and unhappiness) bullying or being cruel to others, and measures of flourishing (finishing tasks, staying calm and in control when faced with a challenge, showing interest in learning new things, and caring about doing well in school). Logistic regression models, adjusted for age, sex, gender, household income, and education assessed the odds of each outcome comparing those who engaged in regular PA to those who did not. **RESULTS:** Unadjusted prevalences showed that 69% of those with ASD were regularly physically active (≥ 3 days/week). Regular physical activity was not associated with excessive arguing, bullying or being cruel to others, or unhappiness. Those with ASD who participated in regular PA were 58% more likely to finish tasks (OR=1.58; $p=0.001$) compared to those who did not

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engage in regular PA. Additionally, those who engaged in regular PA were 44% more likely to stay calm and in control when faced with a challenge (OR=1.44; $p=0.007$). Furthermore, those who engaged in regular PA were 75% more likely to show interest and curiosity in learning new things (OR=1.75; $p=0.006$), and 65% more likely to care about doing well in school (OR=1.65; $p=0.004$) compared to those who did not engage in regular PA. **CONCLUSIONS:** Children with ASD that engaged in regular PA were significantly more likely to finish tasks, stay calm when faced with a challenge, show interest and curiosity in learning new things, and care about doing well in school. These findings suggest engaging in regular PA may increase flourishing in children with ASD.

597 Board #8 May 31 1:00 PM - 3:00 PM
Acute Exercise Effects on Mood Among Young Adults with Worry Symptoms Indicative of Generalized Anxiety Disorder
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 (No relationships reported)

Evidence supports the effects of exercise training on clinical severity, associated signs and symptoms, dimensions of sleep quality and quantity, and health-related quality of life among individuals with Generalized Anxiety Disorder (GAD). However, little is known about the acute effects of exercise among individuals with clinical or subclinical GAD.

Purpose

This study quantified mood responses to either acute aerobic exercise or quiet rest, examined potential sex-related differences in response, and explored potential moderators of response among young adult men and women with worry symptoms indicative of GAD.

Methods

Twenty-five young adults (8 males; 17 females; 21.1±1.3y) with Penn State Worry Questionnaire scores ≥45 (58±8) completed two 30-min conditions in counterbalanced order: vigorous treadmill running or seated quiet rest. Outcomes included worry symptoms, state anxiety, feelings of tension, depression, anger, energy, fatigue, and confusion, and total mood disturbance. RM-ANOVA examined differences across condition and time and between males and females. Hedges' *d* effect sizes (95%CI) were calculated to quantify and compare the magnitude of change in response to exercise compared to control. Regression explored potential moderators of mood response.

Results

Average heart rate was 163±5.4 bpm and participants reported an average session RPE of 13±2 (range: 9 to 17). Compared with control, acute exercise significantly improved state anxiety, feelings of depression, anger, energy, fatigue, and confusion, and total mood disturbance (all $p\leq 0.04$). Moderate-to-large improvements were found for anger ($d=0.57$, 95%CI: 0.01, 1.13), fatigue ($d=0.67$, 95%CI: 0.10, 1.24), confusion ($d=0.87$, 95%CI: 0.29, 1.45), and energy ($d=0.87$, 95%CI: 0.29, 1.45), and total mood disturbance ($d=1.10$, 95%CI: 0.50, 1.69). The magnitude of improvements were greater (i.e., larger effect sizes) among men for all outcomes except feelings of energy and fatigue and worry symptoms. High trait anxiety, depression, and poor sleep did not moderate exercise effects (all $p>0.10$).

Conclusion

Findings provide initial support for both the positive effects of acute aerobic exercise on mood and potential sex-related differences in exercise effects among young adults with worry symptoms indicative of GAD.

B-10 Thematic Poster - Growing Up Active: Physical Activity in Youth

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
 Room: 505

598 Chair: John R. Sirard. University of Massachusetts Amherst, Amherst, MA.
 (No relationships reported)

599 Board #1 May 31 1:00 PM - 3:00 PM
Using Accelerometry To Measure Physical Activity Opportunities During The School Day In Rural Elementary Schools.
 Evan Hilberg¹, Patrick Abi Nader², John M. Schuna, Jr¹, Deborah John¹, Katherine B. Gunter, FACSM¹. ¹Oregon State University, Corvallis, OR. ²Université de Moncton, Moncton, NB, Canada.
 (Sponsor: Katherine Gunter, FACSM)
 (No relationships reported)

Physical activity (PA) guidelines for children recommend accruing 60 minutes or more of moderate to vigorous physical activity (MVPA) per day. Rural children accumulate the majority of their PA at school, so PA opportunities, such as physical education (PE), recess, and classroom-based PA (CBPA) in the rural school environment are critical for this population. There is limited research exploring these PA opportunities in the rural elementary school setting to understand which opportunities provide the most MVPA. **PURPOSE:** To determine the proportion of time rural children spend at different intensities during three specific PA opportunities available during the school day: PE, recess, and CBPA. **METHODS:** Objectively measured PA levels were collected over a period of four school days at six rural elementary schools using research-grade accelerometers. Accelerometers were worn on the waist during school hours by 292 children (grades 1-5). Daily wear times and school schedules were provided by teachers and were matched to the children's accelerometer data to determine the amount of time spent at different intensities during each PA opportunity. ANOVA was used to detect differences with an alpha level of 0.05. **RESULTS:** The average duration for each PA opportunity was 44 minutes of recess, 32 minutes of PE, and 19 minutes of CBPA. Children in our sample of rural elementary schools spent 18 ± 14% (M±SD) of recess time in MVPA, 16 ± 15% of PE in MVPA, and 11% ± 15% of CBPA in MVPA. Boys engaged in higher levels of MVPA than girls across all PA opportunities ($p<0.001$). First grade children accrued more time in MVPA across domains when compared to their fifth grade counterparts ($p<0.001$). Sedentary and light intensity activities were higher for older children and girls ($p<0.001$). **CONCLUSION:** Scheduling PA opportunities with the highest proportion of MVPA may be an effective method to increase activity in rural elementary school children. This sample of children are not meeting the recommendations of 50% for proportion of time spent in MVPA during recess and PE. Targeting approaches to increase MVPA during these already scheduled opportunities may help children reach daily recommendations. Supported by a grant from the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2011-68001-30020.

600 Board #2 May 31 1:00 PM - 3:00 PM
Infancy Weight Gain And Fat Mass In Youth- Does Physical Activity Modify The Association?
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Rapid weight gain in infancy has been linked to increased risk of obesity in youth. Hence, an increased knowledge on possible strategies to prevent excessive total fat mass (total FM) and trunk fat mass (trunk FM) is important to avoid development of obesity. One possible strategy could be moderate-to-vigorous physical activity (MVPA) or vigorous physical activity (VPA), since MVPA and VPA has been associated with lower levels of adiposity. However, it is unknown whether physical activity may modify the association between rapid infant weight gain and later adiposity. **PURPOSE:** To examine whether MVPA and VPA modifies the associations between weight gain the first year of life and total FM and trunk FM in youth. **METHODS:** We used data from a sub-cohort of the Norwegian Mother and Child Cohort Study (MoBa), including assessment of total FM and trunk FM by dual-energy X-ray absorptiometry (DXA), and MVPA (≥2296 cpm) and VPA (≥4012 cpm) assessed by Actigraph accelerometers. Weight gain was calculated as change in weight z-scores between birth and 1 year. We used multiple regression analyses to examine the association between infancy weight gain and total FM and trunk FM (with adjustments for sex, birth weight, gestational age, height and family income), and included the interaction term weight gain x MVPA and weight gain x VPA to

examine the modifying effect of MVPA and VPA (adjustments for monitor wear time included). **RESULTS:** The mean age (sd) of the 147 participants (45.6% girls) were 11.0 (0.61) years. There was a positive association between infancy weight gain and total FM (B=1.1, 95%CI= 0.40, 1.8) and trunk FM (B=0.5 95%CI= 0.16, 0.89). MVPA did not modify the association between infancy weight gain and total FM (p=0.157) and trunk FM (p=0.116), whereas VPA modified both total FM (B (gain x VPA) = -0.061, p=0.026) and trunk FM (B(gain x VPA)= -0.034, p=0.014). **CONCLUSION:** These findings indicate that VPA, but not MVPA, modifies the associations between weight gain during the first year of life and total FM and trunk FM in youth. Vigorous intensity PA may be considered as one of many public health strategies to curb childhood obesity, especially in those who are prone to obesity due to rapid infant weight gain.

601 Board #3 May 31 1:00 PM - 3:00 PM

Physical Activity And Markers Of Inflammation In Children

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(No relationships reported)

Inflammatory markers have been linked to adiposity, atherosclerosis and risk factors for development of cardiovascular disease. Regular physical activity (PA) is associated with potential benefits for many health outcomes. However, few studies have examined the associations between objectively assessed PA and inflammatory markers in healthy children. Moreover, these studies often include small sample sizes and few inflammatory markers.

PURPOSE: To examine the associations of objectively measured overall PA (counts per minute, CPM), moderate-to-vigorous PA (MVPA) and vigorous PA (VPA) with markers of inflammation in children.

METHODS: Of the 1467 children invited in 2005-2006, 1306 children participated, giving an overall participation rate of 89%. Inflammatory markers were; C-reactive protein (CRP), leptin, adiponectin, plasminogen activator inhibitor-1 (PAI-1), tumor necrosis factor α (TNF α) and interleukin-6 (IL-6). PA was assessed objectively by accelerometry (ActiGraph 7164). Outcomes variables were overall PA (CPM) as well as time spent in MVPA (> 2000 CPM) and VPA (> 6000 CPM). We used linear regression analysis to examine the association between PA and inflammatory markers, and one-way analysis of variance to analyze differences between groups. **RESULTS:** Time spent in VPA was negatively associated with CRP (β = -0.162), PAI-1 (β = -0.138) and leptin (β = -0.208) ($p < 0.001$ for all) after adjustment for sex. Further, there was a significant negative association between overall PA (CPM) and MVPA with CRP, PAI-1 and leptin ($p < 0.05$ for all), although the magnitude of association was less pronounced compared with VPA. We observed a graded association of CRP, PAI-1 and leptin across tertiles of VPA ($p \leq 0.01$ for all). **CONCLUSIONS:** Our results show that PA were negatively associated with inflammatory markers in Norwegian nine-year old children. Despite this being a cross-sectional study, the results indicate the importance of overall PA level. The association was most pronounced for VPA, suggesting that vigorous intensity activity may be more beneficial than moderate intensity in relation to inflammatory markers.

602 Board #4 May 31 1:00 PM - 3:00 PM

Moderate-to-vigorous Physical Activity Predicts Change In Clustered Cardio-metabolic Risk In 10-year-old Children

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(No relationships reported)

PURPOSE: Examine the independent, prospective associations between objectively measured sedentary time and sub-components of physical activity with individual and clustered cardio-metabolic risk factors in 10-year-old healthy children.

METHODS: We included 700 boys and girls in which sedentary time, and physical activity were measured by accelerometry. Systolic blood pressure, waist circumference and fasting blood sample (total cholesterol, high-density cholesterol, triglycerides, glucose, fasting insulin) were measured by standard clinical methods and analysed individually and as a clustered cardio-metabolic risk score standardized by age and sex (z score). Exposure and outcome variables were measured at baseline and at follow-up seven months later.

RESULTS: Sedentary time was not associated with any of the individual cardio-metabolic risk factors nor clustered cardio-metabolic risk in prospective analyses. Moderate physical activity at baseline predicted higher levels of triglyceride (β -0.086 (-0.160 - -0.013, $p=0.021$) and insulin resistance (β -0.070 (-0.132 - -0.008, $p=0.027$) at follow-up independent of sex, socio-economic status, Tanner stage, monitor wear time, and waist circumference. One SD increase in moderate-to-vigorous physical activity predicted 0.056 SD lower clustered cardio-metabolic risk at follow-up ($p=0.043$). However, these associations were attenuated following adjustment for waist circumference.

CONCLUSIONS: Physical activity, but not sedentary time, is prospectively associated with cardio-metabolic risk in healthy children. Public health strategies aimed at improving children's cardio-metabolic profile should strive for increasing levels of physical activity of at least moderate intensity rather than reducing sedentary time.

603 Board #5 May 31 1:00 PM - 3:00 PM

High And Low Impact Physical Activity Substitution And Pediatric Bone Density

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(No relationships reported)

PURPOSE: To determine if substituting time spent in high and low impact physical activity (PA) associated with changes in pediatric bone mineral density (BMD) and content (BMC).

METHODS: We analyzed data from the longitudinal Bone Mineral Density in Childhood Study (N=1,856 with up to 7 visits). Spine, total hip, and femoral neck areal BMD (aBMD) and total body less head (TBLH) BMC were measured by DXA, with sex and age specific Z-scores, adjusted for height calculated. Hours per day (h/d) spent in total, high impact, and low impact PA were self-reported. Partition and isotemporal substitution-modeling frameworks were applied to linear mixed models; the latter framework to test how substituting high for low impact PA (and vice versa) affects bone health in an observational study. Statistical interactions with sex, self-reported race (Black or non-Black), genetic ancestry (African, European or Asian), and bone fragility genetic scores for Europeans only (percentage of BMD lowering alleles carried at 63 common loci and at 18 WNT signaling loci) were separately tested.

RESULTS: In partition models, high impact PA was positively associated with each aBMD bone Z-score (e.g., total hip aBMD: $\beta=0.05$, $P=5.5 \times 10^{-14}$) and TBLH-BMC Z-score ($\beta=0.05$, $P=4.0 \times 10^{-22}$), whereas low impact PA was not associated with each aBMD bone Z-score (e.g., total hip aBMD: $\beta=0.00$, $P=0.878$) and TBLH-BMC Z-score ($\beta=0.01$, $P=0.125$). In isotemporal substitution models, replacing 1 hour per day of low impact PA for high impact PA was associated with an increase in each aBMD bone Z-score (e.g., total hip aBMD: $\beta=0.05$, $P=1.6 \times 10^{-8}$) and TBLH-BMC Z-score ($\beta=0.06$, $P=4.2 \times 10^{-15}$). Conversely, the opposite 1 hour per day substitution was associated with a decrease in each aBMD bone Z-score (e.g., total hip aBMD: $\beta=-0.05$,

$P=1.6 \times 10^{-8}$) and TBLH-BMC Z-score ($\beta=-0.06$, $P=4.2 \times 10^{-15}$). The substitution associations were similar by sex and race, genetic ancestry, the common variant genetic score, and the WNT signaling genetic score (interaction P-values >0.05).

CONCLUSION: Dedicating a significant proportion of daily PA to high impact activities is beneficial to the growing skeleton for all children. Importantly, replacing low impact PA with more high impact PA is beneficial even for European children genetically predisposed to bone fragility.

604 Board #6 May 31 1:00 PM - 3:00 PM

Sedentary Time and Anthropometric Characteristics Among Hispanic Children in Puerto Rico

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(No relationships reported)

Too much sedentary time (ST) is associated with poor overall health among adults. However, the effect of ST on children's health is not clear. **PURPOSE:** To evaluate the association between ST, percent of the day in ST (ST%), sedentary breaks (STB), length of sedentary breaks (LSTB) and anthropometric measurements among Hispanic children in Puerto Rico. **METHODS:** A group of 114 children (54 girls and 60 boys; mean age = 7.0 ± 0.73 years, range = 6 to 8 years) completed measurements of height, weight, skinfolds, and waist circumference. They also wore an accelerometer for 7

days attached to an elastic belt placed on the right hip area. T-tests were conducted to detect gender differences, and Spearman correlations to detect associations between ST, ST%, STB, LSTB, age, and anthropometric variables. **RESULTS:** No gender differences were detected for ST (4.9±1.2 hrs/day girls, 4.9±1.1 hrs/day boys), ST% (41.1±8.2 % girls, 40.5±6.6 % boys), STB (4.7±2.1 breaks/day girls, 5.0±1.8 breaks/day boys), LSTB (65.3±2.4 min/day girls, 63.4±2.1 min/day boys), and most anthropometric measurements (BMI percentile (65.7±29.8 girls, 64.5±28.7 boys), waist circumference (57.5±8.8 cm girls, 57.3±5.9 cm boys), waist to height ratio (0.45 ± 0.08 girls, 0.46 ± 0.03 boys). Percent body fat was higher in girls compared with boys (21.1±5.9 % girls, 16.6±7.2 % boys; $P < 0.01$). No correlation was observed between sedentary related measures (ST, ST%, STB, LSTB), anthropometric and body composition measures. However, age correlated with ST ($\rho = 0.27$, $p < 0.01$), ST% ($\rho = 0.30$, $p < 0.01$), STB ($\rho = 0.29$, $p < 0.01$), LSTB ($\rho = 0.24$, $p < 0.01$), BMI percentile ($\rho = 0.19$, $p = 0.04$), percent body fat ($\rho = 0.33$, $p < 0.01$), and waist circumference ($\rho = 0.40$, $p < 0.01$). **CONCLUSIONS:** Although too much ST is not likely a concern, the observed increase in ST, BMI percentile, percent body fat, and waist circumference with age in this group of young children could represent a future health problem. Interventions must be implemented to help reduce this possible trend. Funded by University of PR-FIPI Institutional Grant.

605 Board #7 May 31 1:00 PM - 3:00 PM
Longitudinal Changes in Normalized Grip Strength is Associated with Cardiometabolic Health Maintenance and Improvement among Adolescents.

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(No relationships reported)

PURPOSE: There is an association between normalized grip strength (NGS) and prevalent cardiometabolic health among adolescents; and yet, what remains to be determined is the extent to which changes in NGS predict subsequent changes in health status. The purpose of this study was to determine the longitudinal effect of NGS on changes in health status in a cohort (n=368) of adolescents.

METHODS: Cardiometabolic risk variables included elevated fasting glucose, high blood pressure, elevated plasma triglycerides levels, and low HDL-cholesterol. Fully-adjusted, multinomial logistic regression models were used to quantify the odds of experiencing health maintenance (no risk factors identified at either time point), health improvement (presence of ≥ 1 baseline risk factor, and no risk factors at follow-up), or onset of health risk (no risk factor at baseline, and presence of ≥ 1 risk factor at follow-up) over a 2-year period. **RESULTS:** For every 0.05 unit increase in NGS from baseline, there was a 1.35 (95%CI: 1.05-1.74) and 1.33 (95%CI: 1.06-1.73) increased odds for health maintenance and health improvement, respectively, even after adjusting for baseline body fat percentage, baseline grip strength, cardiorespiratory fitness and objectively-measured physical activity. Conversely, improvements in NGS were inversely associated with odds of onset of health risk (OR: 0.74, 95%CI: 0.57-0.95). **CONCLUSIONS:** Longitudinal increases in NGS are associated with health maintenance and health improvements in adolescent boys and girls. On the other hand, declines in NGS could be used as a prognostic indicator of onset cardiometabolic risk and to identify adolescents that would benefit from lifestyle interventions to improve muscular fitness and reduce risk.

606 Board #8 May 31 1:00 PM - 3:00 PM
Physical Activity Bout Patterns From Childhood Through Adolescence: NHANES 2003-2006

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(No relationships reported)

Moderate-to-vigorous intensity physical activity (MVPA) accumulated in bouts greater than 5 minutes in length are related to beneficial cardiometabolic health outcomes independent of total MVPA in youth. While it has been established that total MVPA decreases as youth age, the associations between age and MVPA bout patterns in youth is unknown. **Purpose:** To identify physical activity (PA) bout patterns by age and sex in 6-18 years old youth. **Methods:** This cross-sectional analysis examined accelerometer data from the National Health and Examination Survey '03-'04 and '05-'06. Participants (n=4069; male=2036, female=2033; mean age 12.5 ± 3.6yrs) were required to wear uniaxial accelerometers set on 1-minute epochs on the right hip for 7 days. Included data had a minimum of 3 days of at least 10 hours of valid wear time. PA patterns were assessed by comparing percent time of total MVPA in sporadic (1-4 minutes), short (5-9 minutes), and medium-to-long (med-long) (≥ 10 minute) bouts of MVPA by age and sex. Multivariable regression analysis was used to determine independent associations of age, sex, race, ethnicity, income, and PA bout patterns. **Results:** Data are presented as percent time. Significant differences by age group were

observed for: sporadic bouts (6-7yrs, 91.2 ± 3.9; 8-9yrs, 92.5 ± 4.1; 10-11yrs, 93.7 ± 4.2; 12-13yrs, 93.7 ± 5.4; 14-15yrs, 93.4 ± 6.3; and 16+yrs, 93.5 ± 8.3; $p < 0.001$), short bouts (6-7yrs, 6.4 ± 2.7; 8-9yrs, 5.5 ± 2.8; 10-11yrs, 4.7 ± 3.1; 12-13yrs, 4.5 ± 3.8; 14-15yrs, 4.6 ± 4.5; and 16+yrs, 4.6 ± 5.8; $p < 0.001$), and med-long bouts (6-7yrs, 2.4 ± 1.8; 8-9yrs, 2.0 ± 2.1; 10-11yrs, 1.6 ± 1.9; 12-13yrs, 1.8 ± 2.6; 14-15yrs, 2.0 ± 3.1; and 16+yrs, 1.9 ± 4.4; $p = 0.002$) of MVPA. Males participated in less sporadic bouts of MVPA (male: 91.7% ± 2.6; female: 94.6% ± 5.6, $p < 0.001$), more short bouts of MVPA (male: 5.8% ± 4.3; female: 4.1% ± 4.1, $p < 0.001$), and more med-long bouts (male: 2.5% ± 3.1; female: 1.4% ± 3.0, $p < 0.001$) of MVPA. Results remained significant after multivariable adjustment for sex, race/ethnicity, income, and age. **Conclusions:** In addition to decreasing total minutes of MVPA, there are also changes in PA bout patterns as youth age. Changes in PA bout patterns by age are moderated by race/ethnicity and sex. Future interventions could focus on changing PA patterns in addition to increasing total minutes of MVPA.

B-11 Thematic Poster - Landing Biomechanics

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
 Room: 101

607 **Chair:** Kevin R. Ford, FACSM. *High Point University, High Point, NC.*

(No relationships reported)

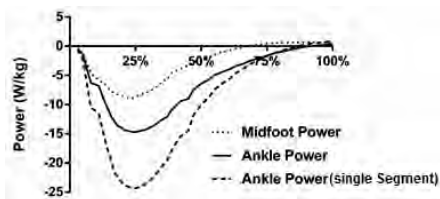
608 Board #1 May 31 1:00 PM - 3:00 PM
The Role of the Midtarsal Joint in Drop Landings

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(No relationships reported)

Multi-segment foot models have allowed the foot to be studied in greater detail, in particular separating the functions of the ankle andmidtarsal joints. While these models have been used in walking and running, they have been limited in application to other sports movements, such as jumping and landing. **Purpose:** To investigate the role of themidtarsal and ankle joints in energy absorption during drop landings using a multi-segment foot modeling approach, and to compare these results with those obtained from a single segment model. **Methods:** Twelve volunteer female collegiate athletes [age: 20.5±1.4 years, height: 162.1±5.4 cm, weight: 58.2±6.1 kg] performed one legged barefoot drop landings from a height of 40 cm. Hanging from wooden rings, each subject dropped onto two adjacent force platforms, so that the hindfoot and forefoot contacted separate plates. Sufficient trials were performed until 3 accurate landings were achieved. 28 reflective markers, attached to the subjects' dominant leg, were used to create a custom kinetic multi-segment foot model. Ankle andmidtarsal joint angles, powers, and total work were calculated from initial contact through the lowest point of the subject's center of mass, representing the energy absorption phase of the landing. **Results:** Themidtarsal joint was plantarflexed prior to contact and moved through nearly as great a range of motion (90%) as the ankle (24.6 ± 7.3° ankle vs. 21.9 ± 7.5°midtarsal), while performing two-thirds the amount of work done by the ankle (0.63 ± 0.21 J/kg at the ankle vs. 0.42 ± 0.17 J/kg at themidtarsals). The single segment foot overestimated both range of motion (40.4 ± 8.8°) and work done (1.05 ± 0.28 J/kg) by 40%. **Conclusion:** Themidtarsals can play a substantial role in impact energy absorption, which may have implications in injury prevention strategies. Future studies should attempt to separate active (i.e. muscles) and passive (e.g. ligaments, windlass mechanism, etc.) contributions tomidtarsal function.



609 Board #2 May 31 1:00 PM - 3:00 PM
Effects of Achilles Tendon Taping on Joint Energetics in Jumping and Landing

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(No relationships reported)

Taping of the Achilles tendon is used by athletes to manage pain during recovery. Previous work has shown differences in ankle work but no differences in force

production with various ankle taping techniques during athletic tasks. **PURPOSE:** To examine the effects of an Achilles tendon assistive taping technique and gender on lower extremity joint work, power generation, and power absorption during jumping and landing in healthy recreational athletes. **METHODS:** 29 subjects - 16 males (20.9 ± 2.4 years, 1.79 ± 0.06 m, 79.0 ± 11.9 kg) and 13 females (21.4 ± 3.2 years, 1.66 ± 0.06 m, 66.1 ± 7.6 kg) - participated in the study. Each subject's dominant limb underwent an Achilles tendon assistive taping procedure by a certified athletic trainer. Subjects performed 5 trials of a stop jump task in both a taped and non-taped condition (randomized test order). The first landing and subsequent jump were analyzed with a 10-camera motion analysis system (240Hz). Joint power was determined based on data from 2 embedded force plates (1920 Hz) using inverse dynamics and was integrated to yield joint work. 2x2 ANOVAs were performed ($p < 0.05$) to determine gender and taping condition effects on peak power generation, power absorption, and work at each joint during landing and jumping. **RESULTS:** Subject height ($p < 0.001$) and mass ($p = 0.002$) differed based on gender, but age ($p = 0.633$) did not. No significant interactions and no taping condition main effects existed for power or work during either jumping or landing. A main effect of gender was identified, with females showing decreased peak power generation at each joint during jumping (Table 1). **CONCLUSIONS:** The assistive taping does not alter peak power generation, power absorption or joint work during landing and jumping in healthy subjects, but gender-specific differences in power generation do exist. Future work is needed to determine the effect of this taping technique in injured athletes.

Table 1: Peak Power Generation

		Females		Males		Gender Effect
		Non-Taped	Taped	Non-Taped	Taped	
Ankle	Landing	-12.3 ± 4.6	-12.3 ± 4.5	-13.0 ± 4.6	-11.6 ± 4.8	$p = 0.863$
	Jumping	15.6 ± 5.4	13.4 ± 4.2	18.1 ± 3.8	15.9 ± 4.0	$p = 0.042$
Knee	Landing	-17.3 ± 2.9	-18.6 ± 5.5	-21.0 ± 6.0	-20.0 ± 5.4	$p = 0.077$
	Jumping	11.2 ± 2.9	11.5 ± 3.3	15.2 ± 3.5	14.7 ± 3.4	$p < 0.001$
Hip	Landing	-7.6 ± 5.0	-6.1 ± 3.2	-13.3 ± 6.1	-14.9 ± 6.1	$p = 0.040$
	Jumping	6.3 ± 5.0	4.6 ± 1.9	10.2 ± 8.1	9.6 ± 6.4	$p = 0.009$

* Units in N*m/(BW*BH*s)

610 Board #3 May 31 1:00 PM - 3:00 PM
Lateral Extrinsic Foot Muscle Size Best Predicts Time To Stability In Single Leg Landing

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(No relationships reported)

A single leg, barefoot landing is a functional movement often executed in athletic events. The inability to quickly stabilize the ankle joint during a landing may contribute to injury risk. **PURPOSE:** To determine whether the size of specific medial and lateral extrinsic foot muscles can be used to predict shorter time to stability in female athletes performing single leg, barefoot landings. **METHODS:** Twenty-one female collegiate gymnasts and cheerleaders (age: 21.2 ± 1.4 years; height: 1.6 ± 0.06 m; weight: 58.1 ± 5.7 kg) completed a dominant single leg, barefoot landing onto a force plate from a height of 28 cm. The time to stability was calculated from the recorded medial to lateral force after landing. The size of the tibialis anterior (TA), tibialis posterior (TP), flexor digitorum longus (FDL), fibularis brevis (FB), and fibularis longus (FL) were measured using ultrasound imaging (12L probe, GE Logiq P6). The TA, TP, and FL were assessed at a distance of 30% from the knee joint-line to the tip of the lateral malleolus. FDL was measured at a distance of 50% from the knee joint-line to the medial malleolus while FB was measured at a distance of 50% from the knee joint-line to the lateral malleolus. Muscle sizes (thickness for the TA and TP and cross sectional area for FDL, FB, and FL) were measured from the ultrasound images ($p > 0.05$). **RESULTS:** A stepwise regression (including height, weight, and muscle size(s)) indicated that the two best predictors of time to stability were the FB and FL ($r^2 = 0.45$, FB $p = 0.002$, FL $p = 0.083$; cross-sectional areas: FB = 3.4 ± 1.2 cm², FL = 4.8 ± 1.1 cm²). **CONCLUSION:** It appears athletes with larger FB and FL had shorter time to stability. These results suggest strengthening of the lateral extrinsic muscles may be a key component in both the prevention and rehabilitation of ankle injuries among gymnasts and other barefoot athletes.

611 Board #4 May 31 1:00 PM - 3:00 PM
Landing Patterns of Collegiate Female Volleyball Players During Practice and Game Competition

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Women's volleyball is generally recognized as a high-volume jumping sport. This repetitive jumping and landing can lead to overuse injuries, especially if performed exclusively on a single-leg. While some data is available regarding jumping volume during competition, there have been few reports on jumping load during practice, and minimal characterization of the double- (DL) and single- (SL) leg landing patterns during the sport to help shape training and/or rehabilitation procedures. **PURPOSE:** To quantify and characterize the jump landing patterns that occur during women's collegiate volleyball practice and game competition. **METHODS:** Recordings from two video cameras from four consecutive competitions (three practices, one game) of 14 Division-1 collegiate women's court volleyball players were analyzed for this study. Recordings were viewed by one of two raters who noted the total number of jumps and categorized each landing as a DL landing, or SL landing on the right (SL_R) or left (SL_L) side. Repeated measures ANOVAs identified differences in jumping load, and the ratio of DL to SL, and SL_R to SL_L landings among practices and between practice and game competition ($p < 0.05$). **RESULTS:** On average, there was a significantly higher overall jumping load (practice: 66.7 ± 40.1 jumps (j), game: 41.5 ± 44.6 j; $p = 0.01$), and frequency of DL (practice: 50.5 ± 38.5 j, game: 31.9 ± 38.6 j; $p = 0.03$) and SL (practice: 16.2 ± 12.8 j, game: 9.6 ± 15.8 j; $p = 0.04$) landings during practice than games. However, individual patterns of DL to SL (practice: 0.76 ± 0.13, game: 0.75 ± 0.18; $p = 0.99$) and SL_R to SL_L (practice: 0.35 ± 0.17, game: 0.36 ± 0.39; $p = 0.89$) were consistent across competitive events. There were no significant differences in any of the jumping or landing variables between practices ($p > 0.05$), yet substantial variability of landing patterns was identified between individuals, with the percentage of DL landings ranging from 35.8-96.0% of total landings and SL_R landings ranging from 3.6-97.4% of SL landings. **CONCLUSIONS:** Volleyball players were found to jump significantly more often during practices than games, but DL and SL landing patterns remained consistent. These data may help clinicians and coaches design training and/or rehabilitation procedures to better simulate the landing demands during volleyball competition.

612 Board #5 May 31 1:00 PM - 3:00 PM
Influence of Hip Extension Strength on Landing Biomechanics In Collegiate Basketball Players

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Decreased hip strength has been suggested to contribute to landing biomechanics that increase the risk of ACL injuries. However, the relationship between hip strength and landing biomechanics is conflicting. Previous studies are limited to examining the peak torque produced during isometric or isokinetic assessments of hip strength. Understanding how the isokinetic torque production of the hip through a range of motion may help clarify the role of hip strength in landing biomechanics. **PURPOSE:** To examine the influence of hip isokinetic eccentric (ECC) and concentric (CON) work on landing biomechanics in male and female basketball players. **METHODS:** Twenty-three male (N=11, 20.5 ± 1.4 yrs, 189.2 ± 8.0 cm, 90.2 ± 10.4 kg) and female (N=12, 19.9 ± 1.4 yrs, 172.4 ± 6.8 cm, 78.9 ± 13.8 kg) Division 1 basketball players participated. Using an isokinetic dynamometer, 5 repetitions of isokinetic CON and ECC hip extension torque were measured at 60 deg/s, with the work per repetition of the middle 3 repetitions used for analyses. Established 3D motion analysis techniques were used to collect three trials of a drop vertical jump and quantify the left limb's sagittal, frontal, and transverse plane hip and knee joint excursions and peak external joint moments, normalized to body weight and height (BWHT). Separate step-wise, linear regressions determined the extent to which CON and ECC work predicted landing biomechanics in males and females. **RESULTS:** In males, the average ECC and CON work per repetition was 0.98 ± 0.15 J/BWHT and 0.92 ± 0.18 J/BWHT, respectively. In females, the average ECC and CON work per repetition was 0.91 ± 0.25 J/BWHT and 0.94 ± 0.21 J/BWHT, respectively. Greater ECC work predicted less hip adduction moment (0.40 ± 0.29 Nm/BWHT, $R^2 = 0.411$, $P = 0.025$) in females. ECC and CON work was not predictive of any other hip or knee joint excursions or peak moments in males or females (all $P > 0.05$). **CONCLUSIONS:** With the exception of hip adduction moment in females, ECC and CON hip strength was not predictive of landing biomechanics. This suggests that a combination of neuromuscular factors at the hip, such as muscle activation, combine to predict lower extremity biomechanics during dynamic activities. Further work is needed to clarify this relationship in more demanding tasks.

613 Board #6 May 31 1:00 PM - 3:00 PM
The Changes in Impacts and Soft-tissue Responses of Lower Limbs between Active and Unanticipated Landings

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 (No relationships reported)

Muscle activity patterns can be modulated in response to soft-tissue vibrations of lower extremity induced by the magnitude of the peak impact and the high loading rate of vertical ground reaction force during landing to reduce the high injury risk. However, the sudden changed pattern of unexpected landing would potentially influence the impact force (as a input signal) and the soft-tissue vibration (as a response), which may further affect the landing performance or even cause injury.

PURPOSE: To determine the biomechanical differences of impact force and soft-tissue vibration between active landing (AL) and unexpected landing (UL). **METHODS:** Twelve trained male basketball volunteers were requested to land from self-made elevated platform at three heights (30, 45, and 60cm) in two different landing maneuvers (AL & UL). The 3D force plates and accelerometers were used to collect the impact and soft-tissue vibration characteristics. The variables for AL & UL included: 1) impact characteristics: the peak of impact force (BW), maximum loading rate (kN/s) and impact frequency (Hz); 2) soft-tissue vibration: maximum amplitude (g) and damping coefficient (s^{-1}) of soft-tissue vibration of quadriceps & hamstrings. A 2 × 3 (landing style × height) repeated measures analysis of variance was used to examine the differences between conditions. **RESULTS:** For the impact characteristics, the peak of impact force (30cm: 3.90 ± 1.16 vs. 2.17 ± 0.50 ; 45cm: 4.35 ± 1.02 vs. 2.82 ± 0.80; 60cm: 4.73 ± 0.84 vs. 3.60 ± 0.64), maximum loading rate (30cm: 240.3 ± 63.8 vs. 88.4 ± 22.5; 45cm: 273.9 ± 77.3 vs. 157.3 ± 36.0; 60cm: 301.6 ± 73.3 vs. 203.3 ± 46.0), and impact frequency (30cm: 15.6 ± 2.3 vs. 7.96 ± 2.2; 45cm: 23.1 ± 2.2 vs. 8.73 ± 1.7; 60cm: 26.1 ± 2.4 vs. 10.38 ± 1.5) in UL was significantly higher than those in AL ($p < .05$) for all three drop heights, respectively. For soft tissue vibration, UL had a significantly greater maximum amplitudes of vibration of quadriceps (except for 60 cm) and hamstrings ($p < .01$) and lower damping coefficients ($p < .05$) compared with AL. **CONCLUSION:** If the neuromuscular system fails to prepare properly for an unexpected landing impact, increased magnitude of impact forces and soft-tissue vibrations emerged which might be detrimental to the impact-related injury.
 Supported by NSFC grant (81302131).

614 Board #7 May 31 1:00 PM - 3:00 PM
Effect of Different Sports on Hip and Knee Biomechanics in Adolescent Females During a Jump-Landing

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 (No relationships reported)

Anterior Cruciate Ligament (ACL) injury is common in adolescent female athletes, with those who participate in soccer (SC) being at the highest risk for primary and secondary ACL injury. However, little is known about the biomechanical differences that may contribute to the variance in injury rate between SC and other sports in adolescent females. Previous research demonstrates that college-age females who participate in SC exhibit greater frontal plane projection angle (FPPA) values than those who participate in basketball (BKB). **PURPOSE:** To assess for differences in hip and knee frontal plane kinematics between adolescent female SC and BKB players. **METHODS:** Cross-sectional study design. Females (N = 30) participating in BKB (Age = 15.33 ± 1.68 yrs; Ht = 167.14 ± 5.91 cm; Mass = 60.49 ± 9.59 kg) or SC (Age = 15.33 ± 1.68 yrs; Ht = 162.86 ± 3.84 cm; Mass = 56.55 ± 5.85 Kg). Participants had International Knee Documentation Committee Subjective Knee Form (IKDC) scores ≥ 95, were healthy at time of testing, and were matched by age and side of dominance (DOM = limb used to kick a ball). During three separate jump-landing tasks, bilateral lower extremity joint angles and moments were assessed at initial contact. Joint displacement (DSP = maximum or minimum - IC) and FPPA (2-dimensional measure of knee valgus) were calculated. Separate independent t-tests were performed to examine differences between groups. **RESULTS:** DOM hip adduction (ADD) DSP was significantly greater in the SC group (9.51 ± 1.3°) compared to the BKB group (4.9 ± 3.1°, $t_{(28)} = -5.2, p < .001$). DOM hip abduction DSP was significantly greater in the BKB group (-3.7 ± 3.2°) compared to the SC group (-1.0 ± 0.9°, $t_{(28)} = -3.1, p = .004$). DOM FPPA negative DSP (knee varus) (BSK = -9.8 ± 8.0°, SC = -5.29 ± 3.9°, $t_{(28)} = -1.96, p = .05$) and non-DOM FPPA negative DSP (BKB = -13.5 ± 4.4°, SC = -6.3 ± 3.0°, $t_{(28)} = -2.7, p = .01$) was significantly greater in the BKB group compared to the SC group. No other significant differences were observed. **CONCLUSIONS:** Greater hip ADD DSP is associated with higher ACL injury risk. Female SC players may be at increased ACL injury risk partially due to higher hip ADD DSP exhibited during

landing as compared to the BKB group. The ability of female BKB players to maintain greater knee varus when compared to SC may also contribute to the variance in ACL injuries in these sports.

615 Board #8 May 31 1:00 PM - 3:00 PM
Landing Biomechanics Influence Circulating Stress Hormone Levels

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High training load (HTL) exposure and stiff landing biomechanics increase an individual's risk of lower extremity injury during sport and physical activity participation. **Purpose:** To determine the influence of movement profile on systemic stress response to HTL exposure. **Methods:** 40 physically active, healthy, college-aged females were enrolled in this study and were assigned to a low-risk / soft (n=19; age=20.5±1.9 yr, height=1.44±0.44 m, mass= 64.5±7.8 cm) or a high-risk / stiff (n=21; age=20.4±1.3 yr, height=1.63±0.23 m, mass= 64.9±6.1 cm) movement profile group defined by The Landing Error Scoring System. Participants completed five cycles of 5-minute treadmill running at a speed coincident with 110-120% ventilatory threshold and 10 jump-landings from a 30 cm box. Blood samples were collected at baseline and 30 minutes following HTL exposure. Menstrual cycle phase, prior diet and exercise were controlled. Samples were analyzed using commercially available ELISA kits to determine serum cortisol concentrations [C]. A two-way mixed model ANOVA was used to evaluate the effect of movement profile on systemic stress response to HTL exposure. **Results:** No significant movement profile-by-time interactions were observed ($F_{1,38} = 0.157, p > 0.05$). There were significant main effects for group ($F_{1,38} = 10.81, p < 0.05$) and time ($F_{1,38} = 9.64, p < 0.05$), with a high-risk / stiff movement profile being associated with greater overall circulating cortisol, and HTL exposure inducing increases in cortisol in both movement profile groups. Movement profile and time descriptive statistics and effect sizes are presented in table 1. **Conclusions:** A high-risk / stiff movement profile is associated with elevated cortisol, a biomarker of systemic stress. Movement profile may moderate systemic stress levels via a high or low level of biomechanical efficiency and shielding against or amplifying mechanical loads experienced during activities of daily life and physical activity.

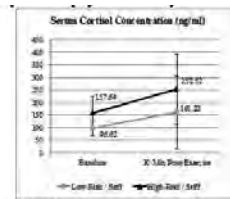


Figure 1. - Raw group serum cortisol response to HTL exposure.

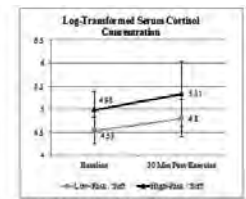


Figure 2. - Log-transformed group serum cortisol response to HTL exposure.

Table 1. - Means, standard deviations, 95% confidence intervals, and effect sizes for the main effects of movement profile and half training load exposure on serum cortisol concentrations [C].

	Baseline			30 min Post-Exercise			Cohen's D
	n	Mean (SD)	95% CI	n	Mean (SD)	95% CI	
Log Cortisol [C]	40	4.77 (0.42)	[4.62, 4.9]	40	5.08 (0.76)	[4.84, 5.32]	0.21
Raw Cortisol [C] (ng/ml)	40	129.66 (59.84)	[110.11, 147.2]	40	209.15 (147.81)	[165.33, 254.69]	0.71
Low-Risk/Soft							
High-Risk/Stiff							
Log Cortisol [C]	19	4.64 (0.96)	[4.41, 4.91]	21	5.16 (0.41)	[4.98, 5.42]	0.64
Raw Cortisol [C] (ng/ml)	19	128.92 (108.12)	[80.31, 177.53]	21	205.98 (118.30)	[154.46, 253.68]	0.67

B-12 Free Communication/Slide - Exercise Psychology

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
Room: 401

616 **Chair:** Dane B. Cook, FACSM. *University of Wisconsin-Madison, Madison, WI.*

(No relationships reported)

617 May 31 1:00 PM - 1:15 PM

Real-time Assessment of the Relationship Between Exercise and Psychological Stress in Overweight Women

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Although higher physical activity (PA) levels are associated with lower psychological stress, real-time associations between PA and stress have not been adequately examined. It is unclear whether stress more often serves as a barrier to PA, thus reducing the likelihood of exercising when stress is high, or whether PA is used as a coping strategy for reducing stress. **PURPOSE:** This study combined objective PA monitors with real-time psychological stress assessments to examine the pattern of stress prior to and following an exercise bout and to determine whether the magnitude of stress predicted PA engagement. **METHODS:** 52 women with overweight/obesity (BMI: 31.5±4.5 kg/m², age: 48.9±9.0 years) were instructed to respond to 5 semi-random prompts delivered daily via their smartphone over a 14-day period while simultaneously wearing an objective PA monitor (SenseWear armband). Stress ratings at each prompt were reported using a 1-7 Likert scale (ranging from 'not at all' to 'very much so'). Moderate-to-vigorous intensity PA bouts (MVPA; ≥3 METs & ≥ 10 minutes in duration) were identified and examined in relation to stress ratings. **RESULTS:** Compliance to answering the surveys (88.0±9.1%) and wearing the armband was high (13.1±1.9 days; 14.1±1.6 hrs/day). On average, participants engaged in 17.3±16.2 min/day of bout-related MVPA and stress ratings were 2.17±0.03 (mean±SE). There was no association between each participant's total MVPA minutes and average stress over the 14-day period ($r=-0.03$, $p=0.81$). However when examined acutely, stress decreased in the time preceding exercise and continued to decrease following exercise ($p=0.04$). Further, when stress was high during the first prompt of the day (stress≥5; 16% of all cases), participants were significantly less likely to exercise on that day compared to when stress was low (stress<5; $\beta=0.70$, $p=0.004$). **CONCLUSIONS:** When PA and stress were assessed using a unique combination of real-time data collection methods, overweight women did not appear to use PA as a method of coping with stress; rather PA occurred more often when stress was low and on a downward trajectory. These findings suggest that reducing stress may be a useful strategy for promoting PA adoption. Future studies should examine this relationship in other populations, including those with higher stress levels.

618 May 31 1:15 PM - 1:30 PM

Age Moderates the Association Between Short Sleep Duration and Reduced Exercise Frequency

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(No relationships reported)

Chronic short sleep increases the risk of a driving accident, obesity and cardiovascular disease mortality. Whether the frequency of resistance and aerobic exercise is reduced among short sleepers has not been examined across a broad range of ages. **PURPOSE:** To assess relationships between sleep duration and self-reported aerobic or resistance exercise frequency according to age. **METHODS:** 8,479 female and male online game players, aged 13 to 79 years, completed a lifestyle survey. Participants provided demographics (age, gender, education level), typical sleep duration, and typical weekly frequency of aerobic and resistance exercise. Data also were obtained on smoking and caffeinated coffee and tea use. Sleep duration (short [< 7 hours per night] vs. normal [7 to 9 hours per night]) x Age (13-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79) ANCOVAs were used to examine relationships. **RESULTS:** Compared to normal sleepers (68% of the sample), short sleepers reported fewer weekly resistance (1.77 vs. 1.99) and aerobic exercise (2.62 vs. 2.92) bouts, effects that interacted with age (RESISTANCE: sleep x age interaction $F=2.243$, $P=.036$; AEROBIC: sleep x age interaction $F=2.142$, $P=.046$). The sleep x age interaction remained significant for both resistance ($F=2.744$, $P=.012$) and aerobic ($F=2.449$, $P=.023$) exercise after including

gender, education level, smoking and caffeinated coffee and tea in the models as covariates. Post-hoc tests showed that compared to normal sleepers, weekly resistance exercise frequency was lower in 40-year old (1.46±1.61 [n=428] vs. 1.75±1.66 [n=752], $t=-2.892$, $df=1,178$, $P=.004$) and 50-year old (1.50±1.57 [n=593] vs. 1.81±1.64 [n=1161], $t=-3.741$, $df=1,752$, $P<.001$) short sleeper groups only. Compared to normal sleepers, weekly aerobic exercise frequency was lower in the 40-year old (2.32±1.83 [n=435] vs. 2.82±1.98 [n=756], $t=-4.282$, $df=1,189$, $P<.001$), 50-year old (2.58±2.06 [n=597] vs. 3.04±1.98 [n=1173], $t=-4.572$, $df=1,160.228$, $P<.001$) and 60-year old (2.81±2.04 [n=455] vs. 3.05±1.99 [n=1017], $t=-2.115$, $df=1,470$, $P=.035$) short sleepers. **CONCLUSION:** Age moderates the association between short sleep duration and self-reported aerobic and resistance exercise in online game players.

619 May 31 1:30 PM - 1:45 PM

Exploring The Link Between Exercise Identity And Intervention Dosage: I-fit (Initiating Feelings Of Individual Transformation)

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(No relationships reported)

Adolescent overweight and obesity in the United States has increased in past decades, resulting in numerous physiological and psychological consequences. Obesity interventions often aim to increase physical activity (PA). Such interventions may strengthen Exercise Identity (EI). A strong EI has been positively related to long-term PA engagement, as individuals seek to engage in behaviors congruent with the role identity of "exerciser." Greater dosage of PA intervention may progressively increase EI, and enhance future exercise behavior. However, the relationship between PA intervention dosage and EI in an overweight and obese adolescent population is unclear.

PURPOSE: To determine if a PA intervention, when delivered in varying dosages, may strengthen an overweight or obese adolescent's EI.

METHODS: Fifty overweight and obese adolescents (age=14.16 ± 1.88 years, BMI=35.66 ± 7.87 kg/m², BMI percentile=97.5% ± 3.7%) were recruited from a behavior change summer camp, which included a PA intervention component. Age, gender, height, and weight were collected, and BMI was calculated. The participants were categorized into three separate groups, according to length of PA intervention (dosage): 3 week PA dosage, 4-5 week PA dosage, and 6-7 week PA dosage. Participants completed the Anderson Exercise Identity Scale and 3 Day Physical Activity Recall (3DPAR) at pre- and post-intervention. Group comparisons of EI were made using two-way ANOVA. Changes in vigorous physical activity (VPA) within groups were calculated using Log-Rank, Kaplan-Meier, and Wilcoxon. Activities on the 3DPAR were categorized and coded to compare exercise behavior within groups.

RESULTS: Upon comparison, the mean EI in the 6-7 week intervention group significantly differed from other group means and resulted in a significant increase in EI within groups ($p<0.001$). All intervention groups demonstrated significant increases in VPA ($p<0.05$), and complied with National PA Guidelines of 60+ minutes of MVPA daily; VPA performed on at least 3 days/week.

CONCLUSION: Exercise Identity may be increased in overweight and obese adolescents following a physical activity intervention. Greater dosage of physical activity intervention will result in greater benefits to Exercise Identity, and may ultimately enhance long-term exercise behavior.

620 May 31 1:45 PM - 2:00 PM

Physical Activity Beliefs in Middle-aged, Weight-challenged Women with Sedentary Jobs

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(No relationships reported)

Physical inactivity, overweight, and obesity are major public health problems in the United States and in the developed world, leading to increased morbidity and mortality. More information is needed regarding physical activity beliefs, attitudes, and perceived self-control among those who are currently sedentary, weight-challenged, and who are frequently underserved by the health/fitness industry.

Purpose: To elicit physical activity beliefs about feasibility, pleasure, and movement descriptions from middle-aged, weight-challenged women with sedentary jobs.

Method: Open-ended questions were utilized throughout individual 30-minute interviews with 23 female participants (age: $M = 52.0$, $SD = 7.3$; BMI: $M = 34.2$, $SD = 9.79$). The intention of the questions was to obtain in-depth insights into participants' beliefs, attitudes, perceived norms, and physical activity behaviors. Questions were asked regarding physical activity descriptions, preferences, pleasurable, and motivating phrases used by physicians and fitness professionals. After the interview process, participants were divided into those who reported they were completely sedentary (12 non-doers) and those who reported they regularly engaged in physical activity (11 doers).

Results: A content analysis and independent *t*-test revealed that non-doers were significantly less active and had more perceived barriers to physical activity (4.58 + 1.88) than doers (1.27 + 1.49; $p < 0.05$). The most frequently cited perceived barriers were injuries, caregiving responsibilities, time, age, dislike of sweating, and depression. Non-doers were significantly more likely to prefer easy-to-moderate intensities, while doers preferred moderate-to-vigorous intensities. Non-doers were also significantly less likely than doers to report physical activity as pleasurable, and they were more likely to cite needing an exercise buddy. The most frequently cited pleasurable activities in both groups were yoga, movement to music, stretching, and walking.

Conclusions and implications: This study provides useful information for health educators and health/fitness professionals seeking to promote physical activity among middle-aged women with weight challenges.

621 May 31 2:00 PM - 2:15 PM

Body-heart-brain Interaction On Exercise: Effects Of Intensity On Inhibitory Control, Affect, Autonomic Cardiac Function And Brain Oxygenation

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(No relationships reported)

Recent work suggests that inhibitory control influences affective regulation and is an important neurobiological mechanism that contributes to physical activity behavior. However, the effects of exercise intensity in this complex interaction body-heart-brain remain unclear. **PURPOSE:** Investigate the effects of exercise intensity on inhibitory control, affect, autonomic function and prefrontal cortex (PFC) oxygenation. **METHODS:** 37 sedentary young adults were randomly assigned to two experimental conditions (control or exercise). For the exercise condition, a maximum incremental test was performed on a cycle ergometer with continuous measurements of PFC oxygenation, heart rate variability (HRV), inhibitory control (Stroop test), associative and dissociative thoughts (ADT) and affect scale every 2 minutes at each of 8 intensity increments. For the control condition, the same assessments were carried out, but participants sat on a cycle ergometer without active pedaling. We evaluated the effects with a two-way repeated measures ANOVA with *Bonferroni* adjustments to compare the effects and interactions of condition and intensity. Then, *Pearson's correlations* to evaluate the relationship between affect and inhibitory control, ADT, HRV and PFC oxygenation. **RESULTS:** Intensities above the ventilatory threshold (VT) induced poorer inhibitory control ($F=33.64$; $p < 0.001$), more ratings of unpleasantness ($F=200.60$; $p < 0.001$), increased HRV activity ($F=29.96$; $p < 0.001$) and increased oxygenation of the PFC ($F=55.97$; $p < 0.001$). Pleasure perception was correlated with ADT at almost all intensities from 2-VT to VT+2 ($r_s > -0.33$, $p_s < 0.05$). We also found pleasure correlation with HRV lower frequencies analysis ($r = -0.34$; $p < 0.05$) and ratio between low and high frequency ($r = -0.33$; $p < 0.05$), in the last stage of intensity, and to PFC deoxy was found at VT+2 intensity ($r = -0.37$; $p < 0.05$). **CONCLUSION:** Exercise at high intensities reduces inhibitory control and affect (ratings of pleasantness). Displeasure correlates to increases in thoughts associated to exercise, and at high intensities, displeasure is correlated with PFC deoxygenation and sympathetic activity. These findings strengthen the existence of an integrative body-heart-brain system and suggests a role of the exercise intensity in this interaction.

622 May 31 2:15 PM - 2:30 PM

Associations Between Mother'S And Children'S Moderate-to-vigorous Activity And Sedentary Time In The Family Context

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(No relationships reported)

Little is known about association between moderate-to-vigorous physical activity (MVPA) and sedentary time (ST) among mothers and their children in different settings (e.g., home, outside of home, weekday vs. weekend).

PURPOSE: (1) Describe the association of MVPA and ST among mothers and their children, overall and while they are at home together, (2) determine how children's and parents' characteristics, and setting, moderate the association in their respective MVPA and ST.

METHODS: We used Healthy Families baseline data from 55 mothers and their children (aged 3-5 years [$n=25$] and 10-13 years [$n=30$]). MVPA and ST data were collected using accelerometry over a seven day period. Proportion of time in sedentary behavior and MVPA between 08:00 h and 20:00 h was calculated. Mixed-effects models were used to examine the association between mothers' levels of ST and MVPA and those of their children.

RESULTS: There was little variability in levels of ST and MVPA by time of day among mothers or children, overall and while at home together. After controlling for child and parent characteristics, and setting variables, mother-child ST and MVPA levels were positively associated ($P < 0.001$). The association for ST and MVPA were 2.2 times ($\beta = 0.254$ versus $\beta = 0.116$) and 1.7 times ($\beta = 0.365$ versus $\beta = 0.215$) stronger, respectively, when mother and child were at home together (compared to when one or neither were at home). The association did not differ by day of the week.

CONCLUSION: MVPA and ST in mothers and their children are directly associated, and that association differed by changes in setting. These results support the rationale for developing a family-centered interventions that take place in the home to increase PA and decrease ST.

Variables	Models	
	Child's ST	Child's MVPA
Mother's ST/MVPA	0.116 (0.050, 0.182)*	0.215 (0.066, 0.363)*
Mother's ST/MVPA by both at home	0.138 (0.059, 0.217)*	0.150 (0.013, 0.286)*

*adjusting for child's gender, child's age group, mother's BMI, age, education, race/ethnicity, family income to needs ratio, number of electronic devices at home, number of available PA equipment pieces at home, day of the week, both at home or not. * $P < 0.001$

623 May 31 2:30 PM - 2:45 PM

A New Test to Measure Neuromuscular Fatigue During and Immediately After Cycling Exercise: A Reliability Study

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(No relationships reported)

Neuromuscular (NM) fatigue has often been measured in human participants through single-joint isometric exercise tests. However, this task is not representative of whole-body exercise (WBE) such as running, and cycling. Furthermore, most studies assessing NM fatigue from WBE have delayed measurement for 1-4 minutes after task failure, despite the knowledge that the NM system can recover quickly. **PURPOSE:** To demonstrate the reliability of a new cycling ergometer for the measurement of NM fatigue in healthy subjects during and immediately after WBE. **METHODS:** A sample consisting of 12 healthy adult males and females aged 19 to 32 was recruited. Each subject performed a fatiguing protocol on the new cycling ergometer on two separate occasions. This protocol had subjects pedal until task failure at pre-determined power outputs scaled to their body weight that increased after NM assessments performed at three-minute intervals. NM assessments included voluntary and evoked force production of the quadriceps measured through instrumented pedals within the ergometer. Evoked contractions were achieved through electrical nerve stimulation and transcranial magnetic stimulation. Reliability was determined with intraclass correlation coefficients (ICC) and coefficients of variation (CV).

RESULTS: During the two sessions, the new cycling test produced a significant mean percent reduction in maximal voluntary contraction (MVC) force from pre to post test of $36 \pm 12\%$ ($p < .0001$). There was no significant difference in MVC measured on the ergometer between sessions ($p > .05$), with excellent relative (ICC = 0.97 ± 0.06) and absolute reliability (CV = $3.2 \pm 1.6\%$). Evoked twitch force, a measure of peripheral fatigue, was reduced by $46 \pm 14\%$ ($p < .0001$) from pre to post test and showed excellent reliability as well (ICC = 0.97 ± 0.06 ; CV = $5.2 \pm 1.5\%$). There was no significant change ($p > .05$) in percent voluntary activation, a measure of central fatigue, within each session, however there was excellent absolute reliability (CV = $1.3 \pm 0.5\%$; $97 \pm 2\%$ vs. $97 \pm 2\%$ measured at pre). **CONCLUSION:** The results suggest that the new ergometer is a reliable tool for measuring NM fatigue during and immediately after exercise. Ultimately, a greater knowledge and understanding of the etiology of NM fatigue will be gained by measuring it during WBE.

624 May 31 2:45 PM - 3:00 PM

Lap Time Variation Predicts Task Error During Dual-Task Walking In Cognitively Healthy Women

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(No relationships reported)

Variation in lap time (LTV) during a fast pace 400m walk test is a new metric thought to be an early indicator of cognitive decline in older adults. While LTV has been found to associate with executive function, no study has examined the potential for LTV to predict capacity of the brain to divide attention and meet the demand of walking and performing other tasks simultaneously. **PURPOSE:** The purpose of this study was to test the hypothesis that greater LTV would associate with larger dual-task cost during walking. **METHODS:** Fifty-two cognitively healthy (MoCA>25) women across a broad age range (30-80y) performed fast pace walking while balancing a tray (Dual1) or balancing a tray while vocalizing serial subtractions by 7's (Dual2). Task error was quantified by degrees of tray tilt and subtraction error. On a separate day, women completed a fast pace 400m walk test (40m x 10 laps) with time to complete each lap recorded. LTV was defined as standard deviation of residuals estimated from the random effects linear model where each lap time was regressed on a person-specific random intercept and random slope associated with lap. Women were categorized into tertiles based on LTV. Comparisons were made between tertiles using ANCOVA after adjusting for age, years of education, and mean lap time. **RESULTS:** Gait speed ($p=0.57$) or the percent change in gait speed ($p=0.34$) were not significantly different between tertiles for the Dual1 condition, but tilt angle was larger in women with greater LTV (tertiles 1 vs. 3: 1.37 ± 0.12 vs. 1.94 ± 0.11 degrees; $p=0.006$). During the Dual2 condition, women with greater LTV had faster gait speed ($p=0.02$), lower percent change in gait speed (tertiles 1 vs. 3: 20.5 ± 2.8 vs. $9.3\pm 2.6\%$, $p=0.02$), similar subtraction error ($p=0.58$), but larger tilt angle (tertiles 1 vs. 3: 1.24 ± 0.19 vs. 2.09 ± 0.17 degrees, $p=0.007$). **CONCLUSION:** Lap time variation identified women that exhibited greater difficulty balancing an object while walking suggesting that LTV may be sensitive to deficits in the ability to share neural substrate for sensorimotor function. Supported by a Women's Health Research Scholar Grant award from the Laura W. Bush Institute of Women's Health and University Medical Center in Lubbock, TX

B-13 Free Communication/Slide - Fitness Assessment and Training

Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
Room: 103

625 **Chair:** Kimberly Reich. *High Point University, Burlington, NC.*

(No relationships reported)

626 May 31 1:00 PM - 1:15 PM

Quantifying Physical Activity Performed During Yoga

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(No relationships reported)

The intensity of yoga is challenging to assess because the asanas of yoga include aerobic and anaerobic components; both of these components are measured through different methods. **PURPOSE:** The purpose of this project was to explore a method of assessing the physical activity completed during yoga. This study had two objectives: 1) Quantify characteristics of yoga (number of poses, body posture of a pose), and explore the concept of a pose rate (number of poses per minute of the routine), 2) Compare characteristics between different yoga categories to assess if the measures can differentiate between different yoga practices. **METHODS:** A content analysis was used to assess yoga routines; these routines were categorized by their primary purpose into one of the following groups: weight loss, beginner, or meditation. Researchers recorded the following characteristics from each routine: body position of each pose, number of poses, and duration of the yoga routine. An ANOVA was used to compare routine characteristics between yoga categories. **RESULTS:** Fifteen yoga routines were assessed (weight loss: 4, beginner: 5, and meditation: 6). The total number of poses completed ($p = 0.010$), number of total standing poses ($p = 0.001$), and percent of time in standing poses ($p = 0.018$) were significantly different between the three categories, with weight loss having the highest values. Significant differences were also observed in the number of body postures completed in standing with the head up ($p < 0.001$), and 'other' body positions (any body posture not explicitly

listed) ($p = 0.033$). The number of poses and percentage of time spent in the body postures of supine, seated, and standing with the head down were not significantly different between the routine categories. The pose rate was not significantly different between categories. **CONCLUSIONS:** This study demonstrated that assessing certain characteristics of routines may be one way to describe activity performed during yoga. A common method to assess the activity performed during yoga will allow for easy comparisons between studies and provide a basis to better interpret results. Further research should assess if similar results are found between different yoga styles and if the number of poses completed corresponds to larger physiological or metabolic responses.

627 May 31 1:15 PM - 1:30 PM

Practical Issues Relating to a 7 Consecutive Days Wear Protocol Using the activPAL™ in Adolescents

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(No relationships reported)

The activPAL™ has been increasingly used in field-based studies as a valid measure of posture and activity. Practical issues relating to its use have been raised in adults but limited information is available in adolescents. **PURPOSE:** To examine the practical utility of a 7 consecutive days wear protocol of the activPAL™ in adolescents. **METHODS:** Six secondary schools in Hong Kong were randomly chosen for the study. 368 students (12-18 yrs; 47.6% boys) agreed to wear the activPAL3™ for 7 consecutive days. The device was worn on the midpoint of the anterior aspect of the right thigh using a water-proof Tegaderm adhesive dressing. Participants were asked to log the duration of and reasons for device removal. Semi-structured interviews with two focus group were conducted to further examine practical wearing issues. Each interview (30 mins) included 6 participants, 3 of them had worn the device continuously for 7 days and the remaining 3 participants had self-reported removing the device. 14 questions were asked to seek further information on the reasons for removal and uncomfortable feelings experienced. **RESULTS:** Of the 368 log records of the participants, 8 of them (2.2%) reported that they lost the monitor while wearing it. 184 participants (50%) wore the device for 7 consecutive days without removal while the other 50% reported removal in their logs. In total, 248 accounts of removal were reported and the main reasons included automatic dropping (48%), allergic reaction (34.7%), loss of adhesiveness during water based activities (10.1%) and voluntary removal (4.4%). For automatic dropping, sweating (78.5%) was the most commonly reported reason; and for allergic reaction, 61.6% of unknown allergy, 20.9% of itch, 7.0% of red skin, 5.8% of erythema, 2.3% of pain and 2.3% of blisters were reported. Uncomfortable skin feeling related to wearing the device was commonly reported during the interviews and the majority of them claimed that they would like to wear this monitor again but without adhesive dressing. **CONCLUSIONS:** The primary practical issue related to continuous wearing of the activPAL™ among adolescents was automatic dropping caused by sweating and allergic reaction to the adhesive dressing. The use of adhesive dressing caused uncomfortableness among adolescents and reduced their compliance to wear the device.

628 May 31 1:30 PM - 1:45 PM

Estimates Of Body Composition In Normal Weight And Overweight Adults Using The Leanscreen App

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(No relationships reported)

The LeanScreen™ app (LS) uses photographs taken from the front and side views, touch screen technology and manufacturer algorithms to estimate circumferences of the neck, abdomen, waist, and hips. The LS app then estimates body composition using the Department of Defense (DOD) circumferences regression equation. **PURPOSE:** This study evaluated the validity and reliability of estimates of percent body fat (%BF) in adult men and women using the LS app compared to DEXA as the criterion method. **METHODS:** Height and body mass were measured on 63 males and 58 females between 18 and 50 years of age. The participants were categorized as normal weight ($n=61$) or overweight ($n=60$) based on BMI. A DEXA scan was performed on each subject once. To assess the within-day and between-day reliability of the LS app, an administrator took front- and side-view photographs of each subject twice on the same day and once on a second day. The LS app was used to identify landmarks of the neck, abdomen, waist, and hips on each set of photographs of each subject. The LS app provided an estimate of %BF. Estimates of %BF from the LS app were compared to %BF values obtained from DEXA. **RESULTS:** A mixed model ANOVA indicated that the LS app significantly ($p = 0.0001$) underestimated DEXA %BF by an average of 3.6 %BF. The difference in %BF values between the LS app and DEXA were not influenced by gender or BMI category. Regressing the %BF determined from the LS

app against DEXA resulted in an $R^2 = 0.83$ and a $SEE = 3.4\%BF$. The intercept (2.84 %BF) and slope (1.035) of the regression line confirmed the significant bias. Bland-Altman analysis suggest that the bias of the LS app estimates of %BF increased with increasing body fatness. Use of the LS app to estimate %BF resulted in high intrarater (0.99) reliability within and between days. **CONCLUSIONS:** The results of this study show that the LeanScreen™ app, although highly reliable, significantly underestimated DEXA %BF. We suspect that this is related more to the DOD regression equation rather than the use of photographs and touchscreen technology.

629 May 31 1:45 PM - 2:00 PM

Body Composition and Bone Mineral Density of NCAA Division I Football Players

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Purpose: To examine positional differences in total and regional body composition in Division I collegiate football players using dual X-ray absorptiometry (DXA). Data is from the Consortium of College Athlete Research (C-CAR) group. **Methods:** Height, weight, total and regional fat mass, lean mass and bone mineral density were measured on 467 players in the preseason (June-August). Players were categorized by their offensive or defensive position (offensive linemen [OL] and defensive linemen [DL], linebacker[LB], tight end [TE], running back [RB], wide receiver [WR], defensive back [DB], quarterback [QB], kicker/punter/long snapper [ST]). An ANOVA tested the effect of position on body composition and bone density, and the Tukey honest significant difference test compared the differences between each position. **Results:** Table 1 presents the positional comparisons. If the rows do not share a letter, the positions are significantly different ($p < 0.05$). All positions were classified as overweight or obese based on body mass index [BMI ($>25 \text{ kg/m}^2$)], yet other than OL and DL, all positions had healthy percent body fat (13-20%) and low visceral fat mass ($<500 \text{ g}$). For bone mineral density (BMD), player position had an effect on total and regional (ex. legs) BMD with OL and DL being similar to TE/LB/RB ($p > 0.05$ for all), but higher than WR/DB/QB/ST ($p < 0.05$). **Conclusions:** Position had a significant effect on body composition measures and is likely associated with on-field positional requirements. From a health perspective, while most positions had higher BMIs, the majority had relatively low body fat and visceral fat. However, OL and DL had elevated total and visceral fat which could place them at higher health risk. Compared to other methods, DXA increases the accuracy and reliability of body composition and BMD, thus improving within and between position comparisons.

Table 1: Positional Body Composition Characteristics mean (\pm SD)

	OL (n=83)	DL (n=53)	TE (n=30)	LB (n=58)	RB (n=36)	DB (n=78)	WR (n=75)	QB (n=23)	ST (n=31)
Percent Fat (%)	30.8 ^a (4.2)	23.5 ^b (7.0)	19.8 ^c (3.9)	18.8 ^c (4.9)	15.3 ^{cd} (3.9)	13.3 ^c (3.2)	14.1 ^{cd} (3.6)	17.2 ^{cd} (4.2)	19.9 ^c (5.5)
Total Lean Mass (kg)	89.5 ^a (6.5)	87.6 ^a (6.8)	82.2 ^b (6.5)	79.5 ^{bc} (5.2)	77.3 ^{cd} (6.8)	72.4 ^d (5.2)	71.6 ^d (6.5)	74.4 ^{de} (6.3)	70.4 ^d (6.0)
Total Fat Mass (kg)	40.1 ^a (7.9)	27.8 ^b (10.8)	20.5 ^c (5.3)	18.5 ^c (5.4)	14.1 ^d (4.6)	11.2 ^d (3.0)	11.9 ^d (3.7)	15.5 ^{cd} (4.4)	17.7 ^{cd} (5.8)
Trunk Lean Mass (kg)	39.5 ^a (3.2)	38.3 ^a (3.0)	37.7 ^{ab} (3.3)	35.8 ^{bc} (2.7)	34.5 ^{cd} (3.3)	32.7 ^d (2.5)	32.7 ^d (3.0)	34.4 ^{cd} (2.8)	32.9 ^{de} (2.8)
Trunk Fat Mass (kg)	21.8 ^a (5.1)	13.6 ^b (6.3)	9.9 ^c (3.1)	8.7 ^{cd} (3.0)	6.7 ^{de} (2.8)	4.8 ^e (1.5)	5.4 ^e (2.0)	7.5 ^{de} (2.7)	8.6 ^{cd} (3.1)
Legs Lean Mass (kg)	33.1 ^a (3.0)	32.7 ^a (3.3)	29.1 ^b (2.8)	28.4 ^b (2.3)	27.9 ^b (2.7)	25.8 ^c (2.4)	25.2 ^c (2.7)	25.8 ^c (2.9)	24.4 ^c (2.7)
Legs Fat Mass (kg)	13.2 ^a (3.1)	10.5 ^b (3.9)	7.5 ^c (1.9)	6.9 ^c (2.1)	5.2 ^d (1.8)	4.3 ^e (1.3)	4.3 ^e (1.4)	5.6 ^{de} (1.5)	6.4 ^{cd} (2.3)
Visceral Fat Mass (g)	811 ^a (499)	645 ^{ab} (481)	228 ^c (142)	241 ^c (184)	181 ^c (129)	204 ^c (144)	223 ^c (116)	248 ^{bc} (123)	331 ^{bc} (94)
Legs Fat Mass (kg)	13.2 ^a (3.1)	10.5 ^b (3.9)	7.5 ^c (1.9)	6.9 ^c (2.1)	5.2 ^d (1.8)	4.3 ^e (1.3)	4.3 ^e (1.4)	5.6 ^{de} (1.5)	6.4 ^{cd} (2.3)
Visceral Fat Mass (g)	811 ^a (499)	645 ^{ab} (481)	228 ^c (142)	241 ^c (184)	181 ^c (129)	204 ^c (144)	223 ^c (116)	248 ^{bc} (123)	331 ^{bc} (94)

630 May 31 2:00 PM - 2:15 PM

Bone Mineral Density in Aesthetic and Performance Sports in Female Collegiate Athletes

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(No relationships reported)

Bone mineral density (BMD) in female athletes is influenced by many factors including genetics, menstrual history, calcium and vitamin D levels, hormonal changes, and physical activity. Percussive activity has been shown to lead to increased BMD. Peak BMD is achieved between the ages of 16-20 in females. Females begin participation in both ice hockey and synchronized swimming during crucial bone building years, which may affect peak BMD and therefore risk of osteoporosis later in life. **PURPOSE:** To evaluate BMD in the lower limb between ice hockey and synchronized swimming female collegiate athletes. **METHODS:** 41 female collegiate athletes ($n=22$ hockey players, $n=19$ synchronized swimmers) received a total body and left femur iDXA scan to evaluate total and regional BMD. Average age of the athletes was 20.30 ± 1.77 yrs. Average weight of the athletes was 65.36 ± 8.37 kg (synchronized swimmers: 62.62 ± 8.45 kg, hockey players: 67.73 ± 7.73 , ($F(1,40)=4.09$, $p \leq 0.05$). Analysis of covariance (ANCOVA) was used to compare BMD of the legs, pelvis, femur, femoral neck, femoral shaft, trochanter, and total body while controlling for age and weight. **RESULTS:** Average body fat percentage as measured by iDXA for all athletes was $28.55 \pm 5.97\%$. Hockey players had higher BMD than synchronized swimmers in their legs ($F(1,37) = 17.31$, $p \leq .01$), pelvis ($F(1,37) = 34.63$, $p \leq .01$), femur ($F(1,37) = 15.2$, $p \leq .01$), femoral neck ($F(1,37) = 7.30$, $p \leq .01$), femoral shaft ($F(1,37) = 13.77$, $p \leq .01$), trochanter ($F(1,37) = 25.88$, $p \leq .01$), and total body ($F(1,37) = 17.58$, $p \leq .01$). **CONCLUSIONS:** Female collegiate hockey players have higher weight and age adjusted BMD than female collegiate synchronized swimmers in the lower limb and multiple sites around the femur. A lower BMD puts these female athletes at a greater risk of developing osteoporosis later in life. Exercise scientists should develop alternative land training programs that focus on bone loading exercises for female synchronized swimmers to optimize bone health at a young age.

631 May 31 2:15 PM - 2:30 PM

A National Survey of Impact of Afterschool Physical Activities on U.S. Youth

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PURPOSE: To address the worldwide childhood obesity epidemic, afterschool physical activities (PA) could play an important role. Yet, little is known about the status and impact of afterschool PA on U.S. youth. This study was to examine the impact through a national survey. **METHODS:** Data from the 2012 National Youth Fitness Survey were used for the study, in which a representative/weighted national sample of 4,647,648 youth, aged 12-15 yr. old (51.30% male) responded to the PA questionnaire and were assessed for their physical fitness, including Plank, Handgrip, Pull-ups, Leg extension, Body mass index (BMI), and Waist circumference. A descriptive statistical summary of the PA participation was created first and, then the relationships between PA participation and PA times, as well as the difference in physical fitness measures between PA participation and no participation groups, were examined. **RESULTS:** The top-5 afterschool PA for boys of this age group are basketball (19.60%), roller blading (14.50), volleyball (12.43), football (11.83), and bike riding (11.68), and for girls are roller blading (11.52), volleyball (11.37), basketball (8.49), dance (7.01), and bike riding (5.98), respectively. Although the correlation is not high, the afterschool PA participation was positively correlated with the number of PA days in the past week ($r = .23$), total time of vigorous PA on a typical day (.15), total time of moderate-vigorous PA (.17), and total time walking (.17). The participation in afterschool PA was found also to have a positive impact on the physical fitness measures. **CONCLUSIONS:** Positive impact of afterschool on promoting youth's overall PA time and improving their physical fitness was confirmed. It is also interesting to find out that activities such roller blading have become popular afterschool PA for U.S. youth. Future school physical education curriculum and afterschool programs should reflect the new interest and trend of this population.

WEDNESDAY, MAY 31, 2017

Comparison of PA And None PA (M±SE)						
	Plank (s)	Handgrip (kg)	Pull-up (#)	Right Leg Extension (lb)	BMI	Waist Circumference (cm)
Yes- PA	92.08±3.16	61.11±1.03	8.50±.51	79.28±1.99	22.56±.35	79.07±.87
No- PA	76.95±3.19	57.66±9.94	5.46±.39	74.47±1.93	23.06±.35	81.08±.88

632 May 31 2:30 PM - 2:45 PM
Instant Metabolic Power: Yet too Simplified but with High Potential
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Instant metabolic power (IMP) to assess energy cost (W) in running tasks with variable velocity (v) has come under critique in terms of substantial underestimations. IMP is based on assumptions that W per meter running distance at constant v (Cr) is invariant of v and that acceleration and deceleration can be modelled as constant v uphill and downhill running (CrIMP), respectively. **PURPOSE:** To test the hypotheses that the observed underestimation of W via IMP is caused by a dependence of Cr on v at running speeds at and above the v corresponding to VO_{2max} (vVO_{2max}) and the limited validity of the IMP-model to acceleration and deceleration less than $\sim 4.4 \text{ m/s}^2$ under interval training (IT) conditions. **METHODS:** 9 males (25.6 ± 2.0 yrs, 176.8 ± 4.2 cm, 76.8 ± 4.1 kg) performed an incremental load test on the treadmill, 15 min constant v runs (2.5 m/s) and IT of 30 x 10 s (average $v = vVO_{2max}$) with 20 s breaks on treadmill (TM) and outdoor track (OT), respectively. Total energy costs (W_{TOT}) of all tests were calculated from respiratory gas measurements and net lactate appearance. W assessed via IMP (W_{IMP}) for TM and OT was estimated using CrIMP: 1) as published previously using Cr of running at 2.5 m/s on TM and OT, respectively, and the previously published IMP-model (W_{IMP1}), 2) using a modified CrIMP-model considering also acceleration and decelerations higher than $\sim 4.4 \text{ m/s}^2$ (W_{IMP2}), 3) considering individual dependence of Cr on v at $v > vVO_{2max}$ (W_{IMP3}). **RESULTS:** W_{TOT} of running at 2.5 m/s on TM ($9210 \pm 842 \text{ J/kg}$) and OT ($8926 \pm 1028 \text{ J/kg}$), and IT on OT ($8970 \pm 559 \text{ J/kg}$) were not different but all higher ($p < 0.05$) than W_{TOT} at IT on TM ($7856 \pm 515 \text{ J/kg}$). W_{IMP1} (OT: $6363 \pm 442 \text{ J/kg}$; TM: $5691 \pm 367 \text{ J/kg}$) and W_{IMP2} (OT: $6528 \pm 368 \text{ J/kg}$; TM: $5691 \pm 367 \text{ J/kg}$) were lower ($p < 0.001$) than the corresponding W_{TOT} . W_{IMP3} (OT: $8731 \pm 484 \text{ J/kg}$; TM: $7009 \pm 572 \text{ J/kg}$) matched W_{TOT} on OT but still underestimated ($p < 0.001$) W_{TOT} of TM conditions possibly due to neglecting W of jumping onto and of the TM. **CONCLUSIONS:** Realistic estimates of W_{TOT} via IMP require adjustments for increased Cr at high v and accelerations and decelerations higher than $\sim 4.4 \text{ m/s}^2$.

633 May 31 2:45 PM - 3:00 PM
Muscle-damage Biomarkers, Hydration And Electrolytes Status Associated With Surfing Sessions Of Elite Brazilian Surfers
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Surfing demands multifactorial physical fitness and continuing interaction with environmental variables, such as tide, wind, wave size and swell direction. Surfing athletes should focus on performance and artistic overview of movements, specially when in competition, regarding scoring criterias. Health issues, such as metabolic and biomechanical, associated with nutritional and hydration status may modulate athletes performance and fatigue. **PURPOSE:** The purpose of this study was to describe surfing sessions on a routine training-day of elite professional surfers using Global Positioning System (GPS) data, and analyze hydration and electrolytes status, as also as muscle-damage biomarkers prior, after and 12h after sessions. **METHODS:** 6 professional male surfers (24 ± 1 yrs) were evaluated using a GPS module on a typical day of surf training session (3×90 sessions), for determining distance, average and maximum speed. Blood samples were collected for Hematocrit (Ht), Sodium (Na), Potassium (K), Urea and CAK levels before, after sessions and 12h after resting period. **RESULTS:** Average distance during the session was 9.1 ± 3.5 km, and maximum and average speed were 38.4 ± 0.1 km/h and 4.7 ± 0.4 km/h, respectively. Pre, post and 12h post sessions values for CK were 223.5 ± 49.5 ; 328.6 ± 94.1 and 305.5 ± 4.2 mg/

dL. Urea values were 26.3 ± 2.1 ; 35.6 ± 4.9 and 35.6 ± 2.8 mg/dL. Hydration variables such as Ht, Na and K were 42.1 ± 2.1 , 40.5 ± 2.1 , $40.3 \pm 1.4\%$; 140.5 ± 0.7 , 140.8 ± 2.8 , 140.3 ± 1.4 mEq/L and 4.2 ± 0.1 , 3.9 ± 0.1 , 4.1 ± 0.2 mEq/L. **CONCLUSION:** Surfers athletic performance should be focused on a multifactorial matter. Dietary pattern, hydration and electrolytes issues may influence performance on a short-term base, specially on typical surfing contests, characterized by followed days of competition. This data suggests that athletes have considerable physical demands, and such tools may guide to improvement on health and performance.

B-14 Free Communication/Slide - Walking Biomechanics
 Wednesday, May 31, 2017, 1:00 PM - 3:00 PM
 Room: 110

634 **Chair:** D.S. Blaise Williams, III, FACSM. *Virginia Commonwealth University, Richmond, VA.*
(No relationships reported)

635 May 31 1:00 PM - 1:15 PM
Asymmetry in Lower Extremity Biomechanics During Walking & Stair Ambulation Following Total Knee Replacement
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Total knee replacement (TKR) presents many challenges to patients including difficulty with activities of daily living. It has been shown that following a TKR there is a non-random evolution of joint problems that begins with the contralateral knee joint. An understanding of asymmetry in the joints following TKR may provide additional information as to why this evolution may occur. Previous research has shown that there is no differences of knee joint excursion and ground reaction force between replaced and non-replaced legs during level walking. **Purpose:** To compare asymmetry in the non-replaced and replaced limbs of TKR patients during level walking, stair ascent, and stair descent. It was hypothesized that greater asymmetry would be seen in knee joint biomechanics during the more demanding tasks of stair ambulation. **Methods:** A total of 13 TKA (65.6 yrs, 28.3 BMI & 24.5 months from TKA surgery) participants performed five trials of level walking, stair ascent and stair descent at preferred speeds. A paired samples t-test was used to detect differences in the replaced and non-replaced limb for each condition ($p < 0.05$). **RESULTS:** There were no differences in first or second peak vertical ground reaction force between limbs for any of the walking conditions. There were also no differences between sagittal plane knee joint range of motion (ROM) between limbs for any conditions. The first peak knee extension moment showed asymmetry only during stair ascent. The non-replaced limb had a trend for elevated peak knee extension moment (1.17 Nm/kg) compared to the replaced (0.97 Nm/kg , $p = 0.05$). No differences were seen for peak internal knee abduction moments between the limbs in any condition. **CONCLUSION:** It appears that there is very little asymmetry between the replaced and non-replaced limb following a TKR in this participant group. Only the knee extension moment during stair ascent showed any signs of asymmetry. Similar results have been shown in previous research when considering only level walking. Contrary to our hypothesis the more difficult tasks of stair ascent and descent did not create asymmetry between limbs. This participant group was highly functional as determined by their ability to ascend and descend stairs without the use of a handrail. Future studies should consider how groups with mixed recovery results may fair.

636 May 31 1:15 PM - 1:30 PM
Walking Aid Use And Arthritis: Impact On Time Spent In Active Propulsion In Older Adults
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(No relationships reported)

Gait cycle percentage spent in active propulsion is significantly greater in those without a history of falling in the past year than those with a history of falling in the past year. **PURPOSE:** This study examined the impact of walking aid use and diagnosed arthritis on gait cycle percentage spent in active propulsion in fallers and non-fallers. **METHODS:** A total of 250 subjects over the age of 60 years (age; 71.1 ± 7.4 yrs, height; 1418.5 ± 21.2 cm, mass; 57.1 ± 6.3 kg) were recruited from the southwest

United States, completed a brief medical history and gait analysis. Following the collection of these data, subjects were assigned to one of two groups based on having fallen (F; n=90) or having not fallen (NF; n=160) in the past year. Independent t-tests were conducted to explore group differences (walking aid, arthritis; $\alpha = 0.05$) in time spent in active propulsion. For these analyses the F and NF groups were analyzed separately with percentage spent in active propulsion as the dependent variable and both walking aid use and self-reported diagnosis of arthritis were the independent variables. **RESULTS:** For walking aid use, NF not utilizing a walking aid had a significantly higher ($p = 0.033$) gait cycle percentage spent in active propulsion ($56.9\% \pm 2.6$) than NF who use a walking aid ($41.4\% \pm 6.4$). There was also a significant difference ($p = 0.029$) in gait cycle percentage spent in active propulsion for NF without a diagnosis of arthritis ($60.6\% \pm 3.4$) compared to NF with a diagnosis of arthritis ($49.9\% \pm 3.4$). In contrast, there were no differences among the fallers in gait cycle percentage spent in active propulsion based on walking aid use ($48.3\% \pm 2.8$ for no walking aid; $43.1\% \pm 6.4$ for walking aid, $p = 0.46$) or arthritis diagnosis ($52.2\% \pm 3.8$ for no arthritis diagnosis; $43.7\% \pm 3.4$ for arthritis diagnosis, $p = 0.09$). **CONCLUSIONS:** Specific to those with a history of falls, use of a walking aid or history of arthritis does not impact gait cycle percentage spent in active propulsion. However, for individuals with no history of falling in the last year, both use of walking aid and diagnosis of arthritis significantly reduces percent of the gait cycle spent in active propulsion which has been previously shown to differ between people with and without a history of falls.

637 May 31 1:30 PM - 1:45 PM

Increasing Body Weight Alters Lower Limb Muscle Balance And Foot Control

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(No relationships reported)

Obesity is a well established risk factor for developing osteoarthritis (OA). Population-based studies in particular have consistently shown a link between obesity and knee OA. Yet many factors for diseases and conditions associated with obesity could contribute to OA initiation and/or progression. The present study examined the effects systematically increasing subject weight and the effects on quadriceps femoris muscle function and foot balance stability during walking and squatting. **Methods:** Twenty asymptomatic healthy young adults (Age = 22 ± 2 ; 19 kg/m²) < BMI < 22 kg/m²) were studied. A three-dimensional gait analysis was conducted for all subjects. Plantar pressure distribution (the peak pressure of the eight plantar surface areas) and foot kinematics, surface electromyograms from the lateral and medial gastrocnemii, lateral and medial hamstrings, vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF) were recorded during squatting and self-selected speed walking. Weight increase (10, 20 and 30% of subject body weight) was achieved by placing a belly bag on the subject's body attached around the hip and to the shoulders. Principal component analysis was used to extract major features of amplitude and temporal pattern variability from the electromyograms of each muscle group (gastrocnemii, quadriceps, hamstrings separately). Analysis of variance models tested for weight load effects and interaction effects for these features ($\alpha = 0.05$). **Results:** Significant weight load effects were found for features that described more prolonged activation of the gastrocnemii and quadriceps muscles during the stance phase of gait ($P < 0.05$). Load increase selectively activated the VL compared to the VM during walking and the first 20 degrees of knee flexion during the squat. Load increase was also associated with increased mid-rear-foot pressure and delay in both the onset of the second wave of flexion at the knee joint and reduced range of motion of the ankle ($P < 0.05$). **Conclusions:** We confirm the effects of increasing body weight on lower extremity muscle activation and foot balance control, both of which may contribute to knee OA development and progression.

638 May 31 1:45 PM - 2:00 PM

Effect Of Excess Weight on Lower-Extremity Vertical Stiffness, Muscle Activation, And Metabolic Cost Of Walking

Victoria A. Gregory, Ronald V. Croce, Timothy J. Quinn, FACSM, Dain P. LaRoche, FACSM. University of New Hampshire, Durham, NH.
Email: vgreg6@gmail.com
(No relationships reported)

PURPOSE: To study the relationship between energy cost of walking (Cw), lower-extremity vertical stiffness (K_{vert}), and muscle activation across various BMIs. **METHODS:** This study compared Cw, K_{vert} , and muscle activation between obese (OB), normal weight (NW), and NW individuals carrying a load (NWL). A sample

of 10 NW (24.2 ± 1.3 kg m⁻²) and 10 OB (33.1 ± 2.0 kg m⁻²) individuals (29.5 ± 11.7 yr, 14 females, 6 males) walked for six minutes on an instrumented treadmill at 1.25 m s⁻¹ while oxygen uptake, muscle activation, and lower-extremity kinetics and kinematics were measured using an indirect calorimeter, electromyography, and a 3D optical motion tracking system, respectively. **RESULTS:** Cw was 24% greater in OB (277.5 ± 45.3 J m⁻¹) compared to NW (211.0 ± 27.0 J m⁻¹, $P = 0.001$), 23% greater in NWL (272.7 ± 35.7 J m⁻¹) compared to NW ($P = 0.002$), but similar between OB and NWL ($P = 0.955$). Mass-specific Cw (Cw_{kg}) was not statistically different between NW (2.99 ± 0.24 J m⁻¹ kg⁻¹) and OB (2.85 ± 0.18 J m⁻¹ kg⁻¹, $P = 0.382$), NW and NWL (2.74 ± 0.24 J m⁻¹ kg⁻¹, $P = 0.071$), or OB and NWL ($P = 0.602$), however a negative correlation ($r = -0.44$, $P = 0.008$) existed between BMI and Cw_{kg} . K_{vert} was higher in OB (32.7 ± 5.2 kN m⁻¹) than NW (23.3 ± 4.7 kN m⁻¹, $P < 0.001$), but NWL (27.5 ± 3.4 kN m⁻¹) was not different from either. K_{vert} per kilogram ($P = 0.081$) and muscle activation ($P > 0.05$) were similar across all conditions. A positive correlation existed between K_{vert} and Cw ($r = 0.55$, $P = 0.001$), but not when expressed per kilogram ($r = 0.22$, $P = 0.120$). Center of mass (COM) vertical displacement was similar between OB (3.3 ± 0.4 cm) and NW (3.5 ± 0.7 cm, $P = 0.875$), OB and NWL (3.9 ± 0.7 cm, $P = 0.076$), and NW and NWL ($P = 0.194$). Angle of attack between the leg and ground was similar between OB (104 ± 6 deg) and NW (106 ± 6 deg, $P = 0.731$) and between NW and NWL (110 ± 3 deg, $P = 0.198$), but 5% lower in OB than NWL ($P = 0.045$). **CONCLUSION:** Cw_{kg} decreased from the NW to NWL condition. K_{vert} was greater at higher BMIs, but per kilogram was lower in NWL than OB likely due to NWL having a greater angle of attack and COM displacement. The linear relationship between K_{vert} and Cw is likely due to the greater muscle force needed to support larger body masses. Contrary to our hypothesis, Cw_{kg} was not different between NW and OB and neither K_{vert} nor muscle activation explained the variability in Cw_{kg} .

639 May 31 2:00 PM - 2:15 PM

Concurrent Validity Of Zeno Compared To Gaitrite With Backward Walking In Healthy Older Adults

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Previous research has identified an age-related decline in backward walking performance measured via spatio-temporal parameters using GAITRite walkway. Moreover, it has also been shown that older adults categorized as fallers performed poorly with slower gait compared to non-fallers during backward walking. Zeno and GAITRite are both instrumented walkway systems used to assess spatio-temporal parameters of gait. The Zeno has a wider walkway than the GAITRite but is less portable for similar configurations. The GAITRite has been used extensively for measuring spatio-temporal parameters of backward gait. The Zeno has been less researched. **PURPOSE:** To determine concurrent validity of the Zeno and GAITRite walkways to assess spatio-temporal parameters of backwards walking in healthy older adults. **METHODS:** 30 healthy older adults (19 females, 75.1 ± 6.3 years of age) participated in this study. Participants were 65 or older, could walk 30 feet independently, and were not at risk for falls as determined by American Geriatric Society guidelines. The participants walked backwards at a comfortable pace on both the Zeno walkway ($16' \times 4'$) and GAITRite walkway ($14' \times 2'$). Participants performed one practice walk and five test walks on each walkway. ICC values (2,5) were calculated using GAITRite compared to Zeno measurements for stride length, width, and velocity, step, stance, and swing time, stance and swing percent, single support time, single support percent, velocity, and cadence. A paired sample t-test was used to determine a significant difference between measurements from both the systems. **RESULTS:** The ICC values ranged from 0.665 to 0.971. Backwards walking stride width was significantly greater when walking on GAITRite (16.80 ± 4.74 cm) compared to Zeno (14.98 ± 3.58 cm; $P < 0.001$). **CONCLUSION:** The validity between the GAITRite and Zeno walkway systems showed excellent correlation on most spatial measurements and moderate agreement for some temporal parameters. Differences in stride width could have been due to method of calculation or perception of participants while walking on a narrower walkway. The results indicate clinicians can use Zeno for clinical assessment of backwards gait, keeping in mind the differences in temporal measurements if compared with published GAITRite results for healthy older adults.

640 May 31 2:15 PM - 2:30 PM

Gait Variability Among Breast Cancer Survivors During Forward And Backward Walking

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(No relationships reported)

Increased in gait variability measured using instrumented techniques has been associated with increased risk of falls in persons with Parkinson's disease, decreased

functional performance and increased fall-risk in older adults. Recently research on breast cancer survivors (BCS) has focused on estimating fall-risk in this population attributed to gait performance. However, little is known about gait variability characteristics among BCS. **PURPOSE:** To assess the differences in gait variability among BCS compared to healthy controls during forward, backward, and accelerated forward walking. **METHODS:** 13 postmenopausal BCS (mean age: 58.5±8.5 years) and 8 healthy controls (mean age: 60.8±6.1 years) participated. Participants completed 5 trials each of forward, backward, and accelerated forward walking conditions on a 16x4' Zeno walkway with a lead and follow-up distance of 1m to capture steady-state gait. Coefficient of variation (CV) was calculated as % of standard deviation over mean of 5 trials. CV of stride length, stance time, and stride width were used as dependent variables. A Group (BCS vs healthy controls) X Condition (forward, backward, accelerated forward walking) ANOVA was performed. **RESULTS:** Significant interaction for stance time showed that BCS had greater CV during forward (4.89±0.63%) and accelerated forward (6.49±0.78%) but lesser CV during backward walking (6.28±1.09%) compared to healthy controls (forward: 3.81±0.80%; accelerated forward: 4.23±1.00%; backward: 9.20±1.38%; $P=0.018$). Significant group main effect indicated that BCS (7.09±3.59%) had greater stride length variability compared to healthy controls (3.59±1.32%) across all conditions ($P=0.05$). Significant condition main effect was observed for stride length and stance time CV (both $P=0.02$) but not stride width ($P=0.063$). During forward walking, stride length (by 5%) and stance time (by 3.3%) CV were significantly less compared to backward walking (both $P=0.004$). There were no other significant differences. **CONCLUSION:** Increased stance time variability during backward walking and overall greater stride length variability may be indicative of increased fall-risk among BCS. Future studies need to examine other balance tests in conjunction with these measures to determine the level of fall-risk among BCS.

641 May 31 2:30 PM - 2:45 PM
Upper Body Accelerations During Walking are Altered in Individuals With ACL Reconstruction
 Cortney N. Armitano, Steven Morrison, Daniel M. Russell. *Old Dominion University, Norfolk, VA.* (Sponsor: David P. Swain, FACSM)
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 (No relationships reported)

One function of the trunk and neck segments is to act as a filter to dampen gait-related oscillations, so ensuring the head is stabilized. While persons with ACL reconstruction exhibit similar overall spatiotemporal gait features to healthy controls, there has been no direct assessment of whether ACL reconstruction impacts the ability of the upper body to attenuate oscillations while walking. **PURPOSE:** This study was designed to assess and compare the pattern of acceleration from the lower trunk, neck and head regions for individuals with reconstructed ACL compared to healthy controls during walking. **METHODS:** Seventeen participants with unilateral ACL reconstruction and 17 control persons matched for age, height, and weight participated in the study. Participants performed 3 trials of over-ground walking at their preferred pace (distance: 55 m). Acceleration were collected using three triaxial accelerometers attached to the head (occipital), neck (C7), and lower trunk (L3). Measures of amplitude (i.e., RMS, peak frequency power) and signal regularity (i.e., ApEn) of the acceleration data were performed. A within-subject, repeated-measures generalized linear model was used to analyze the data. **RESULTS:** Similarities were seen between both groups with regards to the general acceleration patterns in all three axes with trunk acceleration generally being of greater amplitude (both RMS and peak power) than the head ($p<0.05$). However, the results also revealed that the individuals with ACL reconstruction had significantly greater peak power in the AP and ML directions at higher frequencies (3-10 Hz, $p<0.05$), indicating a reduced ability to attenuate frequency signals. Further, the ACL group had an increase in ApEn values for VT direction head motion ($p<0.05$), indicating a reduced ability to control head motion during gait. **CONCLUSIONS:** Both groups demonstrated a similar pattern of gait-related oscillations across the head, neck and trunk segments. However, adults with a reconstructed ACL demonstrated a reduced capacity to compensate for the higher frequency components of the gait signal, which may have led to a decline in head control. Overall, these findings indicate that previous damage to the ACL is not simply localized to the knee joint, but is widespread, impacting on upper body control as well.

642 May 31 2:45 PM - 3:00 PM
Characterizing Shank Angular Velocity During Gait in Individuals Post-ACLR Using IMUs in Ecological Settings
 Paige E. Lin, Gabriel M. Glasser, Ming-Sheng M. Chan, Susan M. Sigward. *University of Southern California, Los Angeles, CA.*
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 (No relationships reported)

Individuals post ACL reconstruction (ACLR) exhibit decreased knee extensor moments during gait in the absence of visible gait deviations that can last up to 2 years post-

surgery. Inertial measurement unit (IMU) derived shank angular velocities (skAV) can be used to detect knee extensor moment asymmetries during gait in individuals 3 months post-ACLR; providing a clinical tool for identification of altered mechanics. These methods could be expanded to quantify gait mechanics during daily activities if skAV asymmetry can be detected during more ecological gait tasks. **PURPOSE:** To compare skAV asymmetry during ecological gait in individuals 3 months post-ACLR to controls. **METHODS:** 7 individuals (4F, 33 ± 9.6 yrs) 84 ± 20 days post-ACLR without observable gait deficits and 5 healthy controls (4F, 24 ± 2.8 yrs) performed 2-5 bouts of unconstrained walking intermixed with standing and sitting. Sagittal skAV was measured using IMU tri-axial gyroscopes (128Hz) affixed to lateral shanks bilaterally. Peak negative skAV after heel strike was identified (2nd order Butterworth filter; high pass 0.25 Hz; low pass 6 Hz) using a previously validated algorithm. skAV for each limb was averaged for 20-231 continuous steps of gait per walking bout. skAV asymmetry was calculated as the ratio between surgical/non-surgical limbs (ACLR) and dominant/non-dominant limbs (control). Independent t-test was used to compare skAV ratios between groups; $\alpha \leq .05$. **RESULTS:** On average, skAV ratios were 0.89 ± 0.09 and 1.00 ± 0.09 for the ACLR and control groups, respectively ($p=0.024$). **CONCLUSIONS:** Consistent with previous studies, individuals after ACLR demonstrate reduced skAV in the surgical limb during loading response as evidenced by a smaller ratio compared to controls. Differences between groups during natural gait tasks performed with other daily tasks suggest that skAV asymmetries are detectable in less controlled settings. Given the capabilities of IMUs to collect and store large amounts of data, these data support the use of IMUs for assessing the quality of gait mechanics throughout the day. Understanding the extent to which individuals adopt altered loading outside of the laboratory is needed for the development of training interventions aimed at mitigating altered gait mechanics during early rehabilitation following ACLR.

B-15 Clinical Case Slide - Lumbosacral Spine I
 Wednesday, May 31, 2017, 1:00 PM - 2:40 PM
 Room: 504

643 **Chair:** Pierre Rouzier, FACSM. *University of Massachusetts, Amherst, MA.*
 (No relationships reported)

644 **Discussant:** Jimmy D. Bowen. *Advanced Orthopedic Specialists, Cape Girardeau, MO.*
 (No relationships reported)

645 **Discussant:** Robert C. Cantu, FACSM. *Emerson Hospital, Concord, MA.*
 (No relationships reported)

646 May 31 1:00 PM - 1:20 PM
Low Back and Bilateral Posterior Hip Pain in an Adolescent Female
 Jasmin Mosley Gooden, Michael Fong, Marissa S. Vasquez. *Kaiser Permanente, Los Angeles, CA.* (Sponsor: Aaron Rubin, FACSM)
 (No relationships reported)

HISTORY: 14-year-old female presenting with persistent low back pain of insidious onset for 1.5 years. Patient initially managed at outside hospital. Work-up included MRI lumbar that noted possible early lumbosacral facet arthritis. Pain persisted despite oral anti-inflammatory medications, functional modifications, and physical therapy. On presentation to our institution, patient was referred by primary care to rheumatology. Patient's generalized low back pain noted to progress to involve the posterior aspect of both thighs with occasional weakness of her legs, right more than left. Pain worsened with prolonged walking and sitting. No radiating pain, night time or early morning pain, nor pain nor swelling of other joints. Rheumatologist recommended Naprosyn, advanced imaging, and referral to sports medicine.

PHYSICAL EXAMINATION: Normal back exam; lower motor strength; muscle tone; and hip and back range of motion. No muscle atrophy. She had posterior hip tenderness in the Ischia-gluteal region that worsened with resisted hip abduction. Negative FABERE, OBER, and straight leg raise. Negative FADIR for anterior hip pain; maneuver produced tenderness in gluteus region. Femoral stretch equivocal bilaterally. Positive Trendelenberg
DIFFERENTIAL DIAGNOSIS.
 - Spondyloarthropathy
 - Bilateral Isthiofemoral Impingement
 - Bilateral Meralgia Paresthetica

TEST AND RESULTS:

EMG LE (08/10/16): normal

MRI Pelvis with/without contrast (05/08/16):

- No osteonecrosis, joint effusion, synovitis.

- Narrowed ischiofemoral interval bilaterally: 11mm on left, 10mm on right; Quadratus femoral space measured 7mm on left, 9mm on right.

- Quadratus femoris soft tissue edema, Left more than Right

X-ray hips (04/25/16): Normal alignment. No fracture.

Spina Bifida Occulta at L5.

HLA-B27; Cocci IgG/IgM; ESR; CRP; ANA within normal limits

MRI lumbar (04/17/15): facet arthritis

FINAL WORKING DIAGNOSIS: Bilateral Ischiofemoral Impingement.**TREATMENT AND OUTCOMES:**

1. Naprosyn - minimal improvement

2. Physical Therapy (gluteal strengthening). Tolerated home exercise program - improved anterior leg pain, but persistent posterior hip pain.

3. Ultrasound guided corticosteroid Injection to right quadratus femoris and relative rest. If symptoms improve will inject left quadratus femoris in 1-2 weeks post treatment.

647 May 31 1:20 PM - 1:40 PM

A Real Pain in the BehindSpencer Jones. *TriHealth Orthopedics & Sports Institute, Cincinnati, OH.*

Email: spencer_jones@trihealth.com

*(No relationships reported)***History and Presentation:**

22-year-old female presented to sports medicine clinic for acute on chronic coccyx pain. She initially sustained an injury 6 years ago when she slipped on some steps, pain resolved until 4 years ago when she slipped stepping out of a car. The pain at that time was identical to previous, with coccygeal pain when seated or supine for extended periods. X-rays were negative at the time, and her pain resolved with PT and meloxicam. She was lost to follow up for 2 years after that time, until she presented with increased pain again. No new injury, but pain feels similar. She has been unable to exercise including bike riding since the onset of her pain. She reported no ambulatory pain. She denied radicular symptoms, systemic symptoms, or bowel/bladder incontinence. PMH was unremarkable, non-smoker, no significant family history.

Physical Examination: Vitals were revealed and normal. No deformity of the lumbar spine, sacrum, or coccyx. She did have some mild tenderness to palpation at the sacral-coccyx joint, but range of motion was normal. Straight leg raise negative. Distal sacral plexus sensation intact. **Differential Diagnosis:** 1. Coccydynia 2. Sacroiliitis 3. Rectal abscess 4. Pilonidal cyst 5. Soft tissue mass 6. Sacral-coccyx joint dislocation 7. Occult fracture **Testing and Results:** Repeat x-ray was negative for fracture, dislocation. There was some non-specific soft tissue edema around the sacral coccyx junction which is unclear. MRI was obtained which revealed a large expansile midline mass occupying the sacrum and coccyx and extending into the anterior pelvis measuring 7.2 x 9 x 8.5 cm. Tissue sampling would confirm a chordoma. **Final Diagnosis:** Sacral chordoma **Treatment & Outcomes:** 1. NSAIDs and opioids for pain control 2. Neurosurgical consultation 3. This patient's treatment is still ongoing at time of abstract submission. Initial surgical resection was modestly successful although the size of the tumor complicated complete resection Possible complications include chronic surgical site pain, nerve damage, continue chronic coccydynia. Median survival rate for sacral chordoma is approximately 7 years

648 May 31 1:40 PM - 2:00 PM

Rapid Return To Sport After Lumbar Epidural Steroid InjectionLauren Geroski, James Natalie, Stephen Woods. *COPC Sports, Spine & Joint, Westerville, OH.**(No relationships reported)*

HISTORY: A 66-year-old healthy active adult male with acute onset lumbosacral pain with referral into left leg while putting weights down after exercising. Initial primary care evaluation was unremarkable and patient was given Naprosyn, Percocet and an XRay was ordered, showing grade 1 spondylololthesis L2-3. Pain continued and he presented one week later with continued severe pain and new left lateral leg numbness. Oral steroids and physical therapy were initiated and pain continued. Gabapentin was tried with no response. He was seen at 9 weeks and complained of pain with all activities, including sitting. MRI was ordered and he was referred to physiatrist. He was seen one week later with 6/10 severe pain in left low back radiating down the left leg into lateral foot and ankle. Activity remains limited with pain even in the seated position and ADLs affected

PHYSICAL EXAMINATION: Positive straight leg raise, decreased sensation left lower limb in the entire foot and lateral calf, 4/5 strength left ADF

DIFFERENTIAL DIAGNOSIS: Lumbar disc herniation, lumbar radiculopathy, spondylololthesis, lumbar stenosis

TESTS AND RESULTS: MRI Lumbar Spine without Contrast:L4-L5 broad-based left-sided disc herniation extruding inferiorly left paracentral measuring 16 x 14 x 15 mm effacing the thecal sac and displacing the left L5 nerve root



FINAL WORKING DIAGNOSIS: L5-S1 disc herniation with left L5 radiculopathy
TREATMENTS AND OUTCOMES: Symptoms persisted despite oral steroids, NSAIDs, and physical therapy, and lumbar epidural steroid injection was performed. Patient had 98% pain relief with resolution of numbness. Left ankle dorsiflexion strength that improved (5-/5), pain was only 1/10 in left lumbosacral junction. Physical therapy was restarted for 4 weeks to improve core strengthening. At 6 wks, numbness had resolved, strength had normalized, and he was back to normal activities of biking 21 miles and lifting regularly.

649 May 31 2:00 PM - 2:20 PM

Back Injury - CheerleadingMichael A. Stiller, Michelle A. Miller. *The Ohio State University, Columbus, OH.**(No relationships reported)*

HISTORY: A 15-year-old high school cheerleader sustained a back injury while cheering on her school's football team. She was performing a "toe touch" jump and upon landing, she felt a "pop" and a sharp pain posteriorly between her shoulder blades. An hour later, she developed a "pins and needles" sensation from her belly button to her toes bilaterally. The next morning, the numbness had spread to just under the ribcage and she fell when trying to stand upright from bed. She presented to the emergency room later that morning.

PHYSICAL EXAMINATION: Examination revealed that she was afebrile with normal vital signs. There was no tenderness on palpation over the spinous processes or the paraspinal musculature. Her neurologic exam was significant for decreased sensation to light touch at the T8 dermatome and caudally with a proprioception deficit in the great toe bilaterally. Strength was 4/5 throughout the left lower limb. The patellar reflexes were 3/4 and the Achilles were 2/4 bilaterally. She demonstrated a wide-based gait with significant loss of balance.

DIFFERENTIAL DIAGNOSIS:

1. Spondylololysis/spondylololsthesis
2. Vertebral fracture
3. Intervertebral disc herniation
4. Transverse myelitis
5. Psychogenic

TESTS AND RESULTS:

ESR and CRP normal

T-spine MRI:

1. Mild age related change/disc degeneration at T7-8 and T8-9 with a small acute appearing central disc protrusion at T8-9 that abuts the adjacent spinal cord.

2. No findings to indicate transverse myelitis.

FINAL/WORKING DIAGNOSIS: T8-9 intervertebral disc herniation resulting in myelopathy.

TREATMENT AND OUTCOMES:

1. Neurosurgery consult with no surgical intervention taken. Patient admitted for continued monitoring, PT, and OT.
2. Notable lower limb strength improvement seen over the first three days, however, acute inpatient rehabilitation was needed to assure ability for safe ambulation with impaired lower limb sensation.
3. After 12 days of inpatient rehab, lower body sensation was still impaired, but patient demonstrated improved lower limb strength and was ambulating with proper technique multiple times around the unit without assistance.
4. Patient discharged with outpatient therapy and a follow-up with neurosurgery in one month with repeat spine MRI.
5. Patient instructed to not return to cheerleading until follow-up.

650 May 31 2:20 PM - 2:40 PM

Low Back Injury and Soccer

Aynur Demirel¹, Mehmet Yorubululut², Ozlem Ulger³.
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(No relationships reported)

Low Back Injury- Soccer

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(sponsor:)

HISTORY: A 17-year-old soccer player has severe back and groin pain applied to our clinic. Two years ago he had transverse process fracture of L5 vertebrae and bone marrow edema in this level. After 8 months, he returned the sport without pain but one month ago problems repeated.

PHYSICAL EXAMINATION: Paravertebral and quadratus lumborum muscle spasm were palpated. Straight leg raise test, sacroiliac mobility tests were negative on both side. Sacroiliac provocation tests were positive at right side. He had pain with trunk extension and rotation. There was no strenght and sensorial deficit. Lumbar lordosis increased.

DIFFERENTIAL DIAGNOSIS

Facet joint syndrome

Fracture of lumbar vertebra (transverse or spinous procces)

Spondylolysis (pars interarticularis defect)

TEST AND RESULTS

Lumbar spine Computed Tomography:

-Chronic fracture at L5 level (pars interarticularis fracture)

Sacroiliac joint T1 and T2 weighted coronal and transverse plane MRI:

-Right sacroiliac joint subchondral lesion (anterosuperior side)

-Left facet joint effusion (L5-S1 intervertebral disc level)

FINAL/WORKING DIAGNOSIS:

Pars interarticularis fracture

TREATMENT AND OUTCOMES

-21 sessions of physiotherapy applied to decrease muscle spasm, gain painless range of motion and functional restoration.

-During therapy, lumbar orthoses was used to stabilization.

-Physiotherapist guided lumbar stabilization exercise applied (4 months follow-up, progression started with positional and went on dynamic and resistive tasks).

-Sport related running, one leg balance and coordination, agility tasks were performed with transversus abdominus muscle contraction.

-After therapy he has painless extension and running.

B-39 Thematic Poster - Behavioral Aspects and Correlates of Physical Activity in College Students

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM

Room: 403

721 **Chair:** Janet Buckworth, FACSM. *University of Georgia, Athens, GA.*

(No relationships reported)

722 **Board #1** May 31 3:15 PM - 5:15 PM

The Relationship Between Fitness App Use And Physical Activity Behavior Is Mediated By Exercise Identity

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(No relationships reported)

There is evidence that cell phone use is associated with greater sedentary behavior and decreased cardiorespiratory fitness. Conversely, certain cell phone functions (e.g., listening to music, mHealth care) may promote healthy behaviors. The use of cell phone based software applications designed to monitor and/or promote exercise behavior (i.e., fitness apps) are a cell phone function which may promote physical activity. However, the relationship between fitness app use and physical activity is not well studied.

PURPOSE: To assess the relationship between physical activity and fitness app use and then to determine if this potential relationship was mediated by measures of exercise identity (i.e., the degree to which someone defines themselves as being an exerciser).

METHODS: A sample of 351 (21.0 ± 2.1 years old, n = 201 females) college students were surveyed for: weekly vigorous, moderate, walking and total physical activity and sedentary behavior via the validated International Physical Activity Questionnaire, exercise identity via the validated Exercise Identity Scale and were asked to report the number of fitness apps they had on their cell phones. Participants were then split into groups of those who use one or more (apps group, dummy coded 1, n = 207) and do not use any (no apps group, dummy coded 0, n = 144) fitness apps.

RESULTS: Correlation analyses revealed that exercise identity was positively associated (r ≥ 0.13, p ≤ 0.02) with all measures of physical activity except walking (r = 0.06, p = 0.31). Exercise identity was inversely associated (r = -0.20, p < 0.001) with sedentary behavior. The app group reported a greater exercise identity (4.61 ± 1.6 app, 3.44 ± 1.8 no app, r = 0.32, p < 0.001) and participated in greater vigorous (2690 ± 2775 MET min per week app, 1651 ± 2344 MET min per week no app, r = 0.19, p < 0.001) and total (6541 ± 4691 MET min per week app, 5122 ± 4381 MET min per week no app, r = 0.15, p = 0.007) physical activity than the no app group. However, when controlling for exercise identity, via partial correlation, physical activity differences between groups were rendered non-significant (r = 0.04, p = 0.50).

CONCLUSIONS: Differences in weekly physical activity between participants who use at least one fitness app on their cell phone versus those with no apps were mediated by exercise identity.

723 **Board #2** May 31 3:15 PM - 5:15 PM

Pokémon Go! Play May Promote Walking And Discourage Sedentary Behavior In College Students

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(No relationships reported)

Pokémon Go! is a downloadable video game for use on an internet-connected cellular telephone (cell phone). The game encourages the player to traverse real-world locations (e.g., neighborhoods) and tracks the player, via GPS, as they move through these locales. The purpose of the game is to find computerized characters as the player moves through the real-world locations. Because the game requires players to move through real-world locales, it may promote physical activity.

PURPOSE: The purpose of this study was to assess self-reported walking and sedentary behavior in young adults before and after downloading Pokémon Go!.

METHODS: A sample of 238 (19.5 ± 1.7 years old, n = 119 females) college students who had downloaded Pokémon Go! on their cell phone for a minimum of two weeks were surveyed for weekly walking and sedentary behavior via the International Physical Activity Questionnaire. Participants reported their walking and sedentary behavior at three time points: the week immediately preceding their download of

Pokémon Go!, the first week after downloading the game and currently. Differences in self-reported physical activity and sedentary behavior across the three time points were compared via repeated-measures analyses of variance.

RESULTS: There was a significant main effect of time ($f \geq 38.4, p \leq 0.001$) for walking and sedentary behavior. Participants reported greater ($t \geq 7.4, p \leq 0.001$) daily walking during the first week after downloading Pokémon Go! (206 ± 138 min) and currently (191 ± 202 min) versus the week before downloading (105 ± 101 min). There was no difference ($t = 1.1, p = 0.27$) between the first week after downloading and current walking behavior. Participants reported greater ($t \geq 6.5, p \leq 0.001$) daily sedentary behavior during the week before downloading (329 ± 219 min) versus both the first week after downloading (242 ± 181 min) and currently (256 ± 152 min). There was no difference ($t = 1.5, p = 0.15$) between the first week after downloading and current sitting behavior.

CONCLUSIONS: Use of the popular, physically-interactive cell phone game, Pokémon go!, had favorable effects upon self-reported physical activity (96% to 82% increase) and sedentary behavior (26% to 22% decrease). Such games hold promise as technology that may promote physical activity and discourage sedentary activity.

724 Board #3 May 31 3:15 PM - 5:15 PM
Effects of Social Support on Physical Activity Participation in College Freshman: The HERD Study
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 (No relationships reported)

Approximately 1 in 6 college aged adults in the United States engage in no leisure time physical activity. Still, a paucity of literature exists regarding what influences physical activity participation in this age group. **PURPOSE:** To determine the effects of social support on physical activity participation in college freshman enrolled in the HERD (Higher Education Reducing Diabetes) Study at Marshall University in Huntington, West Virginia. **METHODS:** The HERD Study is a prospective, randomized study examining the effects of a freshman year, healthy lifestyle intervention on the reduction of student's risk factors for type 2 diabetes and cardiometabolic disease. Freshman students were recruited during the University's Week of Welcome activities throughout campus. Physical activity measures, cardiometabolic health parameters and other demographics were obtained at baseline. Social Support was assessed by the Social Support and Exercise Survey; a 13 item, Likert scale survey that queries about family and friends social support for exercise over the past 3 months. **RESULTS:** To date, 76 freshmen have enrolled into the HERD Study [age = 18.5 ± 2.36 years; female = 60.5% (n = 46); 85.5% Caucasian (n = 65); BMI = 26.5 ± 5.85 kg/m²; VO₂max = 35.4 ± 9.3 ml/kg/min]. Roughly 44% (n = 33) reported engaging in regular exercise, however, of those, only 9.2% meet the recommendations of the aerobic guidelines for American adults and 26.3% meet the resistance training criteria. Those who participate in regular exercise were significantly more likely to report that friends help to: plan activities around their exercise, exercise with them, or ask them about how they (the friend) can adopt more exercise compared to their non-exercising counterparts ($p = .026, p = .037$ and $p = .015$, respectively). Moreover, those who participate in regular exercise were more likely to report that their family makes plans for exercise on recreational outings compared to their non-exercising counterparts ($p = .042$). **CONCLUSION:** Support from both friends and family appears to play a decisive role in the adoption and adherence to regular physical activity in late teenage years. Physical activity interventions should include strategies to promote peer social support in the college setting to enhance physical activity participation in college students.

725 Board #4 May 31 3:15 PM - 5:15 PM
Academic Success And One-Year Of Intramural Sports Participation By Freshmen Students
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 (No relationships reported)

Previous research has shown small, positive relationships between academic success and overall recreational sports participation. However, few studies have focused on these relationships within intramural sports participation specifically rather than recreational sports as a whole.

PURPOSE: To investigate differences in cumulative grade point average (GPA) and cumulative credit difference (CD, credits attempted - credits completed) among intramural sports participants and non-participants following their first year of college. **METHODS:** Participants included first time, on campus, freshmen from the FS13 and FS14 semesters. Matched samples (n = 1,796; 898 pairs) were generated based on cohort, high school GPA, race, socioeconomic status, first generation status, and gender. Intramural sports usage was obtained via an online database system (IM Leagues). All other variables were obtained from a university database, including GPA and CD. Means ± SD and percentages were calculated for all variables of interest. Paired sample t-tests were used to assess differences in cumulative GPA and CD between participants and non-participants after first semester and first year time points.

RESULTS: First semester cumulative GPA was significantly higher (p -value < 0.001) for participants (3.25 ± 0.66) than non-participants (3.09 ± 0.80). Likewise, first year cumulative GPA (p -value < 0.001) was also significantly higher for participants (3.25 ± 0.63) than non-participants (3.07 ± 0.78). First semester cumulative CD was significantly lower (p -value = 0.001) for intramural sports participants (5.53 ± 7.00) than non-participants (6.63 ± 7.72). Finally, first year cumulative CD (p -value < 0.001) was also significantly lower for participants (6.09 ± 7.13) than non-participants (7.70 ± 8.20). **CONCLUSIONS:** Results suggest that freshmen students participating in intramural sports during their first year of college achieve higher cumulative first semester and first year GPAs, and have a lower first semester and first year cumulative CD than students who do not participate in intramural sports. Future studies should investigate intramural sports participation and academic variables beyond the first year, and also include retention as an outcome variable.

726 Board #5 May 31 3:15 PM - 5:15 PM
The Relationship between Physical Activity and Binge Drinking among College Students: A Qualitative Investigation
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An incongruous association between regular participation in physical activity (PA) and binge drinking (BD) among college students (CS) has been reported in the literature. **PURPOSE:** The purpose of this study was to qualitatively investigate the relationship between PA and BD among CS. **METHODS:** CS (18-24 years, non-varsity athletes) who were meeting the national physical activity recommendation (≥ 150 minutes/week of moderate and/or vigorous PA) and reported consuming at least five or more alcoholic beverages in a single sitting within the previous 30 days were recruited to participate in the study. A trained facilitator asked open-ended questions based on the social ecological model during focus groups, separated by sex, to inquire about PA and BD experiences among CS. The sessions were audio-recorded and transcribed verbatim. Transcripts were analyzed by three researchers (first independently, then jointly) to determine emergent themes. **RESULTS:** Participants (n = 58, 19.7 ± 0.2 years, 76% Caucasian) described how PA and BD were related in their everyday lives as full-time students. Several intrapersonal, interpersonal, institutional and community factors were identified. The most frequently occurring theme among females (n = 25) was "calorie conscious." "Damage control: healthy/unhealthy" was the most frequent theme/sub-theme among males (n = 33). **CONCLUSION:** The results indicate there are multiple social ecological levels that influence PA and BD behavior in CS. Although additional research is warranted, results of this study suggest that community level factors greatly influence several intrapersonal and interpersonal level factors described by participants. It is imperative that all social ecological levels are considered when designing interventions to promote PA and reduce BD among CS.

727 Board #6 May 31 3:15 PM - 5:15 PM
How Is Self-efficacy Related To Components Of Health-related Fitness In Male And Female Undergraduates?
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 (No relationships reported)

Introduction: As part of Social Cognitive Theory (Bandura, 1986), self-efficacy (SE) represents the extent to which an individual believes a behavior can be successfully completed (Bandura, 1977). Previous research has found evidence that SE is an important factor for promoting exercise adherence and is related to improvements in health-related fitness (HRF; Imayama et al., 2013). However, additional research is needed to investigate how SE is related to each component of HRF (i.e., cardiorespiratory fitness, muscular strength and endurance, and body fatness) across gender.

Purpose: To investigate how SE is related to each component of HRF in male and female college students.

Method: Participants included 399 male and 327 female college students ($M_{age} = 20.57 \pm 3.82$ years) enrolled in a physical health and wellness course. Students completed survey items assessing exercise SE (Resnick & Jenkins, 2000) and a HRF battery (FITNESSGRAM®; Cooper Institute, 2013) assessing cardiorespiratory fitness (Progressive Aerobic Cardiovascular Endurance Run [PACER]), muscular strength and endurance (curl-ups, push-ups, and handgrip strength), and body composition (body fat percentage). Separate correlation analyses were conducted by gender to examine the bivariate relations between SE and each component of HRF.

Results: Among males, SE was weakly correlated with curl-ups ($r = .11, p < .05$) and push-ups ($r = .14, p < .01$), but SE was not significantly correlated with PACER, handgrip strength, or body fat percentage ($p > .05$). Among females, SE was significantly correlated with PACER ($r = .23, p < .001$), push-ups ($r = .33, p < .001$), handgrip ($r = .23, p < .001$), and body fat percentage ($r = .22, p < .001$), but SE was not significantly correlated with curl-ups ($p > .05$).

Conclusion: Overall, SE was weakly related to each component of HRF. Compared to males, females had slightly stronger correlations between SE and each component of HRF. The lack of moderate or strong relationships between SE and HRF may be due to the focus on academic outcomes in undergraduate courses. Thus, fitness class instructors should consider making additional efforts to promote SE among their students. Techniques could include positively reinforcing small improvements in fitness, discussing ways to overcome barriers, or helping students to experience success.

728 Board #7 May 31 3:15 PM - 5:15 PM
Motivational and Self-Perceptions of College Students Who Exercise for Different Reasons

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 (No relationships reported)

College students exercise for a variety of reasons, but specific differences in their motivations and perceptions have not been extensively studied. **PURPOSE:** The main purpose was to see if students whose primary reason for exercise is to lose fat (FATCON), gain muscle mass (MUSC), or maintain health (HLTH) had differences in their exercise motivations, social physique anxiety, and body image self-perceptions. A secondary purpose was to explore if the participants' supplement use reflected their exercise priorities. **METHODS:** Data were collected at a university Wellness Center, or from exercise classes. Participants ($N = 216$) completed a packet of four questionnaires: Multidimensional Body Self Relations Questionnaire (MBSRQ), Social Physique Anxiety Scale (SPAS), The Behavioral Regulation of Exercise Questionnaire (BREQ-3), and an ad hoc Dietary Supplement Questionnaire (DSQ). **RESULTS:** MANOVA revealed a significant difference between groups ($F(14, 350) = 4.89, p < .001$). Post hoc tests showed significant differences between groups on six out of seven dependent variable scales. Specifically, MUSC was significantly higher in autonomous motivation than FATCON and HLTH ($p < .001$), but FATCON scores on SPAS, appearance evaluation, body areas satisfaction, overweight preoccupation, and self-weight classification were all less positive than the scores of MUSC and HLTH ($p < .001$ to $p < .005$). Supplement use was low in HLTH (11%), FATCON (15%), but higher in MUSC (49%). In addition, some of the supplements listed by MUSC were of questionable efficacy and safety. **CONCLUSIONS:** The majority of these college student exercisers were autonomously motivated, but those who exercised primarily for fat control had more negative body-related perceptions than those who exercised primarily for health, or for muscle gain reasons. Additionally, the data on supplement use indicates a need for consumer education, especially for those who report they are exercising primarily to gain muscle.

729 Board #8 May 31 3:15 PM - 5:15 PM
An Analysis Of Physical Activity Knowledge, Motivators, and Self-efficacy In An Undergraduate Wellness Course

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 (No relationships reported)

Research suggests that many undergraduates do not achieve the minimum recommended amounts of physical activity (PA). These findings are concerning as habits developed during college are likely to be continued into adulthood. **PURPOSE:** The purpose of this investigation was to identify changes in health-related fitness knowledge (HRFK), PA practices, self-efficacy and motivations for exercise that occurred while participants were enrolled in a conceptually-based, mandatory, health and fitness course. **METHODS:** One hundred and thirty-five students (66 females) enrolled in the course (mean \pm SD; age 19.89 ± 2.3 years; BMI 24.5 ± 5.24 kg/m²) completed a pre-course survey on the first day of classes and a post-course survey during the last week of classes. The survey collected demographic data and information on HRFK, PA practices, motivations, and self-efficacy for exercise. **RESULTS:** Analysis demonstrated that HRFK increased significantly ($p < .001$) during enrollment in the course. Self-efficacy and BMI values were largely unchanged between pre- and post-course values. Results for PA practices noted increases in miles walked ($p > .05$) and flights of stairs climbed ($p < .05$) per day. Significantly more ($p = .002$) male students reported muscle development, whereas significantly more ($p = .046$) female students reported weight management as a motivators for exercise. Motivations shifted slightly post-course with a significant increase ($p = .014$)

in the number of females exercising for muscle development at the end of the course compared to beginning. Responses to Likert scale (1=Strongly Disagree, 5=Strongly Agree) questions on course outcomes revealed that most students "agreed (4)" that as a result of the course they understood physical responses to exercise training ($M = 4.3, SD = .67$), improved understanding of their current fitness levels ($M = 4.0, SD = .69$), and learned tools to design effective, individualized exercise plans ($M = 4.2, SD = .64$). However, most students "neither agreed nor disagreed (3)" that they exercised more at the end of the course compared to the beginning.

CONCLUSION: Enrollment in a conceptually-based, health and fitness course can increase HRFK over the course of the semester, however this increase in knowledge is not associated with concurrent increases in activity levels or self-efficacy.

B-40 Thematic Poster - Distance Running Issues

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM
 Room: 505

730 **Chair:** Adam S. Tenforde. *Spaulding Rehabilitation Hospital, Cambridge, MA.*
 (No relationships reported)

731 Board #1 May 31 3:15 PM - 5:15 PM
A 5-year Descriptive Epidemiology and Performance Study of Adolescent Recreational Marathon Runners

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PURPOSE: To descriptively examine injuries, treatments, and performance of adolescent recreational runners who trained for a half or full marathon from 2011-12 to 2015-16. **METHODS:** Musculoskeletal injuries and medical treatments of high school recreational runners who committed to a 30-week half or full marathon training program (mean=3.5 practices/week) were recorded by physical therapists over a 5-year period. The recorded information included number of injured participants, number of injuries, injury sites, diagnosis, and number of treatment sessions. Number of participants who completed a half or a full marathon at the end of the 30-weeks of training was recorded annually for the last 5 years. Obtained information was descriptively analyzed. **RESULTS:** Throughout the 5 training seasons, a total of 448 adolescent runners (age: 16.2 ± 0.9 years; 55% female $N = 247$, 45% male $N = 201$) participated in the 30-week training period. During the training periods, 165 adolescent runners (36.8%) reported 225 musculoskeletal injuries (50.2%). The most common injury site was lower leg (29.9%) followed by knee and ankle/foot as the second and third most commonly injured sites (25% each). Achilles/posterior/peroneal tendonitis was the most common injury diagnosis reported (16.1%) followed by patellofemoral pain (14.7%) and shin splints (14.3%). Overall 87.1% of the injuries required 3 or fewer treatment sessions with a mean of 1.82 treatment sessions per injury. Of the 448 adolescent runners, a total of 441 adolescent runners completed either a half ($N = 62$) or full marathon ($N = 379$). The completion rate was 98.4% in this cohort following the 30-weeks of training. **CONCLUSIONS:** Despite the number of injured runners and reported injuries, most adolescent participants completed a half or full marathon following 30-weeks of training. Also, the injuries do not appear to be severe as evidenced by the low number of treatment sessions required and high percentage of students able to complete the race. Further research detailing volume of training with more precise measures of training time lost to injury is needed to more thoroughly validate these results.

732 Board #2 May 31 3:15 PM - 5:15 PM
Runner's Perceptions And Expectations Of Medical Coverage At Ultramarathons

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 (No relationships reported)

As the popularity of ultramarathons grows, medical directors and staff could benefit from greater understanding of runners' needs and expectations. **PURPOSE:** The purpose was to describe runners' expectations and perceptions of medical coverage at 100-mile trail races. **METHODS:** A survey was distributed via email to 230

registrants of a 100-mile trail race in the Northeast United States. Questions included expectations of medical coverage at ultramarathons as well as perceptions of coverage at prior races. **RESULTS:** One hundred sixteen runners completed the survey (98 men, 18 women; age=42±8). Ultramarathon experience ranged from 2-50+ races with runners reporting 1-20 years' experience (mean 4.6 years). Ninety-one percent (n=110) of runners reported a medical issue during prior ultramarathons. The most common were chafing (n=81; 70%), blisters (n=66; 57%), muscle cramps (n=64; 55%), blood under toenail (n=54; 47%), and GI distress (n=47; 41%). Of those who received medical care during a race, 45 of 46 were satisfied with the treatment they received. Runners thought that medical aid should be available every 10 miles (n=49; 45%) or 20 miles (n=33; 30%) and should include medical tape (n=89; 81%), sodium (n=88; 80%), Band-Aids (n=88; 80%), anti-chafe products (n=86; 78%), emergency blankets (n=82; 75%), and ice packs (n=78; 71%). Runners reported carrying few medical items with them including sodium (n=65; 57%), anti-chafe lube (n=40; 35%) anti-inflammatories (n=39; 34%), and Band-Aids (n=28; 24%). While only 4% (n=4) of respondents believed that there are no conditions under which medical personnel should stop a runner from continuing, others thought that appropriate reasons include venomous bite (n=90; 84%), seizure (n=82; 73%), head injury (n=80; 71%), altered consciousness (n=70; 63%), irregular heart beat (n=60; 54%), chest pain (n=58; 52%), or blood in urine (n=56; 50%). **CONCLUSIONS:** Based on this small sample, a large percentage of ultramarathoners suffer from non-emergent conditions, but most do not seek medical care during the race. Those who sought treatment tended to be satisfied with the care received. Medical directors should provide supplies to care for skin care but have the expertise to recognize and treat more serious issues that may require the runner to stop.

733 Board #3 May 31 3:15 PM - 5:15 PM

Pre-Race Medical Screening and Educational Intervention Reduces Medical Complications: A SAFER Study in 153208 Runners

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(No relationships reported)

We previously reported a high rate of medical complications (1/121 race starters) in a cohort of 65 865 runners participating in 21.1km and 56km races over a 4-year period (2008-2011) (SAFER study 1). **PURPOSE:** To determine if an online pre-race medical screening and educational intervention program reduces medical complications in distance running events. **METHODS:** An online pre-race medical screening (based on the European guidelines for pre-screening of leisure athletes participating in moderate- to high-intensity sports) and an educational intervention program was designed and introduced as part of the race registration process, in the period 2012 to 2015 at the Two Oceans Marathon races (21.1km and 56km). The incidence of medical complications (per 1000 race starters; all and serious life-threatening) during the 4-year post-intervention period (2012-2015: 87 343 race starters) was compared with the pre-intervention period (2008-2011: 65 865 race starters). **RESULTS:** Compared to the pre-intervention (baseline) period, there was a significant reduction in the incidence (per 1000 starters, 95% CI; adjusted for age group, gender and race distance) of all medical complications in all runners by 29% [pre=8.6 (7.9-9.4); post=6.1 (5.6-6.7), p<0.0001], 21.1km runners by 19% [pre=5.1 (4.4-5.9); post=4.1 (3.6-4.8), p=0.0356], and 56km runners by 39% [pre=14.6 (13.1-16.3); post=9.0 (7.9-10.1), p<0.0001]. Serious life-threatening complications were significantly reduced in all runners by 64% [pre=0.6 (0.5-0.9); post=0.2 (0.1-0.4), p=0.0003; adjusted for age group and gender]. **CONCLUSION:** A pre-race medical screening and educational intervention program significantly reduced medical complications and serious life-threatening complications among all runners in community-based mass participation distance running events. The reduction in all medical complications was significant in both the 21.1km and 56km races. Pre-race screening and educational intervention programs could be introduced to reduce medical complications during endurance running events.

734 Board #4 May 31 3:15 PM - 5:15 PM

Two-peaked Increase of Serum Myosin Heavy Chain-α After Ironman Demonstrates Heart Muscle Cell Death

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(No relationships reported)

There is an ongoing debate about the significance of cardiac troponin T (cTnT) elevation after strenuous exercise: heart muscle cell death versus physiologic mechanism of release through an intact cell membrane. While cTnT is a small molecule (37 kDa), cardiac specific myosin heavy chain-α (MHC-α) is much larger (224 kDa) and an increase after exercise could hardly be explained by passage

through an intact cardiac cell membrane. **PURPOSE:** To measure MHC-α, and other biomarkers (C-reactive protein (CRP); cTnT, creatine kinase (CK), myoglobin (MG), creatinine (C), and N-terminal pro-hormone of brain natriuretic peptide (NT-proBNP) before and after a full distance Ironman in order to answer the question of heart muscle cell death versus physiologic changes. **METHODS:** In 52 non-elite athletes (14 female, 38 male; age 41.1 ± 9.7, range 24-70 years; all completed the race) biomarkers were measured by standard laboratory methods 7 days before, directly after, and day 1, 4 and 6 after the race. MHC-α was measured with a commercially available ELISA with no cross reactivity with other myosins. **RESULTS:** The course of MHC-α concentration [μg/L] was 1.33 ± 0.53 (before), 2.57 ± 0.78 (directly after), 1.51 ± 0.53 (day 1), 2.74 ± 0.55 (day 4) and 1.83 ± 0.76 (day 6). Other biomarkers showed a one-peaked increase with maximal values either directly after the race or at day 1: cTnT 76 ± 80 ng/L (12-440; reference <15), NT-proBNP 776 ± 684 ng/L (92-4700; ref. < 300), CK 68 ± 55 μkat/L (5-280; ref. < 1.9), MG 2088 ± 2350 μg/L (130-17000; ref. < 72), and creatinine 100 ± 20 μmol/L (74-161; ref. < 100), CRP 49 ± 23 mg/L (15-119; ref. < 5). There was a significant correlation between MHC-α and NT-proBNP (R=0.48; p<0.001) but neither between MHC-α and cTnT (R=0.13; p=0.36) nor MHC-α and myoglobin (R=0.18; p=0.2). **CONCLUSION:** An Ironman leads to remarkable disturbances in biomarkers as e.g. cTnT was in the range of myocardial infarction in 100% of women and 97% of men. This is to our best knowledge the first investigation of MHC-α after strenuous exercise and its two-peaked increase most likely represents first release from the cytosolic pool and later from cell necrosis including the contractile apparatus. However, many questions remain, not at least why MHC-α baseline levels are as high as 1.33 ± 0.53 μg/L.

735 Board #5 May 31 3:15 PM - 5:15 PM

Are Clinical Symptoms Of Running Overuse Injuries Associated With Thermographic Response? A Proof-of-concept Study.

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Medical infrared thermography (MIT), a non-radiating imaging technology, detects changes in skin temperature. Musculoskeletal injuries result in blood flow changes which may produce patterns of associated changes in skin temperature that can be visually detected by MIT.

PURPOSE: To determine if clinical symptoms of distal lower extremity overuse injuries in runners are associated with visually detectable changes in MIT.

METHODS: 29 competitive distance runners (age 18-25y, running >25 miles per week) enrolled and participated. Once weekly, runners reported to lab for MIT photos of bilateral lower limbs taken with an infrared camera. Prior to MIT, runners acclimatized to lab conditions for 15 minutes and the camera was calibrated to the room temperature and humidity. A modified Oslo Sports Trauma Research Centre (OSTRC) overuse injury questionnaire was used for athlete-reported musculoskeletal symptoms and problems. MIT photos and OSTRC scores were obtained on a weekly basis for 8 weeks. Runners' photos were grouped into those with no reports of any lower extremity problems (Controls: OSTRC = 0, n=5); and those with reports of significant lower extremity problems (Injured: OSTRC >50, n=7). Photos from each group were placed into an online viewer and evaluated by 7 blinded clinicians. For the injured group, a photo from the week of the highest reported OSTRC score was paired with a baseline (OSTRC <25) photo. For the control group, two uninjured photos were paired. The reference photo for each pair was labeled. The order of photos (control vs. injured) was randomized and reviewers were not provided the number of included injured runners. Clinicians visually inspected 12 image pairs and decided whether or not the photo suggested a lower extremity problem existed. Diagnostic accuracy statistics were computed for each evaluator.

RESULTS: The median (interquartile range) for the seven evaluators were: sensitivity=0.43 (0.29), specificity=0.60 (0.2), positive likelihood ratio=1.43 (0.0), negative likelihood ratio=0.71 (0.18).

CONCLUSIONS: Low diagnostic accuracy and considerable inter-rater variability suggests evaluator training of MIT interpretation is necessary to accurately confirm or disconfirm presence of injury based on MIT findings.

736 Board #6 May 31 3:15 PM - 5:15 PM
Hematological Changes in Elite Collegiate Cross Country Runners Residing at Moderate Altitude: A Retrospective Analysis

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(No relationships reported)

PURPOSE: This study assessed selected seasonal hematological changes in elite male and female collegiate cross-country (XC) runners residing at a moderate altitude (1655 m). **METHODS:** Previously collected de-identified data from 29 members of the University of Colorado's XC team (12 males, 17 females) were analyzed for this project. The data was part of the regularly scheduled monitoring of these athletes through the CU Sports Medicine program. This program involves blood samples being taken following a rest day, after an overnight fast, at five time points across the year, (August, October, January, April, and August of the new season). Hematological parameters measured included red blood cell count (RBC), hemoglobin concentration (Hb), hematocrit (Hct), mean corpuscular volume (MCV), red cell distribution width (RDW) and serum ferritin. A linear mixed model was used to assess changes over time, significance set at $p < .05$. For variables that violated the assumptions of the linear mixed model (ferritin), non-parametric analysis was used. **RESULTS:** Males (M) and females (F) had significantly different baseline values for Hct (%) (M: $46.5 \pm .8$ versus F: $43.0 \pm .6$) and Hb (gm/dL) (M: $16.3 \pm .3$ versus F: $14.6 \pm .2$), although they exhibited the same pattern of change across the season. Overall, Hct increased from baseline at the October time point (+5.4%) before returning to near baseline levels for the remainder of the season. Hb had a similar trend, being higher at the October time point (+2.2%, $p = 0.083$) before returning to near baseline levels. MCV (Aug1- $90.4 \pm .6$, Aug2- $92.4 \pm .6$) and RDW (Aug1- $12.7 \pm .1$, Aug2- $12.5 \pm .1$) were the only two variables whose two August time points were significantly different. Serum ferritin (ng/mL) was stable over all five time points for males (average of all time points: 56.5), whereas females demonstrated significantly lower values in January (49.2), (average of all time points excluding January: 56.9). **CONCLUSION:** These results suggest seasonal hematological changes occur in elite collegiate XC runners. These changes could be the result of adaptations associated with alterations in training, nutrition and/or altitude exposure. Future studies should directly assess the contribution of these parameters to the observed changes and determine the impact of these changes on performance.

737 Board #7 May 31 3:15 PM - 5:15 PM
Fluid Replacement Knowledge and Sources of Hydration in High School Cross-Country Runners

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(No relationships reported)

Cross-country is a popular interscholastic sport with a growing number of participants annually. As most training and competitions take place during summer and fall, the risk of dehydration may be increased. Unlike other fall high school sports, knowledge about hydration and fluid intake have not been reported in cross-country runners. **PURPOSE:** To assess fluid replacement knowledge and sources of hydration in high school cross-country runners. **METHODS:** Runners were recruited from high school cross-country teams in San Diego. Each runner completed a questionnaire that assessed fluid replacement knowledge and sources of hydration. **RESULTS:** Overall, 148 runners (80 girls, 68 boys) participated in the study. Less than a quarter (23%) of runners correctly indicated that thirst is not a timely indicator of when to drink fluids. Most runners correctly indicated that monitoring urine color is an effective way to determine if hydrated (89.9%), dehydration decreases performance in endurance events (92.6%), dehydration increases risk of heat-related illness (95.9%), running in hot or humid conditions affects hydration (96.6%), runners should begin each training session or competitive event well-hydrated (98.6%), fluid replacement during running should prevent dehydration of greater than 2% of body weight (89.9%), and during recovery runners should rehydrate within a 2 hour period after running (93.9%). Girls (96.2%) were more likely to report that monitoring urine color is an effective way to determine hydration level than boys (83.8%) ($p=0.02$). Runners in the 9th grader (83.7%) were less likely than 10th (88.4%), 11th (100.0%), and 12th (96.6%) graders to report that monitoring urine color is an effective method to determine if dehydrated ($p=0.02$). **CONCLUSIONS:** Most high school cross-country runners indicated a high knowledge of fluid intake and sources of hydration. However, improving runners' knowledge to hydrate regardless of thirst appears warranted. The data suggest that boys and younger runners may need increased education on how urine color indicates safe/unsafe hydration levels.

B-41 Thematic Poster - Macronutrient Metabolism in Athletes

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM
 Room: 304

738 **Chair:** Craig Sale, FACSM. Nottingham Trent University, Nottingham, United Kingdom.
 (No relationships reported)

739 Board #1 May 31 3:15 PM - 5:15 PM
Exercise Mode Combined with Essential Amino Acid and Carbohydrate Supplementation Differentially Regulate Skeletal Muscle microRNA

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(No relationships reported)

Skeletal muscle microRNAs (myomiR) have been implicated in modulating intracellular regulation of muscle protein synthesis by negative inhibition of the mTORC1 pathway. The acute effects of endurance exercise mode and recovery essential amino acid and carbohydrate (EAA+CHO) nutrition on myomiR expression are not well defined. **PURPOSE:** Determine the effects of endurance exercise mode, with or without EAA+CHO ingestion on myomiR expression. **METHODS:** Twenty five adults (mean \pm SD; 22 ± 2 y, 82 ± 11 kg, $VO_{2peak} 4.0 \pm 0.5$ L \cdot min⁻¹) performed 90 min of metabolically-matched (2.2 ± 0.1 VO₂ L \cdot min⁻¹) load carriage (LC; performed on a treadmill wearing a vest equal to 30% of individual body mass; load carried 24 ± 3 kg) or cycle ergometry (CE) exercise, during which EAA+CHO (10 g EAA and 46 g CHO) or non-nutritive control (CON) drinks were consumed. Expressions of myomiR were determined using RT-qPCR in muscle samples obtained at rest (PRE), immediately post-exercise (POST) and after 3-hr recovery (REC). **RESULTS:** Relative to PRE, POST and REC expressions of miR-1-3p, miR-206, miR-208a-5 and miR-499 were lower ($P < 0.05$) for LC compared to CE, regardless of dietary treatment. Independent of exercise mode, miR-1-3p and miR-208a-5p expression were lower ($P < 0.05$) after ingesting EAA+CHO compared to CON. Expression of miR-206 was highest for CE+CON than any other treatment (exercise-by-drink, $P < 0.05$). **CONCLUSIONS:** These data show that myomiR expression is differentially regulated by endurance exercise mode and EAA+CHO nutrition. Weight bearing exercise downregulates myomiR expression, whereas myomiR expression appears to be upregulated after non-weight bearing exercise. Consuming EAA+CHO attenuated the increase in myomiR expression with non-weight bearing exercise, yet the suppression of myomiR expression with feeding was more pronounced when EAA+CHO were consumed during weight bearing exercise. These findings suggest that combining weight bearing exercise with protein and carbohydrate supplementation may facilitate muscle anabolic adaptations to exercise by lowering mTORC1 inhibition.

740 Board #2 May 31 3:15 PM - 5:15 PM
Fructose and Sucrose Ingestion Increase Exogenous Carbohydrate Oxidation Rates During Exercise in Trained Cyclists

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(No relationships reported)

Peak exogenous carbohydrate oxidation rates typically reach ~ 1 g \cdot min⁻¹ during exercise when ample glucose or glucose polymers are ingested. Fructose co-ingestion has been shown to further increase exogenous carbohydrate oxidation rates. **PURPOSE:** To determine the impact of fructose co-ingestion provided either as a monosaccharide or as part of the disaccharide sucrose on exogenous carbohydrate oxidation rates during prolonged exercise in trained cyclists. **METHODS:** Ten trained male cyclists (VO_{2peak} : 65 ± 2 mL \cdot kg⁻¹ BM min⁻¹) cycled on 4 different occasions for 180 min at 50% Wmax and consumed a carbohydrate solution providing 1.8 g \cdot min⁻¹ of glucose (GLU), 1.2 g \cdot min⁻¹ glucose + 0.6 g \cdot kg⁻¹ fructose (GLU+FRU), 0.6 g \cdot min⁻¹ glucose + 1.2 g \cdot min⁻¹ sucrose (GLU+SUC), or water (WAT). Breath samples were collected to determine the ¹³C/¹²C ratio in expired air and combined with indirect calorimetry (VO₂ and VCO₂) to calculate oxidation rates of total fat, total carbohydrate, and exogenous carbohydrates. Repeated measures ANOVA with treatment as within-subject factor was used to determine differences in exogenous carbohydrate oxidation rates between treatments.

RESULTS: Peak exogenous carbohydrate oxidation rates did not differ between GLU+FRU and GLU+SUC (1.40±0.06 vs 1.29±0.07 g·min⁻¹, respectively, $P=1.000$), but were 46±8% higher when compared to GLU (0.96±0.06 g·min⁻¹; $P<0.05$). In line, exogenous carbohydrate oxidation rates during the latter 120 min of exercise were 46±8% higher in GLU+FRU or GLU+SUC compared with GLU (1.19±0.12, 1.13±0.21, and 0.82±0.16 g·min⁻¹, respectively, $P<0.05$).

CONCLUSION: Fructose co-ingestion (0.6 g·min⁻¹) with glucose (1.2 g·min⁻¹) provided either as monosaccharide or as sucrose strongly increases exogenous carbohydrate oxidation rates during prolonged exercise in trained cyclists.

Funding: Knowledge Centre Sugar and Nutrition, Utrecht, the Netherlands and Sugar Nutrition UK, London, United Kingdom.

741 Board #3 May 31 3:15 PM - 5:15 PM
Multiple-transportable Carbohydrate Has Minimal Impact On Long-distance Triathlon Race Performance

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(No relationships reported)

PURPOSE: In the laboratory, the ingestion of multiple-transportable carbohydrates (fructose, glucose) in beverages at high rates (>1.3 g·min⁻¹) enhances exogenous carbohydrate oxidation, fluid absorption, gut comfort, and performance, relative to single carbohydrate equivalents. In competition, however, endurance athletes prefer to ingest carbohydrate in a solid-gel-drink format but whether multiple-transportable carbohydrates in the mixed format also enhance competition performance is unknown. The objective of the study was to determine the effect of multiple- vs. single-transportable carbohydrate on triathlon race performance when ingested in the common format of bars, gels and drinks.

METHODS: A double-blind randomized controlled trial was conducted within two sanctioned half-ironman triathlon races held 3 weeks apart in 74 well-trained male triathletes (18-60 y; >2 y competition experience). Carbohydrate was ingested before (94 g) and during the race from bars (25%), gels (35%) and drink (40%) comprising a 2:1 glucose/maltodextrin:fructose ratio vs isocaloric placebo glucose/maltodextrin only. Ingestion was apportioned by unit-distance covered during the cycle (2.5 g·km⁻¹) and run (7.8 g·km⁻¹) averaging 78.6 g·h⁻¹ (SD 6.6). Post-race 0-10 unit Likert-type scales were completed to assess gut comfort and energy.

RESULTS: The trial returned low dropout rate (9%), high compliance and sensitivity (typical error 2.2%), but the effect of the multiple-transportable carbohydrate on overall performance time (-0.6%, 95%CI -1.8%, 0.7%), swim, bike, and run times, and on nausea, gut comfort and perceived energy was of trivial-small magnitude without statistical significance. Within-subject covariate adjustment for pre-exercise body weight, heat stress, and within-race change in body weight had negligible impact on outcomes.

CONCLUSION: Multiple-transportable carbohydrate ingested in the common bar-gel-drink format provided negligible benefit to long-distance triathlon performance. The experience of the large sample intervention study showed that in-competition clinical trials offer ecological validity, and high throughput rate, compliance, and sensitivity for evaluation of health and performance interventions in athletes. Funding: Nestec Ltd, Switzerland.

742 Board #4 May 31 3:15 PM - 5:15 PM
Alterations in Exogenous Carbohydrate, Liver and Muscle Glycogen Oxidation with Different Doses of Glucose and Fructose ingestion during Prolonged Cycling

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(No relationships reported)

PURPOSE: To investigate the effect of three CHO doses on fuel selection during exercise, in particular exogenous and endogenous (liver and muscle) CHO oxidation.

METHODS: Eleven trained male cyclists ($\dot{V}O_{2max}$: 60.0 ± 4.3 ml/kg/min) cycled on 4 occasions at 60% $\dot{V}O_{2max}$ for 3 hours after an overnight fast. From 15 min into exercise and every 15 min thereafter, either 80 g·h⁻¹ (LOW), 90 g·h⁻¹ (MED), 100 g·h⁻¹ (HIGH) of GF (all 2:1 ratio) or a placebo (PLA) was ingested in a double-blind randomised order. The formulations contained ¹³C isotope tracers and were designed to span the reported saturation levels for SGLT1 and GLUT5. Total, exogenous, endogenous (muscle and liver) CHO oxidation, and total fat oxidation were computed using indirect calorimetry and isotope ratio mass spectrometry.

RESULTS: Total CHO oxidation was elevated, and total fat oxidation suppressed in all CHO conditions relative to PLA (CHO range 94.0-125.0 g higher, Fat 29.7-34.3 g lower; both ES > 1.05). Exogenous oxidation in the final hour was greatest in HIGH (91.1 g·h⁻¹), a moderate effect to LOW (81.6 g·h⁻¹, ES = 0.64, P = 0.10) and MED (82.9

g·h⁻¹, ES = 0.70, P = 0.39) a moderate increase from the second hour in all conditions (ES = 1.38-2.00, P < 0.014). However, increasing GF dose beyond intestinal saturation increased muscle glycogen utilisation in the final hour (101.6 ± 16.6 g·h⁻¹ in HIGH; 62, -23.5 to 11.1 g·h⁻¹ higher [95% CI] vs. LOW, ES = 0.47, P = 0.61 & 16.1, 0.9 to 31.4 g·h⁻¹ [95% CI] higher vs. MED, ES = 0.68, P = 0.16), and second hour (ES = 0.51 & 0.48, P > 0.05). A small, non-significant reduction was seen in liver glycogen oxidation with HIGH in the last hour compared with LOW (-2.6, -5.6 to 0.4 g·h⁻¹, ES = 0.40) and MED (-2.6, -6.8 to 1.6 g·h⁻¹, ES = 0.42).

CONCLUSIONS: Increasing CHO ingestion beyond previously reported saturation rates produces higher exogenous oxidation, but results in an increased reliance on muscle glycogen. Ingestion of 90 g·h⁻¹ GF can attenuate the rate of muscle glycogen oxidation by the end of 3 hours prolonged exercise, but recommendations should remain in the region of 80 to 90 g·h⁻¹.

743 Board #5 May 31 3:15 PM - 5:15 PM
Glucose Regulation Following A Short And Long Bout Of High-intensity Functional Training

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(No relationships reported)

Glucose regulation is a fundamental process of metabolic function, and is acutely altered by physical activity. Importantly, exercise intensity and duration have been shown to affect glucose regulation differently. High-Intensity Functional Training (HIFT) is a form of exercise performed using combinations of various modalities and durations. Though HIFT is of a high-intensity nature, it is unknown if different durations of HIFT will influence glucose regulation differently.

PURPOSE: To determine the effect of a Short (< 5 min) and Long (15 min) bout of HIFT on plasma glucose and insulin concentration.

METHODS: Ten apparently healthy males (28.11 ± 5.09 yrs) participated in this study. Two HIFT sessions (SHORT and LONG) were performed in a crossover fashion. The SHORT bout consisted of 30 power clean-and-jerk lifts (61 kg) for time, while the LONG bout was a 15-min circuit of 250 m row, 20 kettle bell swings (24 kg), and 15 dumbbell (16 kg) squat presses performed for 15 min. Blood plasma was collected at four different times points: PRE, POST, 1HR, and 3HR in order to examine glucose (GLU) and insulin (INS) responses.

RESULTS: A repeated measures ANOVA showed no trial dependent difference between the SHORT and LONG bouts of HIFT in GLU (p = 0.109) or INS (p = 0.504). A time effect was observed in both bouts only at the POST time point for both GLU; Short: 83.9 ± 16 mg/dL vs. 110.3 ± 18 mg/dL (p < 0.001), Long: 84.5 ± 11 mg/dL vs. 124.6 ± 19 mg/dL and INS; Short: 7.9 ± 4 mU/L vs. 16.1 ± 7 mU/L, Long: 9.1 ± 7.8 mU/L vs. 13.7 ± 7.3 mU/L (p < 0.05).

CONCLUSIONS: This study demonstrated that the SHORT and LONG bouts of HIFT elicited similar glucose and insulin responses. Duration of the HIFT bouts may not be a determining factor in glucose regulation in healthy individuals. Further research is necessary to better understand the relationship of varying durations of HIFT on glucose regulation.

744 Board #6 May 31 3:15 PM - 5:15 PM
Metabolic Effects of Acute Blood Flow Restricted Exercise: Glucose & Insulin

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(No relationships reported)

Blood flow restricted exercise (BFRE) has gained a lot of attention as of late due to its ability to increase muscle mass and strength during low intensity exercise. BFRE results in ischemia, which has been shown to cause a shift to a greater reliance on glucose metabolism. Although the metabolic effect of traditional exercise is well studied, there is a lack of research on the metabolic effects of BFRE. **PURPOSE:** Investigate the blood glucose and insulin response to a single bout of blood flow restricted exercise 12, 36, and 48 hours after completion. **METHODS:** 8 healthy men (22±2 yrs), of above average $\dot{V}O_{2max}$ (46.2±13.4ml/kg/min), and average body fat percentage (17.4±3.2) performed two separate trials of treadmill walking (CON & BFRE) at 50±5% of their predetermined $\dot{V}O_{2max}$ until 200 kcal were expended. For the BFRE trial, pressure cuffs were applied to the most proximal portion of the thigh and inflated to 200 mmHg. Subjects walked in 10-minute increments, interspersed with 2 minutes of passive recovery where the pressure cuffs were deflated. Blood samples were taken at baseline, immediately after exercise, 12 hours, 36 hours, and 48 hours post exercise bout. All values were reported in standard±mean deviation. A 2x3 Repeated Measures ANOVA, a One-way ANOVA, and a Tukey's HSD post hoc test were utilized to evaluate differences from pre to post. **RESULTS:** Minimal differences were found in the glycemic response post exercise between BFRE and CON (95.6±2.8, 99.9±14.1, 102.6±14.8, 104.6±8.2, and 96.8±4.8) vs (97.0±3.9, 93.1±8.1, 96.2±6.5,

92.8±6.2, 93.7±4.7). However, BFRE resulted in significantly lower insulin levels than CON at immediately, 12, 36, and 60 hours post exercise (18.4±7.3, 12.1±6.9, 12.2±7.8, 11.8±5.8, and 12.7±6.0) vs (17.6±7.9, 18.3±8.4, 16.5±8.7, 15.8±6.9, and 18.5±9.4).

CONCLUSION: In this small sample of apparently healthy above average aerobic fitness and average body fat men, treadmill walking to expend 200 kcals in conjunction with BFRE resulted in significant less insulin needed to elicit the same glycemic response post exercise than CON.

Research was funded in part by Sigma Xi Grant in Aide, Provosts Undergraduate Research Fund, and the College of Health Sciences and Professions Student Research Award.

745 Board #7 May 31 3:15 PM - 5:15 PM

Body Composition, Substrate Utilization, Thermoregulation, And Performance In Male Runners After 3-week High Fat Diet

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(No relationships reported)

PURPOSE: This study examined physiological and performance effects of a 3-week high fat, low carbohydrate diet (HFLC) in trained runners.

METHODS: Middle-aged, recreationally competitive ($\text{VO}_2 = 48.5 \pm 4.5$ ml/kg/min) male runners ($n = 8$; 39.5 ± 9.9 y) completed 5 sets of 10 min runs separated by 2 min of rest in a controlled, hot environment (29 °C and 60 % relative humidity). The first 7 min of each stage were run at a sub-marathon pace with the last 3 min of each stage matching the runner's goal pace for 5-km, 10-km, half-marathon, marathon, and sub-marathon race pace (1% grade). Indirect calorimetry variables were collected during each race distance pace. Runners rested for 20 min before a challenging outdoor 5-km time trial (5TT). Runners followed their habitual high carbohydrate (HC) for the first phase of the study followed by 3 weeks of HFLC ($\geq 70\%$ kcals from fat; < 50 g/day carbohydrates).

RESULTS: Pre- and post-exercise ketones increased by ~ 0.5 mmol for HFLC. Sum of 7-site skinfold thickness and body mass decreased ($p < 0.01$) by ~ 13 mm and 2.5 kg for HFLC respectively. Mean RER was lower ($p < 0.01$) by 0.08-0.10 at all paces for HFLC. Mean fat oxidation was predicted to be non-existent at 5-km pace and < 0.3 g/min at all other paces for HC, while ranging from 0.32-0.81 g/min for HFLC. Absolute VO_2 was higher for HFLC or neared statistical significance at all paces slower than 5-km. Rectal temperature was higher in HFLC after the first 10 min bout, but did not differ at any other time point. Total sweat losses and heart rate for each pace did not differ between treatments. Five runners completed their 5TT faster after HFLC, 1 remained unchanged and 2 were slower following HFLC. Mean finishing time was ~ 30 -s faster for HFLC, but there was no statistical difference ($p = 0.25$; HFLC = 23.45 ± 2.25 ; HC = 23.92 ± 2.58 min).

CONCLUSIONS: Transitioning to a HFLC resulted in positive fat oxidation adaptations and may even improve late exercise, high intensity endurance performance for well-trained but recreational runners. Anecdotally, non-responders to HFLC may be identified by lack of cessation in training impairment that is almost always experienced in the first 2 weeks during transition to HFLC. In contrast to the runners with improved times, continued difficulties noted in training logs were only noted in runners with lack of 5TT improvement.

B-42 Thematic Poster - Muscle Activation during Sport and Exercise

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM
Room: 101

746 Chair: Ajit Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*

(No relationships reported)

747 Board #1 May 31 3:15 PM - 5:15 PM

Relationship Between Passive Hip Range of Motion And Hip Muscle Activation During Landing

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(No relationships reported)

Passive hip range of motion (ROM) is theorized to influence activation of the hip musculature during dynamic activity. A decrease in the activation of the hip musculature may lead to landing biomechanics that increase the risk of knee injuries.

Understanding the relationship between passive hip ROM and hip muscle activation during landing is needed to identify individuals at risk for knee injuries. **PURPOSE:** To examine the relationship between transverse plane hip passive ROM and hip muscle activation during a landing task. **METHODS:** Twenty female Division 1 soccer players (19.2 ± 0.9 yrs, 167.2 ± 5.7 cm, 65.9 ± 6.6 kg) volunteered to participate. Passive hip internal (HIR) and external (HER) ROM of the left limb was measured with participants prone and the knee flexed to 90 degrees using a digital inclinometer by a single examiner ($\text{ICC} > 0.87$). The average of three HIR and HER ROM measures was used for analysis. Surface electromyography (sEMG) was used to assess activation of the gluteus medius (GMED) and gluteus maximus (GMAX) during 3 trials of a drop vertical jump (DVJ) task from a 31cm high box. The average root mean square amplitude (RMS) of the sEMG signal of the GMED and GMAX 150ms following initial contact across three DVJ trials was normalized to the peak RMS amplitude across three maximal voluntary isometric contractions (%MVIC). Pearson's Product Moment Correlations were calculated to determine the relationship between passive hip ROM and muscle activation during the DVJ ($p < 0.05$). **RESULTS:** Greater HIR ROM (39.9 ± 11.1 degrees) was correlated with less GMAX activation during the DVJ task ($\text{RMS} = 0.61 \pm 0.40\%$ MVIC, $R = -0.53$, $P = 0.02$). HIR ROM was not correlated with GMED activation during the DVJ task ($\text{RMS} = 0.24 \pm 0.12\%$ MVIC, $R = -0.38$, $P = 0.10$). HER ROM (30.6 ± 8.1 degrees) was not correlated to GMAX ($R = 0.10$, $P = 0.69$) or GMED activation ($R = 0.21$, $P = 0.37$) during the DVJ task. **CONCLUSIONS:** Greater HIR ROM potentially influences the length-tension relationship of the GMAX, decreasing its ability to effectively activate during dynamic activities and increasing the risk of knee injuries. Ongoing work is needed to examine whether the effects of hip ROM on muscle activation contribute to landing biomechanics known to increase risk of knee injuries.

748 Board #2 May 31 3:15 PM - 5:15 PM

Shoe Cushioning Reduces Impact And Muscle Activation During Landings From Unexpected, But Not Self-initiated, Drops

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(No relationships reported)

The drop jump, regarded as "an active landing from a self-initiated drop" (self-initiated drop landing, SIDL), is an effective training modality to develop explosive strength. Contrarily, "a landing from an unexpected drop" (unexpected drop landing, UDL), which is mostly unanticipated, has been proposed to generate potentially hazardous alterations to impact absorption. To date, few rigorous scientific studies have been conducted to understand the impact mechanics and muscle activation characteristics of these two landing tasks and the role of shoe properties.

PURPOSE: To investigate the shoe effects on impact biomechanics and muscular responses during drop landings.

METHODS: Twelve male collegiate basketball players performed bipedal landings from self-initiated and unexpected drops (SIDL and UDL) from a 60-cm height wearing highly-cushioned basketball shoes (Bball) and minimally cushioned control shoes (CC). Sagittal plane kinematics, ground reaction forces (GRF), accelerations of the shoe heel-cup, and electromyography (EMG) of the tibialis anterior (TA), lateral gastrocnemius, rectus femoris (RF), vastus lateralis (VL), and biceps femoris (BF) were collected simultaneously.

RESULTS: In SIDL, no significant differences were observed in peak vertical GRF, peak heel acceleration, or normalized EMG amplitude (root mean square, EMG_{RMS}) for all muscles during either the pre- or post-activation phase between the two shoe conditions. In UDL, however, both peak vertical GRF (4.1 ± 0.7 vs. 4.7 ± 0.8 BW, $p < 0.05$) and heel acceleration (29 ± 7 vs. 36 ± 8 g, $p < 0.05$) were lower in Bball compared to CC. Furthermore, the EMG_{RMS} of TA (17 ± 6 vs. $24 \pm 8\%$, $p < 0.05$), RF (21 ± 3 vs. $28 \pm 7\%$, $p < 0.05$), VL (28 ± 5 vs. $35 \pm 4\%$, $p < 0.05$), and BF (9 ± 4 vs. $14 \pm 5\%$, $p < 0.05$) muscles showed a decrease in Bball compared to CC within the 50 ms after contact.

CONCLUSION: These observations suggest that shoe cushioning may make only a limited contribution to reducing landing impact forces provided that neuromuscular adjustments occur properly during landings from self-initiated drops. However, in the situation when relevant muscles are not activated on purpose, as in landings from unexpected drops, wearing a highly-cushioned shoe decreases peak impact and muscle post-activation.

Supported by NSFC grant (81302131).

749 Board #3 May 31 3:15 PM - 5:15 PM

Muscle Activation Patterns during a Novel Lateral Lunge Jump Reaction TaskMichelle A. Aube, Jeffrey B. Taylor, Audrey E. Westbrook, Anh-Dung Nguyen, Kevin R. Ford, FACSM. *High Point University, High Point, NC.* (Sponsor: Dr. Kevin Ford, FACSM)
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(No relationships reported)

Muscular activation and recruitment patterns of the hamstrings and quadriceps may play an important role in knee joint stabilization with unanticipated reactions during sport.

PURPOSE: To examine lower limb muscle activation during a lateral lunge jump reaction task.

METHODS: Female soccer players participated in the study (n=10, age: 15±1yrs, height: 162.3±4.6cm, mass: 54.5±4.5kg). While wearing standardized cleats, each participant was instrumented with reflective markers for motion analysis. Surface EMG sensors were placed on the semimembranosus (MH), biceps femoris (LH), vastus lateralis (LQ), and vastus medialis (MQ). While standing in a ready position (feet shoulder width apart, knees slightly bent) on force platforms covered with artificial turf, a visual cue of an arrow pointing either left or right was projected on a screen in front of the participant, at which time they were to lunge jump laterally in the correct direction as quick and far as possible. Right directed lunge trials were analyzed. Muscle onset time was defined as greater than SSD above the resting threshold prior to the visual cue. Peak root mean square EMG amplitudes of the left leg were calculated and normalized to maximum amplitude (%) during a cutting task. Reaction time (Rt) was defined as the difference between the visual cue popup and left toe off from the force platform. Paired t-tests (p<0.05) were used to determine differences in muscle onset time and amplitude during the task. Stepwise linear regression was utilized to determine significant predictor variables for Rt.

RESULTS: Rt from visual cue to toe off was 0.99±0.10s. There was a significant difference (p=0.039) between LH (0.40±0.12s) and LQ (0.47±0.11s) onset times with no significant difference (p=0.2) between MH (0.42±0.09s) and MQ (0.48±0.10s) onset times. Differences were not found between peak EMG amplitude (LH: 67.6±24.9%, LQ: 80.9±8.2%, p=0.16; MH: 66.3±24.1%, MQ: 79.2±14.9%, p=0.18). Stepwise linear regression indicated that the single predictor variable of Rt was LQ onset time (R²=0.616, F(1,8)=12.81, p=0.007).

CONCLUSION: Earlier hamstrings activation may provide increased co-activation during an unanticipated reaction requiring a rapid lunge jump. However, quicker quadriceps activation is strongly correlated with improved reaction time performance.

750 Board #4 May 31 3:15 PM - 5:15 PM

Changes in Lower Extremity Muscle Activation After Different Types of ExerciseLindsay Slater, Joe Hart, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: Joe Hart, FACSM)

(No relationships reported)

Muscle activation changes after exercise due to muscular fatigue. Muscular fatigue is often induced using standard exercises such as treadmill incline walking and squats, however exercise that simulates sport including high-speed movements, changes in direction, and decision-making may elicit different muscle activation adaptations.

Purpose: Compare muscle activation patterns before and after two exercise protocols.

Methods: 14 healthy volunteers (10F/4M, 168.3±10.0cm, 66.7±12.5kg, 19.3±0.9 yrs) completed two exercise protocols within 14 days. One exercise protocol (Control) included 30 minutes of incline walking intermixed with brief periods of squat jumps and lateral hops. The second exercise protocol (Sport) included 30 minutes of walking and running intervals intermixed with brief periods of sprinting forcing subjects to respond in random directions. EMG electrodes were placed on the vastus lateralis, vastus medialis, and gluteus medius of the dominant leg using standard EMG placement procedures. Data were recorded while walking at 1.3m/s before and immediately after exercise intervention. Normalized EMG data (MVIC) for 5 strides were reduced to 101 points from heel strike to ipsilateral heel strike to represent 0-100% of the gait cycle. Means and 90% confidence intervals were calculated for each muscle before and after exercise. Areas in which the confidence intervals for EMG activity across the entire gait cycle did not overlap for 3 or more consecutive points were considered statistically significant differences. Cohen's *d* effect sizes and 90% confidence intervals were calculated for portions of gait with significant differences. **Results:** Vastus medialis activation increased during walking gait after both Control (74-78%, *d* = 38.2±9.5) and Sport exercise (73-76%, *d* = 15.0±3.6). Gluteus medius activation only increased after Sport exercise (76-84%, *d* = 7.5±2.0). There were no changes in vastus lateralis after either exercise. **Conclusion:** Both exercise protocols increased vastus medialis activation, however only Sport exercise increased gluteus medius activation, demonstrating that different types of exercise may elicit different EMG activity responses. These differences should be considered when designing exercise protocols for muscle activation testing.

751 Board #5 May 31 3:15 PM - 5:15 PM

Influence of Force Application Strategies on Muscle Activation and Plantar Pressure during Maximal Ergometer RowingRena Jackson¹, Will Wu¹, Mimi Nakajima¹, Tiffanye Vargas¹, James Becker². ¹*California State University Long Beach, Long Beach, CA.* ²*Montana State University, Bozeman, MT.*

(No relationships reported)

The rowing stroke begins with the feet generation force against the foot stretcher. It has been suggested that force application at the foot stretcher can be a limiting factor to rowing performance, however it is unknown how different strategies of applying force underneath the feet influence muscle activation and force-time profiles.

PURPOSE: To determine how different strategies of applying force underneath the feet influences muscle activation and force-time profiles during maximal ergometer rowing. **METHODS:** Seven collegiate rowers (5-female, 2-male) completed two trials of ten maximal strokes. Trial conditions consisted of instructional cues: "Push through the balls of your feet", "Push through the heels of your feet". EMG of the erector-spinal (ES), lastissimus-dorsi (LD), gluteus-maximum (GM), and rectus-femoris (RF) were bilaterally recorded, sampling at 1500Hz. Pressure distribution under both feet was recorded while using a wireless in-shoe plantar-pressure system sampling at 500Hz. Peak force and impulse were calculated in a custom MATLAB program for the total foot, heel, and forefoot regions, under both conditions. Timing of muscle activation, duration, and integrals (iEMG) of drive activation were calculated for the middle 5 strokes. Paired t tests were used to compare dependent variables between the conditions. **RESULTS:** Six participants produced significantly higher peak forces (517.6±109.8N, *p*<0.012, *d*=1.57) and impulses (359.3±57.2N, *p*<0.007, *d*=1.80) when pushing through the balls than when pushing through the heels. Three participants displayed the opposite pattern. EMG analysis did not reveal significant differences in onset, duration, or integration of muscle activation between conditions.

CONCLUSIONS: Rowers in this study can be separated into two groups based on their ability to produce force and generate impulse: those more effective at pushing through the balls of the feet, at those more effective at pushing through the heels. Future research may want to examine performance, strength, and flexibility parameters to determine whether this difference is a beneficial or detrimental adaptation. If certain strategies are associated with variables that determine successful performance, then coaches may use this information to improve rowing performance.

752 Board #6 May 31 3:15 PM - 5:15 PM

Electromyographic Activation Of Quadriceps In Single And Multi-joint ExercisesJessica F. Perle, Danilo S. Felipe, Tamires F. da Silva, Fabiano F. da Silva, Wonder P. Higinio, Elisângela Silva, Wagner Z. de Freitas, Daniela G.M. Bueno, Dênis B. da Silva, Renato A. de Souza. *IFSULDEMINAS, Muzambinho, Brazil.*

(No relationships reported)

Resistance training (RT) is a form of physical activity that is designed to improve muscular fitness. Considering the need to adequately prescribe RT, a better understanding about the effects of mono and multi-joint exercises is required, mainly using electromyographic (EMG) findings. **PURPOSE:** to compare EMG activation of quadriceps in mono-joint and open kinetic chain versus multi-joint closed kinetic chain exercises. **METHODS:** Ten healthy male (25.3 ± 3.7) and with no previous experience with RT were recruited. This study was conducted as a cross-over design; i.e., the subjects were randomly assigned either to mono-joint (n = 5; seated knee extension machine) or multi-joint (n = 5; back squat at knee joint angle of 90°) for the 1(st) trial and 15 days later the subjects were switched conditions for the 2(nd) trial. Surface electromyography was used to measure muscle activation of the vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF) using Root Mean Square (RMS) signal normalized by peak during dynamic contraction. A 12-RM test was used in order to promote some standardized load for both experimental situations. For statistical analysis a two-way ANOVA was performed (muscle and treatment effects). **RESULTS:** RF showed a lower (p<0.05) EMG activation than VL and VM in multi-joint exercise (26.81 ± 7.84% versus 33.43 ± 5.49% and 33.27 ± 4.96, respectively). In another way, RF showed a higher (p<0.05) EMG activation than VL and VM in mono-joint exercise (41.17 ± 5.08% versus 37.87 ± 4.94% and 37.12 ± 3.79%). Mono-joint exercise increased ~34% the EMG activation of RF than multi-joint exercise. There are no significant differences between the vastus (p>0.05). **CONCLUSION:** A mono-joint and open kinetic chain exercise promoted higher RF-EMG activation and not altered vastus-EMG activation when compared with a multi-joint and closed kinetic chain exercise. These findings suggest that EMG pattern may be muscle-dependent even within the same muscle group as the quadriceps.

753 Board #7 May 31 3:15 PM - 5:15 PM

Activation Of Knee Extensor Muscles During Rapid Force Development In Men And Women

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 (No relationships reported)

Adequacy of activation during rapid voluntary contractions is limited in young and old adults and can be shown by comparing the voluntary rate of force development (RFD) and electrically evoked RFD. Nonetheless, it is unknown whether the activation of rapid voluntary contractions differs between young men and women.

PURPOSE: The purpose of this study was to compare the maximal RFD of young men and women during electrically evoked isometric contractions and rapid voluntary contractions with the knee extensor muscles across a range of torques.

METHODS: Eight young adults (18-26 years; 4 men, 4 women) consented to sets of single and double pulse (10 ms interval) stimulations of the femoral nerve at maximal intensities followed by rapid voluntary isometric knee extensions at target torques matched to the electrically evoked torques. For the rapid voluntary isometric contractions, subjects were instructed to kick as fast as possible rather than as accurately as possible. Voluntary target torques ranged between 10-40% of maximal voluntary contraction (MVC) and were set to match the electrically evoked torques. Maximal RFD for each trial (voluntary and electrically evoked) was calculated as the peak values of the first derivative of the torque signal.

RESULTS: Torques (between 10-40% MVC) were similar for the electrically evoked and voluntary contractions ($F_{1,6} = 0.54, P = 0.49$) for both the men ($25.0 \pm 0.6\%MVC$ vs. $26.4 \pm 0.7\%MVC$) and women ($26.0 \pm 2.0\%MVC$ vs. $26.5 \pm 2.7\%MVC$). Although torques were similar, RFD from electrically evoked contractions in men ($514.8 \pm 30.4\% MVC \cdot s^{-1}$) and women ($475.1 \pm 78.0\%MVC \cdot s^{-1}$) was 36% greater than the voluntary contractions (men; 330.2 ± 18.8 vs. women; $305.9 \pm 21.2\%MVC \cdot s^{-1}$; $F_{1,6} = 23.1, P = 0.003$). The linear association between relative torque (%MVC) and electrically evoked RFD ($R^2 = 0.85, b = 0.92, P < 0.001$) was larger and steeper than the association with voluntary RFD ($R^2 = 0.72, b = 0.85, P < 0.001$) indicating that the difference in RFD between the electrically evoked and voluntary contractions increased at the higher forces.

CONCLUSIONS: Young men and women had marked reductions in the ability to voluntarily generate isometric knee extension torque rapidly compared with electrically evoked contractions that were independent of the central nervous system. Supported by NIA R01 AG048262 to SKH

754 Board #8 May 31 3:15 PM - 5:15 PM

Proximal Joint Muscle Activation During Cutting In Chronic Ankle Instability Patients Following a Rehabilitation Intervention

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 (No relationships reported)

Sensorimotor deficits due to ankle sprains often result in altered lower extremity muscle activation during cutting. Interventions focusing on the ankle and hip could enhance muscle activation and subsequent sensorimotor function in patients with chronic ankle instability (CAI).

PURPOSE: To examine the effect of a 6-week ankle and hip intervention program on vastus lateralis (VL), medial hamstring (MH), gluteus medius (GM), and gluteus maximus (GX) activation during cutting in patients with CAI.

METHODS: 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ($\alpha = .05$) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed.

RESULTS: Figure 1. The rehab intervention resulted in up to (i) 28% less VL activation at 0-20% of stance, (ii) 31% more MH activation at 43-100% of stance, (iii) 14% less GX activation at 83-100% of stance. No changes were detected in GM activation over time.

CONCLUSIONS: Relative to the control group, reduced proximal joint muscle activation in CAI patients in the rehab group may be due to altered knee and hip positions. A less flexed position of the knee and hip often leads to less knee and hip extensor moments, which potentially could result in reduced VL and GX muscle activation.

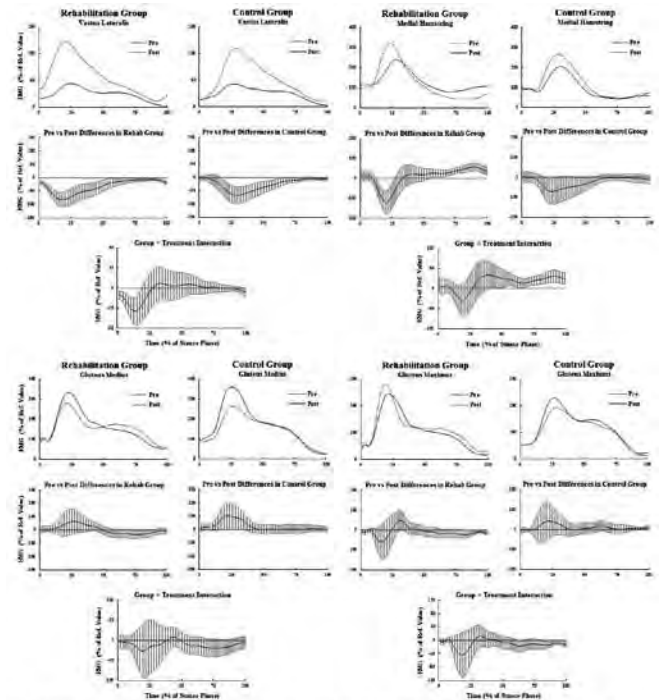


Figure 1. Grand ensembles for proximal joint muscle activation during the stance phase of a cutting task. A group x treatment interaction was defined subtracting "Pre vs Post Differences in Rehab Group" from "Pre vs Post Differences in Control Group". When 95% confidence intervals (shaded area) did not overlap the zero (horizontal red line), significant differences existed.

B-43 Thematic Poster - Running

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM
 Room: 404

755 **Chair:** Andy Bosak. *Liberty University, Lynchburg, VA.*
 (No relationships reported)

756 Board #1 May 31 3:15 PM - 5:15 PM

Energy Expenditure During Treadmill Walking and Running: Accuracy of the 100 Kcal Per Mile Estimate

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 (No relationships reported)

Walking and running are widely used modes of exercise to improve fitness and promote weight loss. The energy expended during walking or running can be measured in a lab or estimated based on speed, grade, and body weight. However, these assessments are not easily completed by the general population, so a crude estimate of energy expenditure (EE) of 100 kcal•mile⁻¹ is commonly used. Although the equations for estimating EE at a given walking or running speed have been validated, the accuracy of the 100 kcal•mile⁻¹ value has not been evaluated.

PURPOSE: The purpose of this study was to determine the accuracy of the 100 kcal•mile⁻¹ estimate across a wide range of walking and running speeds.

METHODS: A sample of 21 subjects (age 23.6±8.8 y) walked or ran one mile at a self-selected speed on a motorized treadmill while VO₂ was measured. The EE was calculated from VO₂ measured after subjects achieved steady-state. The significance of differences in measured EE and the 100 kcal•mile⁻¹ estimate were determined using t-tests.

RESULTS: There were no significant differences between the measured EE and the 100 kcal•mile⁻¹ estimate (108.6±31.5 vs. 100±0 kcal•mile⁻¹, p=0.22) across both running and walking speeds (range: 72.4-187.6 m•min⁻¹). There were also no significant differences between the actual and estimated EE at walking speeds (95.6±12.6 m•min⁻¹; 100.1±23.1 vs. 100±0 kcal•mile⁻¹, p=0.98) or running speeds (158.8±19.4 m•min⁻¹; 115.0±36.2 vs. 100±0 kcal•mile⁻¹, p=0.18). However, the measured EE during running was significantly higher (p=0.03) than during walking.

CONCLUSION: The widely used EE estimate of 100 kcal•mile⁻¹ appears to be accurate across a wide range of walking and running speeds. While the measured EE during running was significantly higher than during walking, neither was significantly different from the 100 kcal•mile⁻¹ estimate. This suggests that this value may be useful for estimating EE for fitness or weight loss purposes in a general population.

757 Board #2 May 31 3:15 PM - 5:15 PM

The Effect Of Acute Body Mass Reduction On Metabolism And Endurance Running Performance

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(No relationships reported)

Reduced body mass and/or relative fat mass is expected to improve endurance running performance, by lowering energy cost of running and allowing the runner to maintain higher mean race velocity using identical %VO₂max. The majority of studies during the last 40 years have been centered mainly on the effect of adding external load on energy cost of walking and running. **PURPOSE:** The purpose of this study was to examine the effect 5 and 10% reduction of inactive body mass on metabolic responses and 3km running performance.

METHODS: Eleven trained (8 male, 3 female) club level runners (mean ± sd body mass, height, %fat, peakVO₂ and vVO₂max, 65.71 ± 12.07 kg, 174.59 ± 8.32 cm, 12.54 ± 3.55%, 56.30 ± 4.57 ml.kg⁻¹.min⁻¹ and 17.1 ± 1.4 km.h⁻¹ respectively) participated in a series of 4 maximal trials 4-6 days apart. During the first trial, the subjects completed an exhaustive incremental peakVO₂ test on the treadmill. On the second visit they completed a 3 km race time trial on the treadmill running with normal body mass (BM). During the last two laboratory visits, the subjects completed two 3km race trials in random order on the treadmill while body mass (a rope through a system of pulleys lifted the runner with the calculated body weight throughout striding phases while not interfering with running technique) was reduced 5 (5%BM) or 10% (10%BM). Repeated Anova was used for the statistical analysis.

RESULTS: Mean (±sd) 3km performance time was lowered (improved) during 5%BM (663.5 ± 76.05 s) and 10%BM (648.9 ± 74.9 s) trials (p<0.05) compared with BM (684.9 ± 74.8 s). The 5 and 10% reduction in body mass induced a mean 3.1 and 5.2% improvement in 3km race performance accordingly. Every kg reduction of inactive body mass improved 1.4% running endurance performance. Mean values of the Rate of perceived exertion, heart rate, VO₂ ml.min⁻¹, RQ, Blood lactate and Volume of expired air were not different between time trials and peak VO₂max test (p>0.05).

CONCLUSIONS: The results of the present study showed that the reduction of 5 and 10% of inactive body mass may improve significantly 3km performance time without noticeable effects on metabolic parameters and are supportive of the notion that one way to maximize further running performance is to reduce inactive body mass.

758 Board #3 May 31 3:15 PM - 5:15 PM

Comparison Of RPE And Energy Expenditure Between Circuit Weight Training And Treadmill Running

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(No relationships reported)

Due to the fact circuit weight training (CWT) maximizes exercise density by minimizing rest intervals, individuals with limited time to exercise may rely on CWT to meet caloric expenditure recommendations for the prevention of weight gain.

Exercise density may lead to an inaccurate perception of energy expenditure (EE). **PURPOSE:** To compare acute EE indices and RPE between traditional CWT and an equivalent bout of treadmill running (T). **METHODS:** College-aged males (n=9) regularly engaged in running and resistance training volunteered. CWT session was performed first and consisted of 10 resistance training stations performed for 30 sec each at 40%1RM for 20 min. HR (Polar monitor) and EE (Cosmed K4 b2) were monitored continuously, and RPE (0-10) was assessed every fourth station. A 20 min T session occurred 2 days later at the average HR maintained during CWT. A dependent samples t-test was used to determine significant differences between RPE, total EE (TEE, kcal), rate of EE (REE, kcal/min), and relative rate of EE (RREE, kcal/kg/min). Pearson's correlation was used to assess the relationship between EE and RPE. **RESULTS:** The average HR elicited by CWT was 58% HRR, a value within ACSM recommendations for aerobic conditioning. There was no significant association between RPE and EE indices for either CWT or T.

Exercise	RPE (0 – 10 scale)	TEE (kcal)	REE (kcal.min ⁻¹)	RREE (kcal.kg ⁻¹ .min ⁻¹)
CWT	6.0 ± 1.1*	168.19 ± 16.42*	8.49 ± 0.90*	0.10 ± 0.02*
T	4.1 ± 0.6	244.20 ± 44.80	12.21 ± 2.24	0.15 ± 0.02

*p<0.001

CONCLUSIONS: CWT elicited an average HR suitable for aerobic conditioning. At equivalent HRs, CWT resulted in a significantly higher RPE but significantly lower EE. It is imperative for participants engaged in CWT to understand that although CWT results in HR values within an aerobic training zone and feels more strenuous than T, it is not associated with greater acute energy expenditure than steady-state treadmill running.

ACSM May 30 – June 3, 2017

759 Board #4 May 31 3:15 PM - 5:15 PM

Effect of Wearing Lower-Body Compression Garment Following Downhill Running on Running Economy

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(No relationships reported)

Accumulating evidences suggest that wearing lower-body compression garment (CG) after exercise facilitates recovery of muscular strengths. However, efficacy of wearing CG during post-exercise period on endurance capacity has not been fully determined.

PURPOSE: To examine effect of wearing lower-body CG for 24 h following downhill running on running economy. **METHODS:** Ten male subjects (170.2 ± 4.1 cm, 63.7 ± 4.1 kg, VO₂max; 52.4 ± 6.1 ml/kg/min) completed 2 trials, with either wearing lower-body CG or placebo garment (CON) during 24 h of post-exercise period. At least 3 months period was provided between the two trials. The exercise consisted of 30 min of downhill running (slope: -10%) at 70% of VO₂max. Time course changes in jump height and score of muscle soreness were evaluated before exercise and during post-exercise period. Blood samples were also collected to determine serum creatine kinase (CK) and hsCRP concentrations. Running economy (RE) was assessed at 24 h following exercise under three different running velocities (70%, 80% and 90% of VO₂max). P < 0.05 was considered to be statistically significant. **RESULTS:** Jump height significantly decreased immediately after exercise in both trials, while the CG trials showed significantly higher values at 24 h following exercise compared with the CON trial (P = 0.0008). Although serum CK and hsCRP concentrations significantly elevated during post-exercise period, the responses were similar between trials. For the RE, no significant difference was observed between two trials. However, there was a relatively large inter-individual variation for efficacy of CG on RE (ΔVO₂ range: -7.1% to 12.2%), and we have divided all subjects into two different groups [improved RE (n = 5), decreased RE (n = 5)]. No significant difference between the groups was observed for jump performance or score of muscle soreness at 24 h after the exercise, while improved RE group showed significantly higher serum CK and hsCRP concentrations compared with impaired RE group (P = 0.005 for CK, P = 0.04 for hsCRP). **CONCLUSION:** Wearing lower-body CG during 24 h of post-exercise period did not improve RE. However, relatively large inter-individual variation existed for efficacy of the CG, and wearing CG during post-exercise period might promote recovery of RE under situation with severe muscle damage.

760 Board #5 May 31 3:15 PM - 5:15 PM

Novel Field Test To Identify Critical Velocity During Non-linear Running: Physiological Profile, Reliability, And Validation

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(No relationships reported)

PURPOSE: Athletes and coaches have interest in identifying specific work rates and related physiology discriminating sustainable vs unsustainable exercise intensity. A threshold intensity for running, termed Critical Velocity (CV), is the boundary between stable metabolism and progressively disturbed metabolism (& ensuing fatigue). We aimed to develop a simple short duration field test (Critical Velocity Shuttle Test, CVST), to accurately and reliably identify CV during intermittent non-linear running. Further, we tested the hypothesis that CV during dynamic non-linear running is distinctly different (i.e. lower) than linear running.

METHODS: Young healthy adults performed a custom designed 7 minute shuttle test consisting of intermittent dynamic non-linear sprint running. Each sprint covered 30 feet out and back, with rest time between maximal efforts of 15 secs for the first 3 mins, 10 secs for the next 2 mins and no rest for the final 2 mins. The CVST was performed twice over the course of 2 weeks to examine test reliability (N=6). In addition, two separate validation trials inclusive of 5% above or below shuttle test end velocity (EV; N=8) were conducted where blood lactate was measured every 4 mins until exhaustion. To compare CV during linear and non-linear running, 10 subjects completed 3 'linear' time trial efforts (1.6, 2.4, 5KM) and the CVST.

RESULTS: Average total distance and shuttle test EV were not significantly different between visits (visit 1 = 864±9m and 3.23m/s±0.05 vs visit 2 = 900±13m and 3.21m/s±0.06, respectively). All subjects who ran 5% above shuttle test end velocity fatigued prior to 20 mins and displayed unstable blood lactate, whereas a stable lactate profile was observed for all running 5% below EV. Non-linear running CV obtained from the CVST was significantly lower than linear running CV (Δ -17±2%), highlighting the importance of modality for threshold determination.

CONCLUSIONS: Collectively, the CVST provides a repeatable and accurate estimate of critical work rate for dynamic intermittent non-linear running activity. Accordingly, the CVST could be employed by coaches and athletes to better understand the physiological impact and rate to fatigue of their chosen work rates during competition.

Denver, Colorado

761 Board #6 May 31 3:15 PM - 5:15 PM
New Running Shoe Reduces the Energetic Cost of Running
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 (No relationships reported)

Running shoe features (low mass, cushioning, midsole bending stiffness) have been shown to individually reduce the energetic cost of running. Recently, energetic cost has been directly linked to time-trial performance.

PURPOSE: To quantify the energetic cost of running in three marathon racing shoes: a prototype and two shoes currently available to runners. **METHODS:** 18 sub-elite runners (sub-31 min 10km at altitude or equivalent; altitude $\dot{V}O_{2max}$: 72.1 ± 3.4 ml O_2 /kg/min) ran six 5 min trials (3 shoes \times 2 replicates) in: a prototype shoe (NP), and two established marathon shoes (NS6) and (AB2), all equilibrated to 250g/shoe (the mass of AB2, size 10) during three separate sessions - 14, 16 and 18 km/hr. The order of the shoe conditions within a session and the session speed order were pseudo-randomized, mirrored and counterbalanced. The NP shoe has a novel, lightweight and highly resilient midsole and a carbon fiber plate that stiffens the shoe in longitudinal bending. We measured submaximal $\dot{V}O_2$ and $\dot{V}CO_2$ during min 3-5 and averaged metabolic rate (W/kg) for the 2 trials in each shoe model. Blood [La] measured after the last trial of each session and RER indicated running energetics were at steady-state (<3.0 mmol/L and <0.91 , respectively). We compared the 3 shoes over 3 speeds using a two-way ANOVA with repeated measures. **RESULTS:** A significant main effect for shoe ($P < 0.0001$) indicated the NP shoes required $4.0 \pm 1.3\%$ (mean \pm SD) less energy than the NS6 and AB2 shoes (NP vs. NS6: $P < 0.0001$; NP vs. AB2: $P < 0.0001$), which had similar metabolic costs (NS6 vs. AB2: $P = 0.34$): NP 16.45 ± 0.89 , NS6 17.16 ± 0.92 and AB2 17.14 ± 0.97 W/kg averaged across 3 speeds. Although the shoe \times speed interaction effect was significant ($P = 0.0005$), post-hoc analyses suggest that relative percent differences between shoes were similar at the 3 running speeds (all $P > 0.56$). **CONCLUSIONS:** The new shoe reduces the cost of running by 4.0% as compared to two other established marathon racing shoes.

This study was supported by Nike Inc. EF and GL are employees of Nike Inc., RK is a paid consultant to Nike Inc.

762 Board #7 May 31 3:15 PM - 5:15 PM
Metabolic Cost Of Overground, Motorized Treadmill And Non-motorized Treadmill Running
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 (No relationships reported)

Non-motorized treadmills (NMT) are becoming an increasingly popular tool for both athletic training and laboratory investigations. However, very little is known about how the physiological response to running on a NMT compares with that of running on either a motorized treadmill (MOT) or overground (OVR).

PURPOSE: To compare the metabolic cost of running on a NMT, MOT and OVR. **METHODS:** Fourteen runners ($\dot{V}O_{2max}$, 57 ± 4 mL \cdot kg⁻¹ \cdot min⁻¹; female, n=7) completed three experimental sessions. Each session consisted of 5 \times 6 min bouts of running at progressively higher speeds, separated by 6 min rest. Running speeds ranged from 9-15 km \cdot h⁻¹ for females and 10.5-16.5 km \cdot h⁻¹ for males. Participants completed the NMT (Woodway Curve 3), MOT (HP Cosmos) and OVR sessions in a crossover manner. OVR sessions were performed around an indoor 144 m oval and pacing maintained using evenly spaced timing lights. Pacing during the NMT was achieved by participants matching a line reflecting their current speed with the required speed on a projected display. Oxygen consumption ($\dot{V}O_2$) and heart rate (HR) during the last 2 min of each bout were determined using a portable metabolic cart (K4B2, Cosmed) and compared between conditions using a magnitude based statistical approach.

RESULTS: Each runner successfully completed all of the 6 min running bouts in the MOT and OVR trials. However, only 1 runner (male) completed the entire NMT trial, and only 6 of 14 runners could maintain the penultimate speed on the NMT. There was an *important* difference in the average % $\dot{V}O_{2max}$ used when running on the NMT compared to OVR (mean \pm 90% CI, $22 \pm 2\%$; ES \pm 90% CI, 1.87 ± 0.15) and MOT ($16 \pm 2\%$; ES 1.50 ± 0.15). Similarly, there was an *important* difference in HR when running on the NMT compared to OVR (25 ± 2 beats \cdot min⁻¹, ES 1.35 ± 0.13) and MOT (22 ± 2 beats \cdot min⁻¹; ES 1.23 ± 0.14). While there was an *important* difference in % $\dot{V}O_2$ max between MOT and OVR trials ($5 \pm 1\%$; ES 0.33 ± 0.08) the difference in HR was *trivial* (2 ± 1 beats \cdot min⁻¹; ES 0.10 ± 0.04).

CONCLUSIONS: Steady state submaximal running on a NMT imposes a markedly higher physiological demand than running on either a MOT or OVR. This increased metabolic cost needs to be considered when designing training programs for or interpreting data obtained from a NMT.

763 Board #8 May 31 3:15 PM - 5:15 PM
Assessing the Relationship Between Body Composition and 50-km Running Performance
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Interest in ultramarathon participation and research has grown substantially over the past decade, with one of the main focus in research being race performance. Previous studies have focused on body composition in relation to race performance at distances ranging from 5-km to multi-day adventure races. However, no previous studies have assessed body composition and performance measures at the 50-km distance. **PURPOSE:** To investigate the relationship that may exist between body fat percentage (BF%) and body mass index (BMI) with race finishing time and position in ultramarathon runners who competed in a mountainous 50-km race. **METHODS:** Forty-six ultramarathon runners (male = 31, female = 15; BF%: 19.75 ± 5.64 ; BMI: 23.7 ± 2.58) participated in this study and were given a preliminary screening questionnaire on-site during packet pick-up on the day prior to the 50-km race. The participants' height was calculated using a leveled measuring tape. Weight and body composition measurements were taken using a bioelectrical impedance analysis (BIA) system. Finishing times and positions were collected from the race website four days after the event. Pearson correlations were calculated to determine if a correlation existed between overall race finish time/position and BMI and BF%. **RESULTS:** All forty-six participants completed the 50-km race (22967.37 ± 3001.1 seconds). Significant correlations were noted between race finish time and BF% ($r = .548$, $p = 0.00$) and race position and BF% ($r = .532$, $p = 0.00$). There were no significant correlations between overall race finish time and BMI ($r = 0.036$) or race position and BMI ($r = 0.004$). **CONCLUSION:** BF% measurements may be more accurate in loosely predicting potential overall finish time and position as compared to using BMI calculations. The results suggest that a runner with a lower body fat percentage may finish with a faster time and therefore better order of finish as compared to a runner with a higher body fat percentage. Future studies may focus on the potential change in body composition and its impact on race performance in male and/or female ultramarathon runners.

B-44 Free Communication/Slide - Immunology
 Wednesday, May 31, 2017, 3:15 PM - 4:45 PM
 Room: 104

764 **Chair:** Jonathan P. Little. University of British Columbia Okanagan, Kelowna, BC, Canada.
 (No relationships reported)

765 May 31 3:15 PM - 3:30 PM
Effects Of Acute Eccentric Exercise On Primary Antibody Responses To Ovalbumin Vaccination In Aged Mice.
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Several studies have suggested that acute eccentric exercise can enhance vaccination responses in humans. However, the underlying mechanisms have remained understudied. We have shown that acute eccentric exercise does not improve the antibody responses to ovalbumin (OVA) vaccination in young mice. Thus, we replicated the study in an immunosenescence animal model, where there is reduced vaccine efficacy.

PURPOSE: To determine the effects of acute eccentric exercise on the primary antibody response to vaccination in aged mice. **METHODS:** C57BL/6 male mice, aged 27 months (n=16) were randomized into either eccentric exercise (ECC, n=8) or sedentary (SED, n=8) groups. For the ECC group, mice were exercised at 17m/min at -20% grade for 45 min on a treadmill. SED mice remained in their home cages. All mice were inoculated in the gastrocnemius with 25 μ g of OVA and 200 μ g aluminum hydroxide (a suboptimal dosage based on titration experiments) in 50 μ l sterile saline immediately after the exercise. Blood was collected prior to, and one, two and four weeks after vaccination. ELISA was performed to analyze anti-OVA IgG. At three weeks post exercise, all mice were injected with 100 μ g OVA dissolved in 10 μ l PBS into the dorsal side of the right ear to determine the delayed-type hypersensitivity (DTH) response. The left ear received 10 μ l PBS alone as a control. Ear thickness was measured immediately before, 24 h and 48 h after intradermal injection. The measurements were performed in triplicate, where

researchers were blinded to treatment. Maximum ear swelling occurred at 24 hours post injection. Results were expressed as the difference between the right and left ear thickness.

RESULTS: We found a significant time main effect ($p < 0.001$) indicating a significant increase in anti-OVA IgG at one, two and four weeks relative to pre-immunization. However, there were no significant time x treatment ($p = 0.652$) nor treatment main effects ($p = 0.764$). There was a significant difference between ECC and SED groups in ear DTH at 24h post injection ($p = 0.028$), indicating eccentric exercise increased the DTH response.

CONCLUSION: Acute eccentric exercise immediately before vaccination improved the DTH (i.e. cell-mediated immune), but not the antibody, response to vaccination in aged mice.

766 May 31 3:30 PM - 3:45 PM

Voluntary Wheel Running and Response to Vaccinia Virus Infection and Inoculation in Mice

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PURPOSE: Exercise has been shown to improve immune responses to viral infections and vaccines in several mouse models. However, previous pathogen studies have primarily used infections limited to the respiratory tract. Additionally, previous studies have utilized forced treadmill exercise paradigms, and voluntary wheel running (VWR) has been shown to have differential effects on the immune system in non-infection models. We examined whether VWR could improve morbidity and mortality to a 50% lethal dose of vaccinia virus (VACV), a systemic pathogen commonly used to examine immune responses. Additionally, we examined whether VWR could improve antibody response to a replication-deficient strain of VACV, mimicking a vaccination. **METHODS:** Male C57Bl/6J mice underwent 8 weeks of VWR or remained sedentary, then were infected intranasally with $10^{7.5}$ PFU VACV strain WR. Mice were followed 14 days for mortality, and body weights and food intakes were recorded daily. In a similar manner, mice in the vaccination study ran or were sedentary for 8 weeks, then were given 10^6 PFU of replication-deficient VACV strain MVA intraperitoneally. Blood was collected under anesthesia from the retro-orbital sinus prior to MVA inoculation and at 1, 2, and 4 weeks post-inoculation, and anti-VACV IgG titer was determined by enzyme-linked immunosorbent assay. **RESULTS:** VWR did not improve mortality due to VACV infection ($p = 0.26$), although fewer VWR mice (4/10) died compared to sedentary (SED, 6/10). VWR did not prevent body weight loss due to infection compared to SED ($p = 0.20$), although VWR mice loss slightly less weight (4%) compared to SED through the first 6 days post-infection. Food intake, the reduction of which is a marker of sickness behavior, was significantly reduced in SED post-infection compared to VWR ($p = 0.05$). In the vaccination experiment, VWR mice developed a greater IgG antibody response, although this was not significant ($p = 0.22$). **CONCLUSIONS:** VWR did not protect against mortality to VACV or prevent infection-induced weight loss, and VWR did not enhance antibody responses. However, there were non-significant trends towards VWR-related improvements in these outcomes, and post-infection food intake was improved by VWR. Funded by ACSM Research Endowment Grant to BDP.

767 May 31 3:45 PM - 4:00 PM

Effect of Exercise Training on Inflammatory Markers in Overweight and Obese Boys and Girls

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PURPOSE: The aim of the present study was to examine the effect of exercise training on inflammatory markers in overweight and obese pre-pubertal boys and girls. **METHODS:** Forty-six overweight and obese children (age range 9-11 yr old, mean Tanner stage 1.2) volunteered for the study and were randomized to no-exercise control (CON, 6 boys and 7 girls) and exercise training (EX, 14 boys and 19 girls) groups for 16 weeks. Serum monocyte chemoattractant protein-1 (MCP-1), interleukin 6 (IL-6) and tumor necrosis factor (TNF-alpha) were measured as markers of inflammation before and after the intervention.

RESULTS: There was no difference between boys and girls in age (9.1 ± 0.6 and 9.3 ± 0.5 yr) or BMI percentile (94 ± 1 and $97 \pm 1\%$) before the intervention. After the intervention, a significant increase in fitness (time to exhaustion for incremental treadmill test, $p < 0.05$) was observed in the EX (81 ± 13 sec) but not in CON (12 ± 22 sec). There was no effect of exercise training on MCP-1, IL-6 or TNF-alpha; however,

percent changes in these pro-inflammatory markers were significantly decreased in girls, while the percent change values were significantly increased in boys, regardless of intervention group (significant main effect of sex, $p < 0.05$, table 1). There was no correlation between changes in body weight and inflammatory markers.

CONCLUSION: There was a decrease in inflammatory markers over 16 weeks in girls, but not in boys, that is not due to exercise training. These data indicate previous findings that exercise training, in the absence of weight loss, do not affect inflammatory markers may be sex (and perhaps age) specific.

Table 1. Inflammatory markers and changes in body weight in boys and girls before and after the intervention.

	Boys		Girls	
	EX	CON	EX	CON
Baseline MCP-1 (pg/uL)	256±17	258±26	249±15	276±24
Baseline IL-6 (pg/mL)	0.9±0.6	0.7±1.0	1.9±0.5	1.3±0.9
Baseline TNF-alpha (pg/uL)	4.4±0.3	3.4±0.5	4.1±0.3	4.2±0.5
Percent change MCP-1 (%) #	12±5	7±8	-4±5	-6±8
Percent change IL-6 (%) #	52±23	55±35	-12±20	-2±33
Percent change TNF-alpha (%) #	0±5	8±7	-8±7	-13±7
Change in weight (kg) *	2.3±0.5	0.4±0.8	2.0±0.4	2.8±0.6

* Significant sex by group interaction

Significant main effect of sex

Supported by NIH RO1DK071081

768 May 31 4:00 PM - 4:15 PM

Interval Walking Training Reduces T Cell CCR5 in Individuals with Type 2 Diabetes

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Recent evidence implicates chemokine (C-C motif) ligand 5 (CCL5, also known as RANTES) and its receptor CCR5 in mediating T cell infiltration into adipose and other tissues, which contributes to chronic low-grade inflammation in obesity and type 2 diabetes (T2D). Exercise may relieve obesity-related inflammation but the effects of interval training on T-cell migration and tissue infiltration in T2D are unknown. **PURPOSE:** To examine the impact of interval walking training (IWT) versus continuous walking training (CWT) on circulating RANTES along with T cell and adipose tissue CCR5 in patients with T2D. **METHODS:** Participants with T2D were randomized to control (n=8), IWT (n=12) or CWT (n=12). Training groups were prescribed five 60-minute sessions per week of free-living training with intensity monitored with an accelerometer and heart rate monitor. Fasting blood samples and subcutaneous abdominal adipose tissue biopsies were obtained before and 6 days after completion of the 16-week intervention period. Plasma RANTES was measured by ELISA. Peripheral blood mononuclear cells (PBMCs) were isolated for subsequent measurement of CD8+ T cell CCR5 surface protein expression using flow cytometry. mRNA expression of RANTES, CCR5 and CD8 were measured in subcutaneous adipose tissue biopsy samples by qPCR. **RESULTS:** Training duration and mean intensity were well-matched between IWT and CWT. A significant group X time interaction ($p < 0.05$) was detected for CD8+ T cell CCR5 surface protein expression, with post-hoc tests revealing a reduction of ~20% after IWT ($p < 0.05$) with no changes seen in CWT or control. Plasma RANTES concentration and adipose tissue mRNA expression of RANTES, CCR5 and CD8 were not altered in IWT, CWT, or control groups following the intervention period (all $p > 0.05$). **CONCLUSIONS:** Sixteen weeks of IWT, previously shown to benefit physical fitness, insulin sensitivity, body composition, and glycemic control in patients with T2D, resulted in lower CD8+ T cell CCR5 protein expression. These findings suggest lower migratory potential for circulating T cells but future research is needed to determine if IWT influences infiltration of T cells into adipose and other tissues. JPL is funded by a CIHR New Investigator Award (MSH-141890)

769 May 31 4:15 PM - 4:30 PM

Increase in Natural Killer Cells with an Activated Phenotype During Recovery from Acute Dynamic ExerciseEmily C. LaVoy, Priti Gupta. *University of Houston, Houston, TX.*

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(No relationships reported)

Acute dynamic exercise enhances Natural Killer (NK) cell cytotoxicity against HLA-expressing tumor target cells. This enhanced killing capacity of NK cells occurs during recovery from exercise. A preferential redeployment of NK cells with an activated phenotype has been proposed as one mechanism to explain increased function. However, NK cells frequently co-express activating and inhibitory molecules, complicating interpretation of earlier results that have failed to fully characterize the mobilized cells. **PURPOSE:** To thoroughly investigate changes in NK cell phenotype due to acute dynamic exercise. **METHODS:** 12 physically active adults accustomed to cycling exercise cycled for 30 minutes at 115% of lactate threshold power. Blood collected pre-, post-, and 1h post-exercise was analyzed using 10 parameter flow cytometry to identify NK cell subsets present at each time point. NK cytotoxicity against the HLA-expressing U266 tumor cell line was assessed following a 4h incubation using a flow-based assay. Differences in NK cell cytotoxicity and NK cell subset proportions between the three time points were assessed using maximum likelihood linear mixed models. **RESULTS:** Similar to earlier reports, NK cell cytotoxicity per cell against U266 tumor cells was highest 1h post exercise ($0.36 \pm .08$ 1H Post vs $0.26 \pm .05$ Pre). The proportion of NK cells expressing the activating receptor NKG2C was increased 1h post exercise (5.1 ± 1.6 vs 4.3 ± 1.6 %; $p < 0.05$), as were cells co-expressing NKG2A (2.0 ± 0.5 vs 1.5 ± 0.5 ; $p < 0.05$). The co-expression of CD158a or CD158b (inhibitory KIRs) by the NKG2C+ NK cells did not differ from pre-exercise at 1h post exercise ($p > 0.05$). Finally, NK cells expressing the late differentiation marker CD57 were at their lowest proportion 1h post exercise (31.6 ± 6.7 vs 37.2 ± 6.7 %; $p < 0.05$). **CONCLUSIONS:** Enhanced NK cell cytotoxicity against HLA-expressing tumor target cells 1h following exercise corresponded to changes in NK cell phenotype towards expression of activating receptors (NKG2C), and away from inhibitory receptors (CD158a, CD158b) and markers of late differentiation. These data lend support to the growing idea that acute exercise may be used clinically to enrich the blood of cytotoxic NK cells for immunotherapy.

770 May 31 4:30 PM - 4:45 PM

Maximal Exercise Alters The Inflammatory Phenotype Of Mononuclear Cells And Response To Ex Vivo Lps StimulationAaron Slusher, Amanda B. Mischo, Tiffany M. Zúñiga, Edmund O. Acevedo, FACSM. *Virginia Commonwealth University, Richmond, VA.* (Sponsor: Dr. Edmund O. Acevedo, FACSM)

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(No relationships reported)

Monocytes express the CD14 receptor involved in LPS ligation to TLR4 and subsequent production of anti-inflammatory (IL-6 and IL-10) and pro-inflammatory (TNF- α) cytokines. However, under pro-inflammatory conditions, there is an increased proportion of monocytes expressing the CD16 receptor, which amplifies TLR4-mediated TNF- α production. **PURPOSE:** We therefore examined the hypothesis that decreased proportions of classical monocytes (CD14+/CD16-) and TLR4 expression following maximal exercise would be accompanied by reduced CD14 expression. Conversely, the mobilization of pro-inflammatory monocytes (CD14+/CD16+) expressing elevated TLR4 would exhibit increased CD14 and CD16 expression. Concomitantly, LPS-stimulated ex vivo production of IL-6 and IL-10 would be attenuated, while TNF- α would be enhanced post exercise. **METHODS:** Human mononuclear cells ($n = 25$) were isolated prior to and following exercise to assess CD14, CD16, and TLR4 expression by flow cytometry. **RESULTS:** Exercise reduced the proportion of classical monocytes and increased pro-inflammatory monocytes. In addition, TLR4 expression decreased to a greater extent on classical compared to pro-inflammatory monocytes. However, while CD14 expression was reduced on all monocytes, CD16 expression tended to increase on pro-inflammatory monocytes. LPS-stimulated production of IL-6 and IL-10 was also significantly decreased, while TNF- α significantly increased. **CONCLUSIONS:** Exercise shifts monocytes towards a pro-inflammatory phenotype, raising additional questions regarding the anti-inflammatory impact of chronic exercise and the mechanisms involved monocyte immune function.

B-45 Free Communication/Slide - School-oriented InterventionsWednesday, May 31, 2017, 3:15 PM - 5:15 PM
Room: 103771 **Chair:** Russell R. Pate, FACSM. *University of South Carolina, Columbia, SC.*

(No relationships reported)

772 May 31 3:15 PM - 3:30 PM

Influence Of A School-based Physical Activity Intervention On Scholastic Performance - The Champs Study-DKAnna Bugge¹, Sören Möller², Jakob Tarp¹, Rodrigo A. Lima³, Charles H. Hillman⁴, Anne K. Gejl¹, Heidi Klakk¹, Niels Wedderkopp¹. ¹University of Southern Denmark, Odense, Denmark. ²Odense University Hospital, Odense, Denmark. ³Ministry of Education of Brazil, Brasilia, Brazil. ⁴Northeastern University, Boston, MA.

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(No relationships reported)

Despite the known benefits of physical activity on physical, cognitive and mental health, there is a trend in many countries to decrease physical activity opportunities for children and adolescents during the school day. **PURPOSE:** To investigate the influence of a school-based intervention with a tripling of physical education (PE) lessons from two (90 min) to six lessons per week (270 min) added to the normal curriculum on scholastic performance in school-aged children. **METHODS:** This study is a part of the CHAMPS study-DK, a quasi-experimental study that began in 2008. The intervention group consisted of six schools and four matched schools served as the control group (mean age at baseline = 8.4 years). Academic performance was extracted from the Danish national test system from 2010 to 2014 (Math and Danish were measured at 3rd and 6th, and 2nd, 4th and 6th grade, respectively). Participants for this investigation include 1,888 students, participating in at least one national test of scholastic performance. Mean of three different domains (Danish: language understanding, decoding, and text comprehension, and Math: algebra, geometry, and basic mathematics skills) were obtained as the test results (from 0-100 points). Mother's educational status was used as an indicator of socioeconomic status (SES). Linear mixed models were applied to test for differences between Groups. **RESULTS:** No significant differences were observed between groups in any of the academic performance tests (control group reference); Danish 2nd grade $\beta = -1.34$ (95% CI -9.90, 7.22), 4th grade $\beta = 0.22$ (95% CI -6.12, 6.56), 6th grade $\beta = 1.03$ (95% CI -5.02, 7.08) and all grades combined $\beta = 0.28$ (95% CI -5.74, 6.31) and Math 3rd grade $\beta = -2.87$ (95% CI -9.65, 3.90) and both grades combined $\beta = -1.28$ (95% CI -8.10, 5.71). Across groups girls performed significantly better in Danish, whereas boys performed better in Math (all $p < 0.05$). **CONCLUSIONS:** No significant differences were observed between intervention and control schools for scholastic performance, which may be interpreted as a positive result, given that a tripling of PE did not result in a cost to scholastic performance. Such findings suggest that increasing physical activity opportunities during the school day does not detract from academic goals, although making the school days longer.

773 May 31 3:30 PM - 3:45 PM

Evaluation of Kaiser Permanente Colorado's Thriving Schools InitiativeCheryl Kelly¹, Timothy K. Behrens, FACSM², Elizabeth Tucker³, Dick Carpenter³, Carmen Luna¹, Julaine Field³.¹Kaiser Permanente Colorado, Denver, CO. ²Northern Arizona University, Flagstaff, CO. ³University of Colorado Colorado Springs, Colorado Springs, CO.

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(No relationships reported)

Purpose: To evaluate the Kaiser Permanente Thriving Schools Initiative, a program designed to increase physical activity (PA) in Colorado public schools. **Methods:** This cross-site evaluation examined 27 public school districts funded to incorporate PA into the school day, operationalized as classroom PA (CPA), before and after school PA (BAPA), and PA occurring in physical education classes or recess (PERPA). All data were collected during the 2014-15 academic year using an online data management system. CPA were collected by asking randomly selected teachers in each school to report classroom PA during a one-week period, 2-3 times each semester. Programming for BAPA was reported by each district's health coordinator and included day⁻¹ offered, min^{-d⁻¹} offered, and number of students participating. PERPA schedules were collected for each school and entered into an aggregate database containing all PA. Mean minutes of PA^{-d⁻¹} was calculated using the sum of CPA, BAPA, and PERPA

divided by the number of school days. Descriptive and inferential statistics were calculated. **Results:** Most districts (76%) provided $\geq 30 \text{ min} \cdot \text{d}^{-1}$ ($42.9 \pm 27.6 \text{ min} \cdot \text{d}^{-1}$) of PA, though only 36% provided $60 \text{ min} \cdot \text{d}^{-1}$. There were no significant differences in the likelihood of achieving mandated PA minutes based on school characteristics. Most PA minutes were offered in PERPA (66.8%). In fact, schools that reported more minutes in these two types of PA were significantly more likely to achieve mandated PA minutes. Schools with greater percentages of free and reduced lunch eligible students reported significantly fewer min $\cdot \text{d}^{-1}$ spent on PA in classrooms, PE, recess, and in total. Finally, coefficients for PE, recess, and total minutes indicate schools with greater percentages of minority students tend to report a greater number min $\cdot \text{d}^{-1}$ in said activities. **Conclusion:** These findings support increased efforts for PA promotion in public schools, though additional research is needed to identify best practices for implementing school-based PA promotion.

774 May 31 3:45 PM - 4:00 PM

Effectiveness Of A Preschool-Based Exercise Intervention On Physical Activity, Motor Performance, Body-Mass-Index And Blood Pressure: A Cluster-Randomized Controlled Trial

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PURPOSE: Beneficial effects of physical activity interventions on health are well described for adults and adolescents. However, the impact in early childhood is understudied. The present study set out to investigate the effectiveness of an exercise intervention on activity level, motor performance, BMI and peripheral and central blood pressure (BP) in 3-6 years old preschoolers, with emphasis on social background.

METHODS: A 6-months cluster-randomized controlled trial including a 45min/biweekly supervised exercise program was conducted in 3 intervention and 2 control daycare centers in Hamburg, Germany. A total of 135 children (IG=92, CG=43; 4.8±0.8 years) completed the trial with baseline and follow-up data on BMI, activity level (time during leisure-time and in organized sports) and motor performance (z-scores of 4 test items assessing flexibility, coordination, power, speed). Peripheral and central BP were measured with a brachial cuff-based oscillometric device. Maternal education (high vs. low) was used as an indicator for social background. We applied linear mixed models with random intercepts for daycare center to evaluate differences in mean change adjusted for baseline value of the outcome, age, sex and height.

RESULTS: No significant differences in mean change, comparing the intervention to the control group, could be detected on weekly activity level (-24.7 min; 95%CI: -55.9,6.4), motor performance (-0.1; -0.7,0.6), BMI-percentile (1.3; -14.9,17.6), pBP (1.0 mm Hg; -1.9,3.9/1.7 mm Hg; -0.5,4.0) or cBP (1.8 mm Hg; -1.7,5.2/1.8 mm Hg; -0.4,4.1). However, subgroup analyses revealed a stronger intervention effect in children of low vs. high social status in terms of a lower increase in systolic pBP (-3.5 mm Hg; -6.9, -0.1; P=0.045) and cBP (-3.7 mm Hg; -6.5, -0.9; P=0.010), whereas BP change did not differ within the control group.

CONCLUSION: In preschool children, we found no evidence for effectiveness of a 6-months multifaceted exercise program on physical activity, motor performance, BMI or BP. However, the results of this study indicate that children from lower social backgrounds benefit more from early exercise-promoting interventions. Implementation fidelity, intervention period and sample size are key issues that should be addressed in further trials to provide definitive evidence.

775 May 31 4:00 PM - 4:15 PM

Relationship Between School Physical Environment And Sedentary Time Among Children In Puerto Rico

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Sedentary time increases the risk of obesity and other hypokinetic diseases. The school's physical environment (SPE) can influence during school sedentary time (DSST) in children. The association between SPE and DSST has not been clearly established in this population. **PURPOSE:** To evaluate DSST and the potential influence of SPE in DSST among children in Puerto Rico. **METHODS:** Fifty-four

girls and 48 boys (age=7.9 ± 0.7 yrs, range=7-9 yrs) wore an accelerometer during 7 consecutive week-days over the right hip area. A filter was created to determine DSST for those children who wore the accelerometer during at least 3 weekdays. The SPE was evaluated taking into consideration the physical education class, recess time, and use of facilities that promoted PA. Time in physical education and recess was provided by the school's administration. To determine the use of facilities, a score was generated based on self-reported activities during school, and the time spent in each activity. Correlation analyses were conducted to test the relationship between: 1) physical education class (min/wk) and DSST (hr/wk); 2) recess time (min/wk) and DSST (hr/wk); and 3), use of school facilities (score) and DSST (hr/wk). **RESULTS:** DSST was different by gender (girls: 4.3 ± 0.5 hr/wk, boys: 4.4 ± 0.3 hr/wk; p = 0.01) and type of school (private: 4.3 ± 0.4 hr/wk; public: 4.6 ± 0.2 hr/wk; p = 0.04). No relationship was observed between DSST and time in physical education (r = -0.15, p > 0.05), or use of facilities that promoted PA (p = 0.001, p > 0.05). However, a direct association between DSST and recess time was observed (p = 0.34, p < 0.01). **CONCLUSION:** Although the average DSST was very low in this group of children, more recess time was associated with more DSST. More research is needed to confirm these observations, and the importance of school interventions to discourage sedentary time during recess time. Funded by University of PR-FIPI Institutional Grant.

776 May 31 4:15 PM - 4:30 PM

The Association Between Perceived Athletic Competence And Physical Activity: Implications For Low-income Schoolchildren

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PURPOSE: Addressing athletic competence (AC) may shape children's physical activity (PA) behaviors through participation in organized and unorganized PA, but these opportunities may be limited in low-income children. We aimed to assess the association between children's perceived AC and daily moderate-to-vigorous PA (MVPA) and whether socioeconomic status (SES) modifies this relationship.

METHODS: Schoolchildren (n=1157; grades 3-4) were recruited from 24 schools in Massachusetts communities to participate in the Fueling Learning through Exercise study. Demographic data were collected by parent report. Free or reduced price lunch (FRPL) eligibility was used as an indicator of SES. Seven-day accelerometry (Actigraph GT3X+) was used to measure MVPA. Measured height and weight were used to derive weight status category. The AC domain (6 items, scored 1-4) from the Harter Self-Perception Profile for Children was used to assess perceived AC, and categorized by tertiles into low, moderate, and high. The association between AC and MVPA were examined using mixed effects models adjusting for sex, race, grade, FRPL, weight status category, accelerometer wear time, and controlling for school-level clustering.

RESULTS: Of those participants with valid accelerometer wear time of ≥ 3 days and $\geq 10 \text{ hr/day}$ (n=1054, 44% male, 8.7±0.7 years), 81% did not meet the 60-min MVPA recommendation (44.9±20.1 min/day). AC scores differed by sex (high AC=37% male vs. 31% female; p<0.05) and FRPL eligibility (high AC=42% non-FRPL eligible vs. 28% FRPL eligible; p<0.001). A significant interaction between FRPL eligibility and AC was found (p<0.01). Non-FRPL eligible children who reported either moderate AC ($\beta=4.0 \text{ mins/day}$; 95% CI: 1.1, 6.8; p<0.01) or high AC ($\beta=9.4 \text{ mins/day}$; 95% CI: 6.0, 12.9; p<0.001) were more likely to engage in more minutes of MVPA compared to children who reported low AC. This association between AC and MVPA did not exist for FRPL-eligible children (p>0.05).

CONCLUSION: Self-reported AC was positively associated with MVPA, but not for low-income children. These findings suggest that AC may not correlate with greater engagement in PA behaviors among low-income children. Further research is warranted to assess which social and environmental factors affect the association between AC and MVPA.

777 May 31 4:30 PM - 4:45 PM

Effects Of Interrupting Prolonged Sitting With Activity On Appetite Sensations In Elementary School-age Children

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(No relationships reported)

BACKGROUND: Short and long term exposure to prolonged sitting is associated with excess food intake and weight gain in children. Interrupting prolonged sitting with low-intensity activity does not alter subjective appetite sensations or food intake

in children. However, it is unclear whether activity performed at a higher intensity will alter appetite sensations in children. **PURPOSE:** The purpose of this study is to examine the acute effects of interrupting prolonged sitting with intermittent activity performed at varying intensities on hunger, satiety, and prospective food consumption (PFC) in elementary school-age children. **METHODS:** Using a randomized crossover design, thirty-nine children (ages 7-11 years; 18 male, 21 female; 33% overweight/obese and 59% non-white), completed four experimental conditions: 8 hours of sitting interrupted with 20, 2-minute low-intensity (L), moderate-intensity (M), or high-intensity (H) activity breaks or 20, 2-minute sedentary (S) screen time breaks. Exercise intensity for the L, M, and H conditions corresponded with 25%, 50%, and 75% of heart rate reserve, respectively. Hunger, satiety, and PFC, were assessed using the Visual Analog Scale at four time points (post-breakfast, pre-lunch, post-lunch, and pre-dinner) throughout each experimental condition. **RESULTS:** Satiety sensations tended to be lower during the L and H conditions compared to the S condition (S: 5.3±0.3, L: 4.8±0.3, M: 5.2±0.39, H: 4.7±0.4, p=0.05). There were no significant differences across conditions for hunger (S: 4.6±0.3, L: 4.6±0.3, M: 4.6±0.3, H: 4.7±0.3, p=0.99) and PFC (S: 4.5±0.3, L: 4.4±0.3, M: 4.5±0.3, H: 4.7±0.3, p=0.63). There were no significant differences between post-breakfast vs. post-lunch scores (p>0.05), and pre-lunch vs. pre-dinner scores (p>0.05). **CONCLUSIONS:** These data suggest interrupting prolonged sitting with moderate-intensity activity may be an effective strategy to increase physical activity energy expenditure without triggering increases in hunger and PFC or reductions in satiety. Future studies should examine the long-term effects of interrupting prolonged sitting with activity on appetite sensations, food intake, and weight outcomes in elementary school-age children.

778 May 31 4:45 PM - 5:00 PM

The Fueling Learning Through Exercise (FLEX) Study: Short-term Findings On Sedentary Time In Lower-income Schoolchildren

Jennifer M. Sacheck, FACSM¹, Catherine Wright¹, Sarah Amin¹, Stephanie Anzman-Frasca², Virginia Chomitz¹, Kenneth Chui¹, Miriam Nelson, FACSM³, Christina Economos¹. ¹Tufts University, Boston, MA. ²University of Buffalo, Buffalo, NY. ³University of New Hampshire, Durham, NH. Email: jennifer.sacheck@tufts.edu (No relationships reported)

PURPOSE: Throughout the elementary school years school-time moderate-to-vigorous physical activity (MVPA) tends to decrease while sedentary time (SED) increases, contributing independent effects on health outcomes. There is insufficient research on how physical activity (PA) programming may impact SED in children. Our objective was to determine whether two innovative school-based PA programs impact school SED in children and if program reach differed by sex, race/ethnicity, and weight status. **METHODS:** Eighteen schools from lower-income Massachusetts school districts were enrolled in the Fueling Learning through Exercise Study (FLEX) and randomized to 100 Mile Club (100MC; walking/running program), Just Move (JM; active classroom breaks), or a Control group. Third- and fourth-grade children (n=883) were recruited and measured at baseline (Fall 2015) and short-term follow-up (Spring 2016) for height/weight and 7-day accelerometry (ActigraphGT3x). Demographic information was obtained by parent questionnaire. PA program effects on SED were examined using mixed-effects models adjusting for child sex, race/ethnicity, free or reduced-price lunch (FRPL) eligibility, weight status, accelerometer wear time, average daily temperature, and controlling for school-level clustering. **RESULTS:** 793 children (8.7 ± 0.7 years, 44% male, 65% non-white, 53% FRPL, 41% overweight/obese) had valid accelerometer wear-time (3 days, 310 hrs/day) at both study visits. At baseline, few children achieved the recommended 30 minutes of school-time MVPA (9%; 18.1 ± 7.9 min) and children were sedentary for 59.7% (233 ± 43 min) of their school day. There was a significant effect of program on SED (p=0.041) with Control and JM increasing in SED (6.2 [95%CI: 2.7, 9.5], p<0.001 and 4.3 [95%CI: 0.9, 7.7] mins/day, p=0.012 respectively) while 100MC did not change (p=0.88). There were no differences in program effects by sex (p=0.58), race/ethnicity (p=0.08), or weight status (p=0.19). **CONCLUSIONS:** Short-term follow-up of program implementation during a two-year PA intervention demonstrates a potential effect of 100MC on mitigating an increase in SED that may occur over the elementary school years. Longer-term findings will demonstrate whether the effects of PA programming on SED are sustained.

779 May 31 5:00 PM - 5:15 PM

Comparison of Moderate-to-Vigorous Physical Activity Between In-school and an Afterschool Program among Urban Underserved Children

Ryan McVann, Marlo P. Dell'Aquila, Madison Burke, Zi Yan, Kevin Finn, Kyle McInnis, FACSM. Merrimack College, North Andover, MA. (No relationships reported)

With the elimination of physical education and recess, the opportunities for children to be physically active in schools has declined. Therefore, afterschool programs have been identified as ideal settings where children (5-14 years) can accumulate a significant portion of their total daily, recommended level of moderate-to-vigorous physical activity (MVPA). **PURPOSE:** The first purpose of this pilot study was to quantify the level of in-school MVPA in underserved elementary school settings. A second purpose of the study was to quantify the level of MVPA achieved through a structured afterschool program that integrates physical activity with a STEM (Science, Technology, Engineering, and Mathematics) learning component. **METHODS:** Participants were 13 children (female n=5, age= 9.36, SD=0.83) enrolled in an afterschool program offered at a YMCA located in an urban community. All participants wore accelerometers to track their MVPA during the school day (6 hours and 15 minutes) and while participating in the structured afterschool program (30 minutes) called *Active Science*. During the program, the participants completed thirty minutes of physical activity followed by a science lesson delivered through the *Active Science* Mobile App. Physical activity levels were monitored for five consecutive days (Monday-Friday) during the in-school and afterschool environments. **RESULTS:** Participants mean in school and afterschool MVPA were M=14.5+2.60, M=16.87+3.6 minutes, respectively. T-test showed a significant difference between these two settings t(12)= 16.29, p<.05. The 6-hour school day contributed to approximately 24% of the recommended daily physical activity, while the 30-minute afterschool program contributed to 28% of the daily-recommended MVPA time. **CONCLUSION:** A guided and well-structured afterschool physical activity program can significantly impact MVPA levels in children. The results of this study are well aligned with national recommendations that endorse innovative strategies to incorporate movement into afterschool programs to improve physical activity levels in children.

B-46 Clinical Case Slide - Foot and Ankle I

Wednesday, May 31, 2017, 3:15 PM - 4:55 PM
Room: 504

780 **Chair:** Melody Hrubes. Schwab Rehabilitation Hospital, Chicago, IL. (No relationships reported)

781 **Discussant:** Aaron Lee. MacNeal Hospital, Berwyn, IL. (No relationships reported)

782 **Discussant:** Benjamin Hasan. Northwest Community Hospital Medicine Group, Arlington Heights, IL. (No relationships reported)

783 May 31 3:15 PM - 3:35 PM

Recurrent Medial Heel Pain In An Elite Triathlete: Location, Location, Location.

Jason L. Zaremski, FACSM¹, Dustin Nabhan². ¹University of Florida, Gainesville, FL. ²United States Olympic Committee, Colorado Springs, CO. Email: zaremjl@ortho.ufl.edu (No relationships reported)

Case History We present a 25 year old female elite triathlete with nine months of left medial calcaneal discomfort associated with running. Her symptoms are described as aching in the medial inferior calcaneus. She denies swelling, sensory changes, discoloration, or burning. Previously she was diagnosed at an outside institution with plantar fasciitis as well as impingement of the first branch of the lateral plantar nerve. She was treated with a diagnostic lidocaine injection, as well as a cortisone injection without relief. **Physical examination** The patient was tender to palpation posterior and inferior to the medial malleolus. Tapping at that location created mild pain and sensation of radiation of pain inferiorly but there was no electrical or burning sensation. Range of motion, strength, and light touch of the ankle was normal. There was a negative Tinel's sign at the Fibular Head. A calcaneal squeeze test created medial sided calcaneal pain only. The patient had negative slump and straight leg raise tests. **Differential Diagnosis** Impingement of the First Branch of the Lateral Plantar

Nerve Posterior Tibial Nerve Impingement Stress Reaction/Fracture of Calcaneus Fat Pad Syndrome Plantar Fasciitis **Tests and Results** Previous MRI's of the foot and ankle as well as lumbar spine were negative. A reported electromyographic and nerve conduction study was negative for lumbar radiculopathy but without evaluation of calcaneal nerves. Given the entire clinical picture, we proceeded with a lidocaine challenge with ultrasound guidance at the location at the bifurcation of posterior tibial to calcaneal nerves. She received complete relief of pain within five minutes.

Working Diagnosis Posterior Tibial Nerve Impingement at Level of Bifurcation of Calcaneal Nerves

Treatment & Outcomes Given the positive Lidocaine challenge, the decision was made to proceed with hydro-dissection at the level of posterior tibial nerve bifurcation of medial and lateral calcaneal nerves. In plane short axis hydrodissection technique with 1% plain Lidocaine and Triamcinolone was performed. The patient had complete relief of pain at 5 minutes, 24 hours, 72 hours, and 90 days post procedure. The patient has returned to training without restriction with hopes of competing for a spot on the next Olympic Team.

784 May 31 3:35 PM - 3:55 PM

Foot Pain - Recreational Skier

Kelly L. Roberts Lane, FACSM. *Fix It physical therapy, Mahtomedi, MN.*
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(No relationships reported)

HISTORY: 35 yo slipped down her back deck steps 1/25/16. She experienced severe pain and inability to stand on her R foot with immediate swelling and minimal bruising on day 1. She was evaluated at an Orthopedic Clinic, where X-ray showed a talar avulsion fx. She was given a cast boot and instructed to follow-up in 4 wk. She saw me at the physical therapy clinic 7 days post fx with complaints of severe pain and inability to weight-bear on booted R foot. The boot was not fitted correctly with the front piece missing and the air bladder not inflated. The boot fit was corrected and she left for Colorado. She returned 2 wk later with continued severe pain.

PHYSICAL EXAMINATION: Examination 3 wk post talar avulsion fracture revealed severe tenderness with palpation R foot, significant bruising and severe R lower leg, ankle, and foot swelling. Her R foot skin was cool to touch compared to the L and had a mottled appearance. She had painful and severe tightness with R calcaneal and forefoot varus and valgus PROM and R dorsiflexion PROM. She had limited ability to wiggle her toes, but no complaints of numbness or tingling.
DIFFERENTIAL DIAGNOSIS: 1. Additional Fracture 2. Ligament Tear 3. Complex Regional Pain Syndrome **TEST AND RESULTS:** MRI of R ankle/foot 2/23/16: Avulsion fragment along the talar head, No acute ligament injury, impaction of plantar aspect of talus with extensive marrow edema talar head and neck, calcaneus contusion
FINAL WORKING DIAGNOSIS: Complex Regional Pain Syndrome post avulsion/impaction fx of the talar head complicated by the ill-fitting cast boot **TREATMENT AND OUTCOMES:** 1. Discontinuation of boot 8 wk post fx 2. Knee walker for 10 wk 3. Gabapentin 900 mg / day 4. Facilitation of joint movement to improve gross ankle/foot movement and decrease pain response 5. Fracture fully healed 11 wk post fracture 6. Slow return to activity over 6 mo - dance, paddle boarding, Pilates 7. CRPS sx resolved over 9 mo post fx

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Tarsal Dysostosis in the Adolescent Athlete

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(No relationships reported)

Articular Dysostosis is a rare musculoskeletal condition due to an abnormal bridging of two bones by cartilage, bone, or fibrous tissue. This abnormality changes the intrinsic physiologic motion of those two bones and surrounding structures. The most common site involves the talus, calcaneus, and navicular bones- known as Tarsal Dysostosis or Tarsal Coalition (TC). The condition has been linked to a gene mutation that can affect both feet in fifty percent of cases. TC typically presents in the adolescent patient after beginning athletic activities.

A 12-year old male with no significant medical history presented to the Sports Medicine office complaining of worsening left non-traumatic foot pain for over one years time. The patient had been participating in high school football and sustained an inversion ankle injury. On physical exam tenderness to palpation at the proximal dorsal surface of his left foot was elicited. Osteopathic exam of the foot and ankle was noted for Pes planus with fallen arch and the inability to induce medial arch, Hammer toes, and hallux valgus deformities of the foot. The patient was empirically started on a rehabilitation program consisting of foam rolling exercises of the lower quarter, increase flexibility, ankle and foot intrinsic exercises, ambulation with a non-inflating walking boot. With only minimal clinical improvement, magnetic resonance imaging (MRI) was ordered revealing bony contusions in the talus, calcaneus, and navicular bones. He was referred to Shriners Hospitals for Children and underwent a resection of the left calcaneonavicular coalition. He has since has returned to pain-free athletics after completing rehabilitation and therapy.

Current literature indicates that Tarsal Dysostosis affects up to 1% of the population. It is a diagnosis found primarily in children and young adolescents during the ages of 8-16 when the ossification process of bones initiates. The disease is caused by mutations in the NOG gene. This gene is responsible for the noggin protein, which plays an important role in proper bone and joint development. The diagnosis of tarsal coalition begins with clinical suspicion and key physical exam findings of pain in an adolescent with decreases in foot range of motion, as well as pain into the hind-foot.

786 May 31 4:15 PM - 4:35 PM

Ciprofloxacin Induced Achilles Tendinopathy

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(Sponsor: Kenneth Bielak, FACSM)
(No relationships reported)

HISTORY: 26 year old college graduate student with past medical history of a kidney stone had painful urination and increased frequency over several days. He was seen by internist at student health center, prescribed Ciprofloxacin for 14 days for acute bacterial prostatitis. Two months later he developed right Achilles tendon pain which had started insidiously upon awakening one morning, with no inciting event except for taking Ciprofloxacin 6 weeks earlier. **PHYSICAL EXAMINATION:** Swelling of the of posterior ankle noted. Tenderness to palpation at the insertion site of a tight Achilles tendon was appreciated. **DIFFERENTIAL DIAGNOSIS:** 1. Ciprofloxacin induced Achilles tendinopathy 2. Idiopathic Achilles tendinopathy 3. Posttraumatic Achilles tendinopathy **TEST AND RESULTS:** 1. Ankle ultrasonography: Thickening and swelling of Achilles tendon. 2. Ankle X-ray: No bony abnormalities. **FINAL WORKING DIAGNOSIS:** Ciprofloxacin Induced Achilles Tendinopathy **TREATMENT AND OUTCOMES:** 1. Walking boot 2. NSAIDs 3. Physical therapy. Patient has recovered after six month of treatment.

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Ankle Pain and Swelling - Tennis.

Gabriel Carpio-Bracho, Poonam Thaker, Anthony Rizzo, Brian Donohue. *Presence Resurrection Medical Center, Chicago, IL.*
(No relationships reported)

HISTORY: 19 yo F D3 collegiate tennis player presented to the athletic training room for evaluation of b/l ankle pain on 9/12/2016. Pain began 2 months prior, while at home in Germany, starting in the left ankle, progressing to the right ankle a few weeks later with accompanying swelling, numbness & weakness. Denied any trauma or acute injury. Initial evaluation in Germany consisted of serum blood analysis and joint aspiration without joint fluid analysis. She returned to school & began a course of PT with the athletic training staff, with improvement in the numbness and weakness, but continued to have intermittent ankle pain and swelling. She denied taking any medications or herbal supplements. History of "allergic" reactions to many medications, which vary from blisters on her body to GI upset. At the time of initial presentation ROS neg. **PHYSICAL EXAMINATION:** Ankle: mild non pitting edema b/l. No erythema, ecchymosis, or deformity. Full A/PROM. Pain with passive and active dorsiflexion, plantar flexion, eversion, and inversion b/l. TTP over anterior and inferior aspect of lateral malleoli b/l, Achilles' insertion b/l. Anterior drawer negative b/l. Altered gait due to pain. Normal arches. Toe walk elicited pain, heel walk was painless. Strength 5/5 b/l in ankle and foot. DTR 2+ at Achilles' tendon b/l. Sensation intact b/l in all fields. **DIFFERENTIAL DIAGNOSIS:** 1. Systemic Lupus Erythematosus (SLE) 2. Drug Induced Lupus 3. Rheumatoid Arthritis 4. Seronegative Spondyloarthropathy 5. Lyme Disease 6. Synovitis/Tenosynovitis 7. Stress fracture / Stress reaction 8. Hypercholesterolemic Arthritis **TEST AND RESULTS:** Initial labs: **Chol 202, TG 178, LDL 110, CBC** (WBC = 9.5, Hb = 12.4, **Plt = 473**), CMP wnl. ASO neg, Fe wnl, Uric acid = 3.1, CRP = 5; CCP, Lyme neg. MRI = synovitis & edema around talar joint. Otherwise normal. F/u Labs: **ESR = 26; Anti-histone = 1.3 (weak positive);** CRP, CCP, ANA, dsDNA, Smith Ab, RNP Ab, SSA, SSB, SCL70, myeloperoxidase Ab, Anti-Centromere Ab, Lyme neg **FINAL WORKING DIAGNOSIS:** Early Lupus or drug induced lupus **TREATMENT AND OUTCOMES:** She was prescribed prednisone but preferred nonpharmacologic therapy. Continue PT, repeat labs. F/u in 2 wks: Symptoms improved. Work up ongoing. Continues to have occasional foot and ankle pain without functional limitation. Final diagnosis pending

B-47 Clinical Case Slide - Lumbosacral Spine II

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM
Room: 401

788 **Chair:** Sherrie L. Ballantine-Talmadge. *CU Sports Medicine and Performance Center, Boulder, CO.*

(No relationships reported)

789 **Discussant:** Samuel K. Chu. *Rehabilitation Institute of Chicago, Chicago, IL.*

(No relationships reported)

790 **Discussant:** John P. Batson, FACS. *Lowcountry Spine and Sport, Hilton Head Island, SC.*

(No relationships reported)

791 May 31 3:15 PM - 3:35 PM
Loss Of Forward Flexion And Lumbar Back Pain In A 7yo Male.

Danielle M. Magrini. *Children's Hospital of Philadelphia, Philadelphia, PA.*

(No relationships reported)

HISTORY: A 7 year old male comes into the office with low back pain which is worse with activity. Mother states that there is no specific injury or mechanism just progressive pain over the last 2-3 months prior to this visit. He was seen by an OSH where he obtained X-rays and was prescribed physical therapy. Pain began to progress despite PT and now he is unable to bend over and touch his toes. There is no numbness, tingling, or overt weakness in the lower extremity. He does have an occasional radicular pain into the left leg. No recent infections, fever, or change in bowel or bladder habits.

PHYSICAL EXAMINATION: Inspection: stiff gait otherwise reciprocal and non-antalgic; able to walk on toes and heels. No swelling, erythema or superficial skin stigmata in the lower lumbar spine Palpation: midline tenderness to palpation over the L2-L4 vertebrae. Mild paraspinal tenderness left greater than right. ROM: unable to forward flex at the waist; decreased ROM in extension, lateral side bending and rotation. Special tests: + 2 patellar and achilles reflexes; sensation intact throughout. Negative straight leg raise. Unable to bring knees into chest. **DIFFERENTIAL**

DIAGNOSIS:Tumor, ABC, muscle strain, infection

TEST AND RESULTS: Xray of lumbar spine-shows obliteration of the left L3 pedicle, + winking owl sign. MRI L spine- L3 vertebral body severe compression deformity on the left, essentially vertebral plana appearance, bulging/extraneous extension of enhancing tissue involving the left vertebral body, pedicle, and posterior elements extending into paraspinal tissues. Findings may represent Langerhans cell histiocytosis or other neoplasm. CT needle guided biopsy-confirmed LCH Skeletal survey- no other bony involvement **FINAL WORKING DIAGNOSIS:** Bone tumor of L3 pedicle. Possible LCH

TREATMENT AND OUTCOMES: - Symptomatic treatment including-TSLO brace and activity modifications - close monitoring and followup - no chemo or radiation secondary to focal disease.

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Back Injury - Mountain Biking

Cory Mitchell, Lauren Simon, FACS. *Loma Linda University, Loma Linda, CA.* (Sponsor: Lauren Simon, FACS)

(No relationships reported)

HISTORY: A 31-year-old recreational mountain biker presented with a one-month history of 5/10 low back pain. During a weekend excursion, he rode off of a 15 foot drop and landed flexed forward at the waist on his bike with his tailbone landing directly on the rear tire. He experienced immediate low back pain without radiation, numbness or tingling in the legs, or loss of bowel and bladder control. He was able to complete his ride and walk to his car. He continued to have low back soreness (2-4/10) particularly when sitting upright in a chair that limited his normal 5x/week exercise routine.

PHYSICAL EXAMINATION: Examination revealed tenderness to palpation off of the midline bilaterally at L3-L4. He was nontender over the sciatic notches with very mild lumbar paraspinal muscle spasm at L2-L4. Forward flexion was 90% of the floor. He exhibited full extension and lateral bend. L1-S1 sensation was intact. Normal squat, heel and toe walk with 5/5 EHL strength bilaterally. He had negative straight leg raises supine and seated. Achilles and Patellar reflexes were 2 and 2+.

DIFFERENTIAL DIAGNOSIS: 1. Lumbar Compression Fracture 2. Lumbar Paraspinal Muscle Sprain 3. Lumbar Disc Injury 4. Lumbar Isthmic Spondylolisthesis

TEST AND RESULTS: Lumbar spine AP and lateral radiographs: -No evidence of acute fracture or dislocation. No significant degenerative changes. -Partial fusion of the anterior aspects of the vertebral bodies of T12 and L1, possibly congenital. Lumbar spine MRI without contrast: -Partial fusion of T12 and L1 vertebral body. -Degenerative disc disease at L4-L5 with central annular tear of the disc.

FINAL WORKING DIAGNOSIS: Central annular tear of the L4-L5 disc

TREATMENT AND OUTCOMES: 1. Rest and activity modification for 7 months. 2. Core strengthening physical therapy program for 8 weeks. 3. Negative radiographs rule out compression fracture with continued symptoms 9 months post injury. 4. Return to 65% capacity mountain biking with new onset low back weakness and radiation of pain into left buttock/testicle. Continued to deny red flag symptoms. 5. MRI revealed an annular tear of the L4-L5 disc. 6. Return to physical therapy for core strengthening program. Pain decreased to only upon awakening after 12 of 16 sessions. Gradual return to activity will be implemented with continued pain free progress with physical therapy.

793 May 31 3:55 PM - 4:15 PM

Back Pain in a Tennis Player

Renu Gautam, George Pujalte, FACS. *Mayo Clinic Florida, Jacksonville, FL.* (Sponsor: George Pujalte, FACS)

Email: gautam.renu@mayo.edu

(No relationships reported)

HISTORY:

A 51-year-old female with a history of rhabdomyosarcoma and breast cancer presented with sudden, sharp, constant, 10/10 pain on the left lower back, radiating to her left hip and thigh. She had numbness and tingling over her left anterior thigh. The pain decreased when supine or standing, but increased with sitting. The pain was worse at night and in the early morning. Methylprednisolone and opioids provided little relief. No history of trauma. She had done light rowing machine workout the previous day. Rest of review of systems negative.

PHYSICAL EXAMINATION:

Back inspection showed no deformities, step offs, nor erythema. Level shoulders and iliac crests. Able to rise from a seated position. Gait was normal; toe and heel-walking, normal. Normal and pain-free lumbar spine range of motion (ROM). Negative straight leg raise test. No tenderness. Full ROM of left hip and knee. Mild left hip flexion weakness. Stinchfield negative. Decreased L2-L3 light touch sensation. Anterior thigh tingling reproduced with palpation inferomedial to left anterior superior iliac spine.

DIFFERENTIAL DIAGNOSIS:

Lumbrosacral plexopathy
Meralgia Paresthetica
Lumbrosacral plexitis
Paraneoplastic syndrome
Lumbar radiculopathy

TEST AND RESULTS:

X-rays: Straightening of normal lumbar lordosis. Lower lumbar facet joint osteoarthritis. Normal lumbar vertebral body heights and intervertebral disc spaces. EMG: Nerve conduction normal. Fibrillation potentials and mildly polyphasic motor unit potentials in the left L2 innervated muscles. MRI: Foraminal/extracanalicular disc extrusion on the left at L2-L3 compressing and superiorly shifting L2 nerve root and dorsal root ganglion with associated left L2 radiculopathy. No pathologic contrast enhancement or metastatic disease.

FINAL WORKING DIAGNOSIS: L2-L3 radiculopathy

TREATMENT AND OUTCOMES:

1. Physical therapy (PT) with mild improvement in symptoms
2. Epidural steroid injection with minimal relief
3. Continued PT; tried acupuncture and chiropractic treatments. Improved strength and decreased pain; continued numbness
4. Gabapentin with minimal improvement
5. Neurosurgery recommended microdiscectomy, patient declined
6. Continued nonsteroidal anti-inflammatory drugs. Advanced tennis skills slowly, introducing serving 10-15/session at mild to moderate level.

794 May 31 4:15 PM - 4:35 PM

Low Back Injury - Football: Complexities of In-Season Decision Making

Luke Widstrom, Sourav Poddar. *CU School of Medicine, Aurora, CO.* (Sponsor: John Hill, FACS)

(No relationships reported)

HISTORY: A 23 year old division I football player presented for recurrent back pain after two separate injuries at practice. He has a prior history of left sided low back pain and spasm which responded well to mobilization treatments. However, during a power lifting session he felt increased pain with radiation down the left leg with extension maneuvers. At a subsequent practice, he rotated to grab a ball and noted significant right sided low back pain.

PHYSICAL EXAMINATION: Full flexion, extension, sidebending, and rotation at waist

Bilateral lumbar paravertebrals are tight and TTP, worse on left. Left SI region TTP.

Spinous processes are non-tender.

Full sensation in bilateral LE L2-S1 dermatomes

5/5 strength in bilateral LE L3-S1 myotomes

2+ patellar and achilles reflexes bilaterally. No clonus.

SLR equivocal left, negative right. Slump test positive left, negative right. Stork test with mild discomfort left, negative right. **DIFFERENTIAL DIAGNOSIS:** 1. Lumbar radiculopathy 2. Lumbar paraspinal strain 3. Spondylolysis 4. Spondylolisthesis 5. Degenerative disc disease

TEST AND RESULTS: XR L-spine, AP/Lat/Flexion/Extension views: Negative **MRI L-spine:** 1. Stress fracture with nondisplaced fracture of anterior pedicle on left and pars interarticularis on right of L4. Early stress injury without fracture at the pedicle and pars interarticularis of L5.

2. Left paracentral protrusion compressing left S1 nerve root at L5-S1.

CT scan L-spine: Bilateral posterior element fractures at L4 vertebral body level, involving right lamina and pars interarticularis and left pedicle. No evidence of spondylolisthesis.

FINAL WORKING DIAGNOSIS: Left L4 pedicle fracture. Right L4 pars fracture. Bilateral L5 pars and pedicle stress reactions. L5-S1 disc protrusion with left S1 nerve root compression.

TREATMENT AND OUTCOMES: 1. L4-L5 and L5-S1 transforaminal epidural steroid injections: Complete resolution of leg pain.

2. Restricted from practice, weight lifting, and extension activities for 4 weeks with LSO brace.

3. Returned to running at 4 weeks, progressed to non-contact drills without pain.

4. Progressed to full contact practice and game play at 8 weeks without pain.

5. Plan for surgical fixation with screws at end of season with 3 to 6 month recovery.

6. If any setbacks, will be withheld from football and plan for earlier surgery.

795 May 31 4:35 PM - 4:55 PM

Back Pain in a High School Soccer Player

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(No relationships reported)

History: A 16 year-old male soccer player presenting to primary care sports medicine with 2 months of low back pain that was first noticed after a throw-in during a game. The patient has previously been evaluated by a pediatric orthopedic spine surgeon and was noted to have scoliosis and mild kyphosis but no other diagnosis. On further history he recalled intermittent low back pain prior to the injury, but it has become much more consistent since the injury. He has not had any numbness, tingling, weakness or incontinence. Upon further review of systems he has crampy, loose stools daily for over 2 months. Stool studies by his primary care provider have been negative so far. He denies any recent fevers. He has started probiotics and cholestyramine. **Physical Exam:** Well-developed young man in no distress. Spine with a mild thoracolumbar scoliosis, mild kyphosis. Pain with both forward bend and lumbar extension. Stork test revealed mild discomfort. No pain on palpation over the lumbar spine. Negative figure 4. Popliteal angle 120 degrees. No SI joint tenderness. Nonantalgic gait. Normal deep tendon reflexes.

Differential Diagnosis

1. Spondylolysis
2. Disc Herniation
3. Muscle strain
4. Scoliosis
5. Infection
6. Inflammatory bowel disease

Test and Results:

-Spine radiographs show a mild scoliotic curve but no signs of spondylolysis or listhesis

-No clear indications for MRI

-Labs:

CBC-

WBC 7.02 (4.5-11)

HBG 14.8 (13.5-17.5)

Platelet 296 (150-450)

BMP Normal

ESR-33 (0-15)

CRP 2.3 (0-1)

Final Diagnosis

1. Crohn's Disease

Treatment

1. Gastroenterology consultation. He had an extensive work-up including a colonoscopy which showed inflammation of the terminal ileum consistent with Crohn's disease. GI has tried multiple immunomodulators including steroids, vedolizumab, ciprofloxacin, vancomycin and infliximab. He remains difficult to control and is being considered for a fecal transplant.

2. He has continued to participate in soccer

ACSM May 30 – June 3, 2017

796 May 31 4:55 PM - 5:15 PM

Sacral Stress Fracture in a Collegiate Distance Runner

Samuel F. Carlson, Ward McCracken, Suzanne Hecht, FACSM.

University of Minnesota - Twin Cities, Minneapolis, MN.

(Sponsor: Suzanne Hecht, FACSM)

(No relationships reported)

HISTORY: A 20-year-old male NCAA D1 distance runner presented with gradual onset of left low back pain present for two weeks without acute injury. He was running 60 miles per week and had been running seven days a week for an extended period of time. The pain was notably aggravated the week prior to presentation while practicing hurdles. He has no history of stress fractures. He endorsed mild radiation of the pain to the lateral buttock and hip, but not further down the thigh. He experienced no numbness or tingling.

PHYSICAL EXAMINATION: FROM of the lumbar spine, but with painful F/E. Negative SLR and Slump. 5/5 strength throughout LE b/l. Reflexes 2+ b/l. TTP over L SIJ and sacrum. The left sided pain was reproduced with single leg hopping, worse on the left than the right. He had a non-antalgic gait.

DIFFERENTIAL DIAGNOSIS:

1. Lumbago with Radiculopathy
2. Sacroiliac Joint Dysfunction
3. Sacral Stress Injury

TEST AND RESULTS:

XR Lumbar Spine

- negative

MRI of the Lumbar spine and pelvis

- Non-displaced fracture of the left sacrum predominantly at the S1 vertebral level, with subtle extension to the S2 vertebral level

DEXA Hip/Pelvis/Spine

- Z score L1-4 = -1.4

Laboratory Testing

- normal range for all labs including Vitamin D, Calcium, Testosterone Free and Total, BMP, PTH, Ferritin, CBC, LH, FSH, TSH, and free T3 & T4

FINAL/WORKING DIAGNOSES:

- 1) Left grade 4 sacral stress fracture
- 2) Low bone mineral density for an athlete

TREATMENT AND OUTCOMES:

1. Initial treatment – stop high impact activity and running, cross-train, and counselled regarding appropriate calcium intake
2. At 8 weeks, started return to run program under team's ATC
3. At 4 months, returned to regular training, running up to 5 days per week
4. At 5 months, began to have discomfort in the left lower back. Repeat MRI showed resolution of previous fracture, but now showed marrow edema involving the right peripheral aspect of S5, most consistent with stress reaction. This area is asymptomatic to the patient and he has no TTP at either site.
5. Presently, working with formal PT and returned to reduced volume running.

B-48 Clinical Case Slide - Shoulder IV

Wednesday, May 31, 2017, 3:15 PM - 5:15 PM

Room: 402

797 **Chair:** Dina C. Janse van Rensburg, FACSM. *University of Pretoria, Pretoria, South Africa.*

(No relationships reported)

798 **Discussant:** Wayne Franklin Sease, FACSM. *Steadman Hawkins Clinic of the Carolinas, Greer, SC.*

(No relationships reported)

799 **Discussant:** Andrea Arruda. *São Paulo, Brazil.*

(No relationships reported)

800 May 31 3:15 PM - 3:35 PM

An Unusual Cause Of Arm Pain - Lacrosse

Brady J. Bowen, Deborah I. Light, Alexander Gozman, Hamish

A. Kerr, FACSM. *Albany Medical Center, Albany, NY.* (Sponsor:

Hamish A. Kerr, FACSM)

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(No relationships reported)

HISTORY:

A 17-year-old female presented with 2 days of right arm pain. The day after lacrosse practice, she awoke with a dull ache, swelling and redness starting at the elbow then progressing to the shoulder, worse with movement and improved with elevation.

She denied recent trauma, shortness of breath, cough, paresthesias or arm weakness. There was no recent immobilization or travel, no illness or history of similar symptoms.

Past medical, surgical and birth history were unremarkable. She denied tobacco use or known allergies. She was started on levonogestrel-ethinyl estradiol four months ago. Her Father had a remote post-surgical deep vein thrombosis.

PHYSICAL EXAMINATION:

Vitals: Temp 36.7, BP 112/64, HR 58, RR 16, 99 % O2 on room air
Well-appearing female in no apparent distress. Normal heart sounds. Lungs were clear, abdomen was benign. Pulses were intact and bilaterally symmetric throughout. Good muscle tone and bulk. The right arm was swollen from the elbow to the shoulder with mild erythema and warmth. Moderate tenderness to palpation of the elbow and shoulder, worse on the medial brachium. Elbow and shoulder range of motion was full but painful, limiting provocative maneuvers. Adson's test and costoclavicular compression tests were negative. Reflexes were 2+ throughout.

DIFFERENTIAL DIAGNOSIS:

1. Undisclosed trauma or non-accidental injury
2. Septic or reactive arthritis
3. Cellulitis or bursitis
4. Upper extremity DVT
5. Thoracic outlet syndrome or overuse injury

TESTS AND RESULTS:

- CBC, CMP, PTT, INR unremarkable
- Hypercoagulable work up pending
- Chest x-ray: No cervical rib or acute pathology
- Venous Doppler: Extensive right subclavian and axillary vein DVT
- Venogram: subacute thrombosis of the axillary and subclavian veins likely due to stenosis at the level of the first rib and medial clavicle

FINAL/WORKING DIAGNOSES:

Paget Von Schroetter Syndrome

TREATMENT AND OUTCOME:

1. Initial anticoagulation with Enoxaparin
2. Thrombectomy with heparin and tPA infusion
3. Repeat thrombectomy and balloon venoplasty for residual stenosis
4. Discharged on Apixaban
5. Right thoracic outlet decompression with anterior scalenectomy and balloon venoplasty
6. Hypercoagulable work up was negative
7. Three months oral anticoagulation with Apixaban
8. Held from contact sports for the duration of anticoagulation

801 May 31 3:35 PM - 3:55 PM

Unusual Cause of Periscapular Pain

Kimberly Sikule, John H. Stevenson. *UMass Worcester, Worcester, MA.*

(No relationships reported)

HISTORY: 38 yo female recreational athlete presents with left posterior shoulder pain which has gradual worsened over the past 4 months. Denies any previous trauma, injury to the area. It 8/10 sharp quality pain localized to posterior scapula with radiation to the neck. Denies any numbness, tingling, weakness, instability or crepitus. Symptoms are worse with activity. She tried PT and has modified her activities. On 1/29/2016 she underwent an ultrasound guided injection into the subscapular bursa. On 4/29/2016 she reports symptoms had resolved. On 7/29/2016 she reported her symptoms returned with a feeling of crunching under the shoulder blade. Underwent a second injection into the subscapular bursitis, MRI was obtained and she restarted physical therapy home exercise program.

PHYSICAL EXAMINATION:

GEN: Alert, oriented x 3
EYES: emoi
RESP: normal respiratory effort
SKIN: intact no signs of infection
NEURO: sensation to light touch intact. CN 2-12 intact.
MSK: Neck: full rom to flexion, extension, lateral rotation. Negative spurlings.
Shoulder: Mild periscapular tenderness, crepitus with active abduction. ROM 180 degrees of abduction, forward flexion. 5/5 strength with empty can testing, internal external rotation, negative obriens, Hawkins, neers testing. Myofascial soreness on posterior medial boarder of the scapula. Negative scapular liftoff with scapular stress, pain with scapular compression and active abduction.

DIFFERENTIAL DIAGNOSIS:

- Subscapular Bursitis
- Cervical Paraspinal Muscle Strain
- Cervical Radiculopathy
- Glenohumeral Joint Arthritis
- Labral Tear
- Neoplasm
- Multidirectional Instability
- Parascapular Strain
- RTC Tendonitis

TESTS AND RESULTS:

Musculoskeletal Ultrasound left periscapular region showing no subscapular bursal fluid collection. MRI: medial border of right upper scapula, within intermuscular planes between trapezius, erector spinae, serratus anterior muscles there is a 2.9 x 1.3 x 1.1 cm mass. Lobulated cluster of grapes morphology with interspersed fast and central low T2 signal dots. No surrounding soft tissue edema. 3cm soft tissue mass consistent with a vascular lesion such as soft tissue hemangioma.

FINAL WORKING DIAGNOSIS:

3cm soft tissue hemangioma

TREATMENT AND OUTCOMES

Consult Vascular Surgery
Continue activities as tolerated

802 May 31 3:55 PM - 4:15 PM

A Shot at Expanding Shoulder Pain Differential Diagnosis

Mark McEleney, Andrew Peterson. *University of Iowa, Iowa City, IA.*

(No relationships reported)

History

14 yo male swimmer who was seen on 2/24/16, for evaluation of left upper extremity numbness and weakness of 2 month duration. Symptoms had begun the day after receiving his second of three injections for HPV vaccination series in his left shoulder on December 29, 2015. The patient woke up the following day with tightness in his left shoulder. Intense, sharp pain and weakness of his arm developed inhibiting participate in swim practice the following evening.

The patient had previously been seen by his pediatrician as well as an orthopedist, neurologist, and physical therapist. Parsonage-Turner syndrome was diagnosed clinically. The patient received a six-day course of oral methylprednisolone and underwent physical therapy for shoulder strengthening and range of motion. There was improvement of pain though weakness with shoulder flexion and abduction, decreased tactile sensation over the shoulder, and paresthesias of the fingertips had persisted.

Exam

Decreased tactile sensation over the dorsal hands and fingers. Passive ROM full, active ROM was limited to 90 of forward flexion and abduction. Scapular winging with flexion and abduction. 5/5 strength with resisted internal and external rotation. 4+/5 strength with empty can and Speed's test. Lift off test was positive.

Differential Diagnosis

cervical disk herniation, cervical neural foraminal stenosis, mass lesion compressing the brachial plexus, calcific tendonitis, acute subacromial bursitis, adhesive capsulitis, thoracic outlet syndrome

Tests/Results

NCS/EMG of the left upper extremity (2/24/16)
-mild median neuropathy at the left wrist
Left shoulder MRI without contrast (5/31/16)
-normal

Final Working Diagnosis

Parsonage-Turner syndrome

Treatments and Outcomes

Two rounds of IVIG (135 g) separated by 24 hours were given on 3/7/16 - 3/8/16. Shoulder strength improved significantly and pain resolved completely within one week of treatment. There was slightly diminished muscle bulk of the supraspinatus, deltoid, bicep, tricep, and latissimus dorsi as well as scapular winging with wall push-up and scapular dyskinesia at follow-up exam (3/28/16). Mild (4+/5) weakness with shoulder shrug/protraction/retraction, resisted internal rotation, and supraspinatus testing persisted to visit on 5/31/16.

803 May 31 4:15 PM - 4:35 PM

Shoulder "Droop" In Multi-sport Athlete

Amy Rabatin¹, Daniel Lueders², Cara Prideaux¹. ¹Mayo Clinic, Rochester, MN. ²University of Michigan, Ann Arbor, MI.

(Sponsor: Karen Newcomer, FACSM)

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(No relationships reported)

HISTORY: A 16 year old, right handed, multi-sport male athlete presented with right shoulder region asymmetry noted 3 months prior by teammates and athletic trainer. Scapular dyskinesia noted one month prior. No associated pain, paresthesias, sensation changes, or frank weakness. Active range of motion was impaired with overhead activities, but did not adversely affect sports performance. No history of shoulder, arm or neck trauma or injury. Past medical history unremarkable with no recent viral illnesses.

PHYSICAL EXAM: Peripheral pulses intact, normal capillary refill. Gross asymmetry and atrophy in right trapezius and latissimus dorsi muscle bulk with prominence of right scapula inferior angle. Right acromion 2-3 cm inferior to left. Normal activation of serratus and stabilization of scapula with wall push with no frank scapular winging.

Right scapula dyskinesis with slowed elevation and rotation with shoulder abduction and forward flexion. Ten degrees of right glenohumeral internal rotation deficit. 2/5 right shoulder elevation and external rotation strength, otherwise normal. Reflexes and sensation normal. No tenderness to palpation. No pain with Neer's, Hawkins, Scarf, O'Brien's and dynamic labral shear testing. No shoulder apprehension.

DIFFERENTIAL DIAGNOSIS:

1. Brachial plexopathy
2. Focal myopathy or myositis
3. Neuromuscular disease
4. Mononeuritis

TEST AND RESULTS:

Shoulder radiograph:

- Normal

MRI chest:

- Diminutive right trapezius relative to left. Mild increased T2 signal in right trapezius with subtle post contrast enhancement. No abnormality noted in latissimus dorsi.

EMG:

- Electrophysiologic evidence of focal myopathy involving right trapezius, latissimus dorsi and sternocleidomastoid.

Laboratory:

- CK, CRP, and ESR normal

- Connective tissue disease testing negative

- Fascioscapulohumeral Dystrophy testing negative

FINAL/WORKING DIAGNOSIS:

Focal myopathy involving right trapezius and latissimus dorsi, possible FSHD variant

TREATMENT AND OUTCOMES:

1. Physical therapy - scapular stabilization and strengthening of compensatory musculature.
2. Overhead sport evaluation. Neuro-reeducation focused on form and positioning during exercise performance.
3. Educated in safety with weightlifting activities.
4. Participated in football camp and fall football.

804 May 31 4:35 PM - 4:55 PM

Soccer Player with Neck Pain and Upper Extremity Parasthesias

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²University of Pittsburgh Medical Center, Pittsburgh, PA.

(Sponsor: Dr. Bradley C. Nindl PhD, FACSM)

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(No relationships reported)

HISTORY: An 18 year old right hand dominant female Division 1 soccer goalie with no medical history presented in February to clinic with neck pain and right upper extremity parasthesias radiating to her wrist. Initial symptoms began in October after diving for a ball when an opponent fell on to her right shoulder, neck, and head. She was diagnosed with a concussion and was held out of competition for 3 weeks during which she reports resolution of her symptoms. Her symptoms gradually returned and then remained present during activity only after she was cleared to return to play from her concussion.

PHYSICAL EXAMINATION: Full cervical and upper extremity range of motion. No tenderness or swelling in the cervical spine or upper extremities. Upper extremity strength was 5/5, reflexes were 2+/4, and sensation was intact to light touch and pinprick. Speed's, Yergason's, Empty Can, Hawkin's, O'Brien's, Spurling's, cervical facet provocation, Neer's, and Tinel's at the medial elbow were negative. Adson's, Wright's Hyperabduction, Allen's, and Costoclavicular maneuvers reproduced her symptoms.

DIFFERENTIAL DIAGNOSIS:

Brachial Plexopathy

Cervical Radiculopathy

Cervical Discogenic Pain Syndrome

Cervical Fracture

Clavicle Fracture

Mononeuropathy

Shoulder Impingement Syndrome

Spondylolisthesis

Thoracic Outlet Syndrome

Tumor

TEST AND RESULTS: Cervical X-ray (November 2)-No abnormalities

MRI cervical spine without contrast (November 13)-Punctate focus of increased susceptibility in the cervical cord at C1-C2. Recommend MRI with contrast to exclude hemorrhage or vascular malformation

MRI cervical spine with contrast (November 19)-Previously questioned susceptibility at C1-C2 is not seen and most likely represents artifact

EMG/NCS (February 13)-Normal study without evidence of radiculopathy, brachial plexopathy, or mononeuropathy

Right upper extremity ultrasound (February 18)-Vascular compression with reproduction of symptoms in provocative positioning

FINAL WORKING DIAGNOSIS: Vascular Thoracic Outlet Syndrome

TREATMENT AND OUTCOMES: Through a comprehensive rehabilitation program and adjustment in her throwing mechanics she was able to prevent provocation of symptoms without hindering her performance and ultimately was able to continue her college soccer career without symptoms or limitations

805 May 31 4:55 PM - 5:15 PM

Do Not Get Stung By What Is Not A Stinger In Boys Lacrosse Player

Matthew D. Sedgley. *MedStar Sports Medicine, Ellicott City, MD.*

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(No relationships reported)

14 year old male is at the sports medicine outpatient clinic with his mother. She mentions that her son gets "stingers" all the time. The stingers are felt to be appreciated in the bilateral upper arms. The duration is for many months (greater than 6.) Time makes them better and they are worse with motion around the neck or playing lacrosse.

PHYSICAL EXAMINATION: VITAL SIGNS: Pulse is 72 and regular, respirations 18 and regular, blood pressure 122/78. GENERAL: WNWD 14yom in no acute distress. EXTREMITIES: No peripheral edema or varicosities. NEURO: Inspection: no atrophy or bruising Palpation: no tenderness to palpation to the spinous process of the neck DTRs: Negative for Hyperreflexs bilaterally. Cervical range of motion: 1. Right side bending: Within normal limits, painful. 2. Left side bending: Within normal limits. 3. Forward flexion: 45 degrees with pain at the end of range. 4. Extension: Within normal limits. Special Test: + Spurlings:shows Positive with pain down the bilateral arms and occasional tingling and numbness. MSK: Palpation of the upper neck and shoulders is non tender ROM: full range of motion of arms is noted Gait: normal with normal station

Images: MRI C Spine: Cranioclavial angle of 139.
DIFFERENTIAL DX: 1.HERNIATED DISK 2.SPINAL STENOSIS 3.OCCULT FRACTURE OF THE C SPINE 4.TUMOR OF THE SPINAL CORD 5.ABSCCESS OF THE SPINAL CANAL 6.PYSCHOGENIC ETIOLOGY 7.VASCULAR ANOMALY/ THORACIC OUTLET 8.REDUCED CLIVAL ANGLE**FINAL DIAGNOSIS**

ABNORMAL CRANIOCLIVAL ANGLE
Cranioclival angle is the angle at the base of the skull that forms when a line is drawn at the posterior of the axis and the dorsum of the skull base. Normal angles range from 150 to 180 degrees. If the measurement is 150 degrees or less, there may be the concern for ventral spinal cord compression.

Disposition: Patient was referred to Orthopedic spine clinic. Consult performed there determined that there was no evidence of any symptoms at rest or baseline. There was no evidence of cord compression or injury on images. Only recommendations were to avoid contact sports and to follow up if any further symptoms presented. After discussion of the risks (of invasive surgery) and the benefits patient and his parents decided not to pursue further work up and and stop all contact sports including lacrosse.

B-59 Basic Science World Congress/Poster - Cognition, Intelligence, and Learning

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM

Room: Hall F

822 Board #1 May 31 2:00 PM - 3:30 PM

The Acute Effects Of A Physically Active Games Lesson On Cognition In Primary School Children

Andy J. Daly-Smith¹, Margaret A. Defeyer², Jim McKenna¹, Pamela L. Graham², Melissa A. Fothergill², Scott Lloyd³. ¹Leeds Beckett University, Leeds, United Kingdom. ²Northumbria University, Newcastle, United Kingdom. ³Redcar & Cleveland Borough Council, Redcar, United Kingdom.

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(No relationships reported)

Evidence regarding the impact of acute physically active bouts on cognition in schools is conflicting. Treatment fidelity of PA bouts is often unconfirmed, while many studies focus on few cognitive outcomes. **PURPOSE:** To investigate effects of a physically active games lesson (PAGL) on cognition in primary school children. **METHODS:**

Six schools (N=123, F=73; 9.9±0.3yrs) were ranked and paired by socio-economic status, with one per pair randomly allocated, by coin toss, to a ~40 min PAGL (n=62) or sedentary class lesson (n=61). One week post-familiarisation, immediately before and 10-mins after each lesson, pupils completed a computerised cognitive battery (COMPASS): simple, easy and hard reaction time (correct response reaction time, RT), Stroop (RT and % correct answers, %C), Digit Vigilance (RT & %C), Tower of London (ToL; thinking time TT, RT & %C), immediate word recall (%C), delayed

word (RT & %C) and picture recall (RT & %C). MVPA was measured in 15-second epochs using accelerometers and Evenson cutpoints. A threshold for the PAGL analysis was ≥ 12 mins MVPA. Two-way ANOVA with repeated measures assessed changes in cognitive outcomes. **RESULTS:** Average MVPA was 12.19 ± 2.55 mins (range 7.00-17.50 mins). Only 36 participants (58%) met the MVPA threshold. Negative effects of time were observed for: simple RT ($p=0.024$); hard RT (RT, $p<0.001$; %C, $p=0.002$); Stroop congruent (%C, $p=0.006$); Digit-vigilance (RT, $p=0.003$); immediate word recall (%C, $p<0.001$); delayed word recall (%C, $p<0.001$) and delayed picture recall (%C, $p<0.001$). Positive effects of time were observed for ToL RT ($p<0.001$). Significant interaction effects favoured the PAGL for ToL thinking RT ($p=0.048$, Partial eta squared = 0.041). **CONCLUSIONS:** We addressed a range of weaknesses affecting previous studies of the acute effects of PA. Low MVPA excluded many pupils from analysis. MVPA during PAGLs may be insufficiently intense or prolonged to influence these cognitive processes. ToL performance may be improved by MVPA total or the cognitive demands of PAGL lessons.

823 Board #2 May 31 2:00 PM - 3:30 PM
The Impact of Daily Physical Education on Perceptual Speed and PACER Laps Over Time

Haley K. Holan, Julian A. Reed, Abigail C. Short. *Furman University, Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)
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 (No relationships reported)

Developmental research has demonstrated that Perceptual Speed is related to higher cognitive abilities and linked to increases in fitness and physical activity participation. Epidemiological research has also shown that there is an inverse relationship between cardiorespiratory fitness and all-cause mortality. **PURPOSE:** The purpose of the study was to examine the impact of 45 minutes of daily physical education on Perceptual Speed and on fitness performance among youth attending Legacy Charter School. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education and Perceptual Speed among youth in grades 2nd-5th attending Legacy Charter, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2016 - pre-test assessment in September 2014) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school who provided physical education once per week was identified and utilized as a comparison. **RESULTS:** Legacy Charter School students observed significant gain increases on: 2 of 4 ($p<0.05$) Perceptual Speed sections, including the Total section, compared to 0 of 4 for the control ($p<0.05$). When stratified by gender, Legacy Charter females observed significant gain score increases on 3 of 4 sections. In particular, significant increases were observed in the Total section (Gain Score= 14.14 ; $F=8.17$; $df=1,162$; $p=0.005$) over time. On the PACER fitness test, Legacy Charter School students observed significant gain score increases (Gain Score= 9.75 ; $F=64.07$; $df=1$; $p=0.000$) over time. Legacy Charter School males and females also demonstrated significant increases in gain scores on the PACER test (Males: Gain Score= 11.59 ; $F=40.58$; $df=1,170$; $p=0.000$) (Females: Gain Score= 8.06 ; $F=27.26$; $df=1,166$; $p=0.000$). **CONCLUSION:** 45 minutes of daily physical education led to increases in Perceptual Speed and fitness performance among Legacy Charter male and female elementary school students over time from 2014 to 2016. Funded by Campbell Young Leaders.

824 Board #3 May 31 2:00 PM - 3:30 PM
Links Between Daily Physical Education, Fluid Intelligence, and Fitness Levels of Underserved Middle School Youth

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 (No relationships reported)

The investigation of the impacts of regular physical activity on cognition and general intelligence is under studied, however findings from a report from the Institute of Medicine (IOM) suggest positive associations between participation in regular physical activity and youth brain health. Unfortunately, only 8% of American public middle schools provide daily physical education according to the CDC School Health Policies and Program Study. **PURPOSE:** Examine the impact of 45 minutes of daily physical education on fluid intelligence and fitness levels among underserved middle school youth attending Legacy Charter School. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on fluid intelligence and the fitness performance among middle school youth attending Legacy Charter, a Title I school in the southeastern US. Gain scores (post-test assessment in May 2016 - pre-test assessment in September 2015) were calculated, stratified by ethnicity and gender, and analyzed

for significance. The interaction between school and time was estimated for each outcome. Each analysis was adjusted by age to control for baseline differences by school. A control school that did not provide daily physical education was utilized as a comparison. **RESULTS:** Legacy Charter School underserved females improved in fluid intelligence total score (Gain Score= 2.16 ; $F=5.88$; $df=1$; $p=.016$), aerobic capacity (Gain Score= 0.59 ; $F=7.796$; $df=1$; $p=.006$), number of push-ups performed (Gain Score= 2.58 $F=25.065$; $df=1$; $p=.000$), and number of curl ups performed (Gain Score= 5.64 ; $F=37.592$; $df=1$; $p=0.000$) compared to controls. Legacy Charter School underserved males improved in aerobic capacity (Gain Score= 1.94 ; $F=4.316$; $df=1$; $p=.039$), number of push-ups performed (Gain Score= 2.60 ; $F=35.542$; $df=1$; $p=.000$), and number of curl-ups performed (Gain Score= 11.27 ; $F=42.904$; $df=1$; $p=.000$) compared to controls. **CONCLUSION:** These findings suggest that daily physical education can influence the cognitive and fitness performance of underserved middle school youth. Funded by Campbell Young Leaders.

825 Board #4 May 31 2:00 PM - 3:30 PM

Dose Response Effect Of Physical Activity And Behavioral Regulation Measures On The Science Achievement Of At-risk Middle School Girls

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 (No relationships reported)

PURPOSE: After school programs have played a key role in engaging youth in the learning process by providing opportunities to explore interests, increase health and wellness, set goals, solve problems, and connect with adult role models. The purpose of this study is to measure the effects of an after school program with a fitness and informal health and nutrition science curriculum on cognitive processes and science achievement in previously sedentary middle school girls. **METHODS:** A between subjects study was designed with $n=29$ female adolescents (mean age = $12.03 \pm .73$) engaged in supervised triathlon training, health and nutrition science education in a 20 week intervention. A second group of $n=30$ randomly selected females (mean age = $12.93 \pm .91$) served as the comparison group. To assess changes in science achievement, data were collected pre- and post- intervention. Hierarchical regression analyses examined the linear association of physical activity, aerobic fitness level, cognition and science content knowledge controlling for relevant covariates. **RESULTS:** Science achievement by treatment group was significantly predicted by fitness level $F(5,53) = 6.27, p < .001$; physical activity $F(5,53) = 6.98, p < .001$; aspects of cognition including behavioral regulation $F(5,50) = 5.88, p < .001$; and processing speed $F(5,53) = 6.27, p < .001$. **CONCLUSIONS:** The intervention with informal nutritional science learning and a controlled aerobic fitness component suggested improved cognition and science achievement in previously sedentary middle school girls.

826 Board #5 May 31 2:00 PM - 3:30 PM

The Effect of Different Exercise Modalities on Cognition Among Adolescent Populations

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 (No relationships reported)

PURPOSE: A growing body of literature documents the beneficial effects of aerobic exercise on cognition. One of the most interesting findings dictates that aerobic exercise preferentially benefits executive function, a term for complex cognitive processes including attention, working memory, mental flexibility, reasoning, planning, and inhibition. The purpose of this study was to measure the effect of acute intervals of two different exercise modalities (soccer and running) on cognition and executive function among adolescents between the ages of 11-14 years. **METHODS:** Ninety-eight middle-school students (50 males, 48 females, mean age = 13.09 years) volunteered to participate in this prospective study. Baseline neurocognitive and background data was collected at an initial study point. Two-weeks after the initial study point, subjects were matched by age, math class, and grade. Participants were randomized into one of three study groups involving soccer, running, or no aerobic activity for 30 minutes. Directly after the 30-minute exercise period, all participants were re-administered the neurocognitive battery. **RESULTS:** Subjects in the soccer group had significantly higher average score differences from baseline ($M = +0.588$, $SD = 0.556, p = .01$) on a neuropsychological measure of executive functioning, specifically planning and organization (Rey-Osterrieth Complex Figure) compared to subjects who did not participate in aerobic activity ($M = -1.770$, $SD = 0.573$). There was no significant difference found for this measure between subjects who participated in 30 minutes of running and those who did not engage in aerobic activity. No significant differences found between groups on measures of creativity and divergent thinking, processing speed, perceived stress, self-efficacy, or inhibitory control and cognitive flexibility. **CONCLUSIONS:** The modality of physical activity may

influence subsequent cognitive performance. Specifically, physical activity involving strategy and planning may prime maturing adolescent brains toward enhanced organization. The duration of these cognitive effects are unknown; further investigation is needed.

827 Board #6 May 31 2:00 PM - 3:30 PM
Low Academically-achieved Students Did Not Get Worse Score from Being Physically-active

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 (No relationships reported)

It is not surprised that parents and educators struggled for time resources allocated to low academically-achieved students. Cutting physical activity (PA) time is one of the common practices as PA has been generally thought to produce negative impact on academic performance. Such belief has not yet been verified. **PURPOSE:** To examine the associations between mathematics performance and level of PA engagement in Chinese adolescents.

METHODS: A total of 882 grade 9th Chinese students were randomly recruited in Hong Kong that covered all 18 districts and three school bandings (high, middle, and low). Participants' mathematics performance was assessed at the beginning (T0) and the end (T1) of an academic year using validated and uniformed test papers. Their PA level was measured using self-reported questionnaire (PAQ-A). At both T0 and T1 time points, participants were classified as physically-active, moderate-active, and inactive according to the composite ratings in PAQ-A. They were further categorized into Go-Active, Go-Inactive, and Unchanged-PA groups based on the changes in their PA status throughout the academic year. Longitudinal changes in mathematics scores over the year were compared among the groups using two-way repeated measures ANCOVA, adjusted for family income and revision time.

RESULTS: Significant Time (T0 - T1) x PA-group interaction effect on mathematics ($F=5.22, p=0.02$) was observed. Significant improvement was found in Go-Active participants. When same analysis was split by school-banding, no adverse effect was shown in low-banding students ($F=2.35, p=0.14$) but a significantly positive change in high- and middle-banding students. Shift of PA status from T0 to T1 was a significant predictor of mathematics score change ($p=0.02$). **CONCLUSIONS:** Higher school-banding students gained better mathematics scores from being more active. More importantly, a reduction in PA time among low-achieved adolescents seemed unrelated to academic performance. This study demonstrates that students' academic achievement (i.e. mathematics scores) may not be boosted considerably from cutting their PA time. However, such finding has yet to be examined in other learning areas such as languages and science subjects.

828 Board #7 May 31 2:00 PM - 3:30 PM
Combined Associations Between Sitting Time And Physical Activity With Cognition And Academic Achievement In Young-adults

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Working memory capacity (WMC) is a core cognitive process that involves holding and manipulating information to meet task goals. WMC, in conjunction with other cognitive processes, is essential for improving vocational performance, academic achievement and for developing skills to achieve life goals. While evidence indicates the positive influence of structured aerobic exercise on WMC, few studies have examined how sitting time (ST) -alone or in combination with habitual physical activity (PA)- influences WMC. **PURPOSE:** To examine combined associations between self-reported context-specific ST and PA with WMC and academic achievement in a sample of Spanish adults. **METHOD:** Undergraduates (n=371; 21 years \pm 3 yrs, 44% female) from University of Vic-Central University of Catalonia completed a 68-item survey that assessed socio-demographic variables (e.g., age, gender, academic year), min/week of light, moderate and vigorous PA (International Physical Activity Questionnaire), min/day of domain-specific ST (Last 7 days sedentary behavior questionnaire), academic performance (grade point average) and perceived stress (Perceived Stress Scale). WMC was assessed through a multiple complex span task that included: Operation Span, Symmetry Span and Rotation Span. These tasks interleave a processing task with a short list of to-be-remembered items. General linear models - adjusted by PA, ST, gender and stress- assessed combined associations between ST and PA with WMC and academic achievement. **RESULTS:** Performing at least 3 hrs/week of moderate-intensity PA was related to increases in WMC ($p<0.001$). However, PA intensity was not associated with academic performance. >3 hrs seated on a weekend day while performing non-screen leisure activities (e.g., listening to music) was related to reduced WMC after adjusting for

PA intensity ($p=0.012$). Similarly, >3 hrs/weekday spent seated in these sedentary activities and in leisure-forms of screen time were inversely associated with academic performance regardless of PA time and intensity ($p=0.033$; $p=0.048$). **CONCLUSION:** Moderate PA may benefit working memory; however, specific domains of leisure-time sedentary behavior may have an unfavorable influence on working memory and academic performance regardless of time spent in PA.

829 Board #8 May 31 2:00 PM - 3:30 PM
Effect of Physical Activity on Cognitive Control in College-Aged Students

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PURPOSE: To determine the effect of Physical Activity (PA) on three differing types of cognitive processes, within an under-researched segment of the population. **METHODS:** 45 College-Aged Students were recruited from a University in the Southwestern United States. These participants completed three computer-driven tests from a battery of measurements that assess various components of cognitive control (CC)- One Card Learning Test (Attention) Two Back Card Test (Working Memory) Revised Groton Learning Maze Test (Inhibition/ Executive Function). Testing took place after a bout of Sedentary Activity, and two weeks later, after a bout of individualized PA (based on VO₂ max). **RESULTS:** Due to the high intellect/ high fit nature of the participants there was no statistical significance with the One Card learning or Two Card Back Tests (i.e. many reached the test 'ceiling' on the initial attempt). After controlling for sex, age, GPA, BMI and aerobic capacity, there was significant differences between sedentary and PA conditions in both moves (mean difference = 0.136, $p < 0.001$, Cohen's $d = 0.85$) and duration (mean difference = 22179, $p < 0.001$, Cohen's $d = 0.74$) within the Revised Groton Maze Learning Test. The differences between conditions represented a medium-to-large effect. There were no moderating influences on the condition differences.

CONCLUSIONS: This study adds to the existent literature that suggests PA may facilitate increases in CC, dependent on the nature of the cognitive task.

830 Board #9 May 31 2:00 PM - 3:30 PM
Correlation Of BDNF And Irisin With Aerobic Fitness And Cognition In Graduate Students

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PURPOSE: A positive relationship between exercise and cognition has been observed in the developing brains of school children and the degenerating brains of elderly adults. However, this relationship remains relatively unstudied in the fully functioning brains of young adults. Brain-derived Neurotrophic Factor (BDNF) is known to promote neurogenesis and long-term potentiation within the hippocampus and is believed to mediate the effect of exercise on brain structure and function. A recently discovered myokine, irisin, may upregulate expression of hippocampal BDNF in response to exercise. This study explored the impact of fitness on cognition in graduate students and considered BDNF and irisin as potential mediators of the relationship. **METHODS:** Forty-four apparently healthy graduate student participants (19 women) completed a comprehensive online cognitive assessment (Lumosity™) and an incremental maximal treadmill exercise test immediately followed by blood collection. Aerobic fitness was measured in terms of maximum oxygen uptake (VO₂max) during the exercise test and expressed relative to body mass (mL/kg/min) for data analysis. Plasma concentrations of BDNF and irisin were determined by enzyme-linked immunosorbent assay (ELISA).

RESULTS: Participants were 26.0 (23.0-28.3) years old, with 19.4 (12.1-24.7) % body fat and a VO₂max of 44.8 (38.3-53.5) mL/kg/min; median (IQR). The median score on the cognitive assessment was 63.5 (55.8-74.0) %. The median plasma BDNF concentration was 1.00 (0.28-2.09) ng/mL and irisin was 19.79 (16.98-24.65) ng/mL. Significant correlations between aerobic fitness and performance on the cognitive assessment were not found. An inverse relationship was observed between aerobic fitness and BDNF ($\rho=-0.32, P=0.03$), as well as irisin ($\rho=-0.27, P=0.11$). Irisin was moderately and positively correlated with cognitive assessment score ($\rho=0.33, P=0.03$).

CONCLUSIONS: Irisin may be a valuable peripherally detectable marker of cognitive ability. An inverse relationship between fitness and irisin is inconsistent with the original understanding of irisin's role. The lack of correlation between aerobic fitness and cognitive performance may suggest the presence of a cognitive ceiling, above which the benefits of exercise on cognition significantly taper off.

831 Board #10 May 31 2:00 PM - 3:30 PM
The Effects of Exercise Intensity on Cognition In Adults Age 18-45
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Purpose: Growing evidence suggests that moderate intensity continuous training (MICE) appears to improve cognition function. Physical activity to improve cognitive function is thus strongly recommended, however evidence regarding the training intensity is still lacking. The purpose of this randomized study was therefore to assess the effects of a high intensity interval training (HIIT) compared to MICE, representing the same total training load, for improving cognitive functions in healthy adults. **Methods:** Twenty-five participants exercised three times a week for 6 weeks after randomization to the HIIT or MICE training group. Target intensity was 60 % of maximal aerobic power (MAP) in the MICE group and 100% MAP in the HIIT group. A maximal graded test, a cognitive battery of paper tasks and a computerized Stroop task, were performed before and after the six weeks training program. **Results:** After training, MAP increased significantly in both the HIIT and MICE groups (9% and 15 %, $p < 0.01$). The cognitive results from this study showed that after 6 weeks of training HIIT was mainly associated to a greater improvement of overall reaction time in the executive components of the computerized Stroop task (980.43 ± 128.97 ms vs 890.89 ± 109.45 ms, $p < 0.01$). Participants in the HIIT training also improved their test time in the executive component of the Trail test after 6 weeks of training (42.35 ± 14.85 s vs 30.35 ± 4.13 s, $p < 0.01$). **Conclusion:** Exercise intensity was clearly an important factor for improving executive functions in young adults. These findings may have important implications in designing effective training programs to help improve cognition in different populations.

832 Board #11 May 31 2:00 PM - 3:30 PM
Time-Dependent Effects of Acute Cycling Exercise On Long-Term Emotional Memory and Salivary Alpha-Amylase
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Psychological research has strongly documented the memory-enhancing effects of emotional arousal. Current opinion implicates the central release of stress hormones, specifically norepinephrine, as the neurobiological basis for this enhancement. Experimental induction of arousal has been shown to enhance long-term memory in a time-dependent manner. While extensive research has provided evidence for the memory benefits of exercise training, the effects of an acute bout of exercise on long-term memory are not as well understood. Furthermore, acute exercise of a sufficient intensity and duration stimulates norepinephrine release. This presents an opportunity to investigate the role of acute exercise-induced arousal in the modulation of long-term memory. **PURPOSE:** The purpose of this study was to determine the time-dependent relationship between acute exercise-induced arousal and long-term emotional memory. **METHODS:** Forty healthy young adults (22±4 yrs) were randomly assigned to an exercise-before, exercise-after, or rest group. Participants in the exercise groups completed a high-intensity session of cycling exercise before or after viewing pleasant, neutral, and unpleasant images. Exercise intensity was prescribed using Borg's Ratings of Perceived Exertion (RPE) scale, and participants were instructed to exercise at an intensity of 15 ('Hard'). Salivary α -amylase (sAA), a noninvasive biomarker of noradrenergic activation, was measured as an indicator of arousal. A recognition memory test was administered after a 48-hour delay. Memory data were submitted to a 3×3×2 (Group × Valence × List) mixed ANOVA. The sAA data ($n = 33$) were submitted to a 3×4 (Group × Time) mixed ANOVA. **RESULTS:** No effect of Group or Valence on recognition memory was revealed, however; high-intensity cycling (159 ± 18 bpm) increased sAA in both exercise groups, indicated by a significant Group × Time interaction, $F(6,90) = 6.995$, $p = .001$, $\eta^2 = 0.318$, and confirmed with paired t -tests ($p < .05$). **CONCLUSION:** We demonstrated that an RPE-prescribed 'hard' bout of cycling exercise resulted in increased sAA. Further investigation is needed to draw conclusions about the memory-enhancing potential of acute aerobic exercise. Supported by the University of Maryland Kinesiology Graduate Research Initiative Fund.

833 Board #12 May 31 2:00 PM - 3:30 PM
Changes In Cortical Neural Arousal As A Result Of Increasing Exercise Intensity
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 (No relationships reported)

Exercise has been shown to affect central nervous system arousal, which in turn may impact cognitive performance during certain tasks. What is not known is if there is an intensity threshold for these effects to occur. **PURPOSE:** To investigate changes in cortical neural arousal as a result of increasing exercise intensity. **METHODS:** This study included 22 recreational runners (12 women, 10 men) with a mean (SD) age of 25.1 (6.2) years. Subjects were asked to complete three 30 minute runs on a motorized treadmill at prescribed rating of perceived exertion (RPE) levels of 13, 15 and 17. These correspond to the verbal descriptors of "somewhat hard," "hard," and "very hard," respectively. Individuals were blind to the treadmill control panel but allowed to adjust their speed throughout the trials in order to maintain the prescribed RPE. Prior to and immediately after each exercise session, subjects were asked to complete a critical flicker fusion threshold test (CFFT). This test is designed to assess cortical neural arousal via visual stimuli and requires individuals to determine the precise moment in which a low frequency flashing light fuses into a solid light (ascending) and vice versa (descending). Subjects identified the change by pressing a handheld button on a wired remote. The final value was an average of three ascending and descending values. **RESULTS:** No changes occurred from pre (37.5 ± 3.8 Hz) to post (37.4 ± 4.2 Hz) exercise at RPE13 ($p = 0.729$). Similarly, pre (37.1 ± 4.2 Hz) and post (37.7 ± 4.4 Hz) values did not differ at RPE15 ($p = 0.082$). However, there was a significant increase from pre (36.7 ± 3.6 Hz) to post (37.8 ± 4.8 Hz) values after exercise at RPE17 ($p = 0.019$). **CONCLUSIONS:** These results confirm that a specific threshold exists where cortical sensitivity is determined by the intensity level of exercise. These findings may be useful when considering ways in which to enhance cognitive performance during certain tasks that require substantial focus and attention. Increases in cortical arousal as the result of exercise could positively affect cognitive functioning, and could be advantageous for athletic, professional, and military populations.

834 Board #13 May 31 2:00 PM - 3:30 PM
Habitual Physical Activity Moderates the Negative Influence of Adiposity on Cognitive Control
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PURPOSE: To assess the moderating influence of time spent engaging in moderate to vigorous physical activity (MVPA) on the known inverse relationship between adiposity and cognitive control. **METHODS:** Bivariate correlations and hierarchical linear regression analyses were conducted among a sample of adults between 25-45 years ($N = 65$, 39 females). Subjects completed a modified version of the Eriksen Flanker task to assess cognitive control, specifically attentional inhibition. Whole body adiposity (%Fat) was assessed using Dual Energy X-ray Absorptiometry (DXA). Daily percent time spent engaging in MVPA (> 1951 counts per minute) was monitored using an accelerometer (Actigraph GT3X+) worn for at least 4 days (minimum 8 hours/day). **RESULTS:** After adjusting for significant demographic variables (age and IQ), %Fat was a negative predictor of attentional inhibition ($\beta = -0.32$, $P = 0.02$) such that those with higher %Fat exhibited lower inhibitory control, as measured by incongruent Flanker task accuracy. Interestingly, the negative effect of %Fat ($\beta = -0.21$, $P = 0.13$) was mediated after controlling for the influence of %MVPA. Furthermore, hierarchical linear regression analyses revealed an added positive effect of %MVPA on incongruent Flanker task accuracy ($\beta = 0.30$, $P = 0.03$), with those spending a higher percentage of time engaged in MVPA demonstrating higher attentional inhibition. **CONCLUSIONS:** Although previous research has examined the relationship between excess fat mass and cognitive function, the influence of habitual physical activity in moderating this relationship has received comparatively less attention. These results replicate previous work linking excess fat mass to lower cognitive control while extending the body of literature by demonstrating that habitual moderate to vigorous activity mediates this influence while independently and positively predicting cognitive control. These findings have implications for public health policy advocating for greater daily MVPA for cognitive health among adult populations. Funded by the Department of Kinesiology and Community Health at the University of Illinois and the Hass Avocado Board.

835 Board #14 May 31 2:00 PM - 3:30 PM
Training-Induced Modulation of Cerebral Blood Flow and Cognition
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Exercise may be a means to ameliorate the progression of cognitive decline in older adults, although the mechanisms underlying exercise-induced neuroprotection are not well understood.

Purpose: (i) To assess cerebral hemodynamics under exercise-induced stress on cognitive function; (ii) To determine the cerebral changes occurring during cognitive tasks; We hypothesized that these effects will be different with training.

Methods: Right-handed college-aged adults (28 sedentary and 24 athletic) performed 10 minutes of light and moderate (20% and 65% max power) constant-load cycling. Right middle cerebral artery (rMCA) blood flow velocity (CBFv) was continuously monitored during exercise and cognitive test using Transcranial Doppler ultrasonography (TCD). Cognition was assessed using the Cogstate brief battery test: Detection (psychomotor function/ processing speed), Identification task (visual attention), One-card learning (Visual learning & memory), One-back task (working memory) and Groton maze (for visuospatial memory) before and immediately after exercise.

Results: Exercise increased CBF during 20% but this was not significant for either group. Exercise at 65% decreased CBF with a significant decrease of -9.6% ($p < .05$) for athletes. It also decreased for sedentary individuals but it was not significant. Cognitive performance improved significantly during the ONB with a significant increase in reaction time (RT). At 20 and 65% for sedentary and only at 65% for athletes. Speed on the Groton Maze test increased following exercise at 65% however this increase was associated with a significant increase in number of errors in the sedentary participants. Athletes demonstrated increased Groton maze speed however no significant change in errors (1.3%). Athletes also demonstrated an increase in RT for the ONB only following exercise at 65%.

Conclusion: Training status may demonstrate adaptations to cerebral blood flow and cognition.

836 Board #15 May 31 2:00 PM - 3:30 PM
Differences In Brain Structure And Function Among Yoga Experts And Controls
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Yoga is a mind body based physical activity that has demonstrated a variety of physiological and psychosocial benefits. Recent studies have also examined the benefits of this practice on behavioral measures of cognitive function. **PURPOSE:** To determine the effect of yoga practice on brain function and structure by examining: i) differences in brain activation, and ii) differences in grey matter volume of subcortical structures among yoga-experts and controls. **METHODS:** Participants included 13 yoga experts, defined as having more than 3 years of regular yoga practice, and age-sex-matched controls. All participants completed a 6-minute walk test to assess fitness, psychosocial and demographic questionnaires. They were scheduled to complete a 3T MRI scan lasting one hour, during which the Sternberg working memory task was administered. **RESULTS:** The mean age of the participants was 35.8 and 35.7 respectively and the experts on average had 9.3 years of yoga experience. There were no groups differences on demographic measures of income, education, personality, and on estimated VO₂max (6-minute walk) or physical activity assessed using the Godin leisure time exercise questionnaire. Experts showed less activation in the frontal pole area of the prefrontal cortex compared to controls during the encoding phase of the Sternberg task. Reaction time and accuracy on the task did not differ between the two groups. We investigated grey matter volume differences in the hippocampus, thalamus, and caudate nucleus and the left hippocampal volume was found to be greater in yoga experts compared to controls. **CONCLUSION:** Our preliminary results suggest that regular long-term yoga practice affects selective structures and neural networks in the brain. The literature on behavioral studies of yoga appears to corroborate these findings as the frontal pole and hippocampal areas have been implicated in performance on executive function measures. Future studies need to examine intervention effects of yoga and explore the potential of this practice to maintain and improve cognitive health across the lifespan.

837 Board #16 May 31 2:00 PM - 3:30 PM
Effects of a Combined Aerobic and Cognitive Training Intervention on Cognitive Function in Cancer Survivors
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INTRODUCTION: Cancer-related cognitive impairment (CRCI) has been reported to negatively affect upwards of 75% of cancer patients undergoing treatment. Treatment and management of CRCI has proven to be a difficult task due to the fact that it has yet to be fully characterized. Some studies have shown that cognitive training or aerobic exercise may mitigate aspects of CRCI. Yet, it is unclear whether simultaneously combining these two interventions could provide additive or synergistic benefits on cognitive function in cancer survivors. **PURPOSE:** To determine the effects of a quasi-randomized, controlled aerobic and cognitive training intervention on cognitive function in cancer survivors ($N = 28$). **METHODS:** Pre and post physical and cognitive assessments were administered. A 36-session computer-based cognitive, aerobic, and flexibility training intervention was completed. Participants were assigned to one of the following groups: aerobic exercise only (AER), cognitive training only (COG), simultaneous aerobic exercise plus cognitive training (AER+COG), or a control flexibility only group (CON). **RESULTS:** No significant ($p > 0.05$) main effects between groups and variables were observed. Within groups measures revealed that the AER logical memory scaled scores (+33%), delayed recall scaled scores (+27%), block design scaled scores (+19%), and letter-number sequencing scaled scores (+12%) significantly increased ($p < 0.05$, respectively) pre-to-post. The CON group significantly ($p < 0.05$) increased from pre-to-post in controlled oral word association gender, age, and education verbal fluidity subtests (Z-scores). All cognitive scores (AER+COG and COG groups) failed to significantly ($p > 0.05$) increase pre-to-post. **CONCLUSIONS:** Aerobic training alone had the greatest impact on cognitive function. Individually, these methods may be appropriate for addressing CRCI in this population, but combined training of this nature may be too demanding for cancer survivors suffering from CRCI.

838 Board #17 May 31 2:00 PM - 3:30 PM
Golf Intervention For Veterans Exercise: Can Golf Influence Gait Speed And Cognition In Older Veterans?
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 (No relationships reported)

Gait speed is an important predictor of successful aging. For example, slow gait speeds are associated with poor health outcomes and decreased dual-task (DT) walking performance is associated with increased fall risk. We hypothesize that golf may improve gait speed, DT gait speed, and cognitive function in older military veterans. **PURPOSE:** The objective of the present study was to examine the influence of a 12-week golf intervention on walking performance and cognitive function in older military veterans. **METHODS:** Gait speed and cognition were measured before and after a 12-week golf intervention (2 x weekly; 90 min per session). Two male participants (74 and 67 years old) completed 5 gait trials walking as fast as possible, 5 dual-task gait trials walking as fast as possible while performing a backwards counting task, and the Dimensional Change Card Sort Test, Flanker Inhibitory Control and Attention Test, List Sorting Working Memory Test, Picture Sequence Memory Test, and Pattern Comparison Processing Speed Test, which make up the Fluid Cognition composite score of the NIH Cognition Toolbox. **RESULTS:** Participants improved gait speed by 5.3% and 15.8% and fast DT gait speed by 29.2% and 26.1%. Fluid Cognition composite scores improved by 11% and 1% and the percent change in DT accuracy were -2.9% and 0%. **CONCLUSION:** Following the 12-week golf intervention, both participants improved their fast gait speed, fast DT gait speed, and fluid cognition function. There was little to no decrease in counting accuracy during the fast DT gait speed. These results demonstrate that the participant's improved gait speeds were not at the expense of maintaining cognitive performance. These preliminary findings suggest that the physical and cognitive demands of golf (navigating the course, walking hilly terrain, bending over, swinging, shifting the center-of-pressure, planning and strategizing) may improve physical and cognitive function in older military veterans. Future expansion of this study will inform the development of golf programs to improve everyday function and quality of life in older adults.

839 Board #18 May 31 2:00 PM - 3:30 PM

Changes in Cognition and Power Output in Adults Following High-Velocity Circuit Resistance and Treadmill Training

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Previous studies report that increases in aerobic capacity produce improvements in cognition. However, the effects of power training on cognitive domains are not well understood. **PURPOSE:** To compare the effects of high-velocity circuit resistance (CRT), treadmill (TM) training and no exercise (CONT) on cognitive domains and power output in older adults. **METHODS:** Fifteen subjects (2M, 13F; 71.3 ± 2.5 yr) participated in 12-wks of CRT, TM or CONT. Executive function (EF)/attention, EF, episodic memory, working memory, processing speed and overall cognition were measured by the flanker (FL), dimensional card sort (DCS), picture sequence (PS), list sorting (LS), pattern comparison (PC), and composite score (CS), respectively, using the NIH Cognition Battery. The walking response and inhibition test (WRIT) also assessed EF. A global score (GS) was determined by the WRIT. Aerobic power (AP) was determined from a peak oxygen consumption test, and lower body power (MP) by a chair stand. **RESULTS:** A between-groups analysis revealed significant decreases in MP (MD= -269.3, SE= 91.6, p=.04) for TM compared to CONT and a decrease approaching significance compared to CRT (MD= -213.7, SE= 81.9, p=.07). There was a significant main effect for AP (p=.05, n_{2p}=.448) with a trend towards an increase for TM compared to CONT (MD=2.4, SE=1.0, p=.09) and CRT compared to CONT (MD=2.5, SE=1.0, p=.07). No significant interactions were present for cognitive measures. Within-group analyses revealed a significant increase in PC (MD=12.6, SE=4.9, p=.04), a decrease in MP (MD=-205.3, SE=56.9, p=.01), and a trend towards an increase in LS (MD=9.8, SE=4.7, p=.08) and GS (MD=33.1, SE=16.2, p=.07) for TM. For CONT, there was a significant decrease in PC (MD=-12.8, SE=4.9, p=.04) and AP (MD=-2.4, SE=.8, p=.02). Correlation analyses revealed a strong positive association between AP and FL (r=.99, p=.008), MP and GS (r=.97, p=.03), and an inverse correlation between MP and AP (r=-.97, p=.03) and MP and FL (r=-.93, p=.02) for CRT. A strong positive correlation was observed for AP and FL (r=.96, p=.03) for TM, and an inverse correlation between MP and FL (r=-.99, p=.04) for CONT. **CONCLUSION:** TM and CRT resulted in an increase in AP compared to CONT that corresponded to improvements in EF and WRIT performance, however, only TM exhibited significant decreases in MP.

840 Board #19 May 31 2:00 PM - 3:30 PM

Differences Between Functional Fitness and Cognitive Impairment in Independent Older Adults in the Community

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PURPOSE: The purpose of this study is to examine the performance of functional fitness in a community-dwelling elderly population with different levels of cognitive impairment. **METHODS:** 316 community-dwelling older adults aged 60 to 91 years were divided into normal cognitive group (NOR, N=84, 68.5±0.76 yrs), mild cognitive impairment group (MCI, N=124, 71.8±0.62 yrs) and serious cognitive impairment (SCI, N=108, 75.8±0.67 yrs) group using the Saint Louis University Mental Status (SLUMS) examination. The Senior Functional Fitness Test (SFFT) was used to measure upper muscle strength (30-second arm curl), lower muscle strength (30-second chair-to-stand), aerobic endurance (two-minute step), upper (back scratch) and lower flexibility (chair sit-and-reach), agility and dynamic balance (eight-foot up-and-go). **RESULTS:** There was a significant relationship between the SLUMS score and SFFT (p<.05). The NOR subjects scored significantly higher than the SCI subjects in BMI(5%), lower- and upper-body strength (33.1%; 17.4%), max strength (22.5%), upper- and lower-body flexibility (102.1%; 83.1%), cardiovascular endurance (16.2%) and dynamic balance (29.5%) (p<.05). The MCI subjects also had better performance than the SCI group with regard to lower- and upper-body strength (23.9%; 13.7%), cardiovascular endurance (13.8%), upper- and lower-body flexibility (71.3%;34.0%), and dynamic balance (20.5%) (p<.05). Furthermore, there were no significant differences between MCI and NOR group in cardiovascular endurance and muscle strength. **CONCLUSIONS:** The level of cognitive impairment was correlated to the degree of body composition and functional fitness in the group of community-dwelling elderly adults examined in this work, influencing muscle strength, flexibility, cardiovascular endurance and dynamic balance. The MCI period is perhaps the key phase during

which it is still possible for most elderly people to return the normal condition of functional fitness in cardiovascular endurance and muscle strength. Therefore, the any director or interventions aimed at achieving this should be properly developed modified to reflect the elderly subject adult's level of cognitive abilities.

841 Board #20 May 31 2:00 PM - 3:30 PM

Peak Heart Rate during the 6-Minute Walk Test Predicts Cognitive Performance of Healthy Older Adults

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Purpose: Cardiorespiratory fitness positively correlates with cognitive function in healthy older adults (Barnes et al., 2003) and quality of life depends on maintaining cognitive and physical health (Ortman et al., 2014). The submaximal 6-minute walk test (6MWT) is a commonly used clinical assessment of cardiorespiratory fitness in older adults, but the relationship between 6MWT and cognitive performance remains undefined. Here, we tested the relationship between 6MWT and cognitive performance in healthy, ethnically diverse older adults. **Methods:** In this cross-sectional study, 90 participants (69 female, 21 male), ages 60-95 years (75 + 9.5 yrs.; mean + SD), were recruited from the local area. Cognitive performance was measured in the Modified Mini-Mental State Test (3MS), Trailmaking tests A and B, and Animal Naming test. Physical measures included 6MWT active and recovery heart rates, distance walked, anthropometric data, peak hand-grip strength, and surveys including Physical Activity Scale for Elderly (PASE) and Perceived Stress Scale (PSS). Stepwise multiple regression analyses were used to evaluate the contributions of 6MWT performance and physical measures to cognitive performance. **Results:** Mean 3MS scores (92.5 + 7.7) revealed that our population was cognitively healthy. Controlling for demographic covariates, peak heart rate recorded during the 6MWT (6MWT HR_{PEAK}) significantly predicted performance on 3MS (R²=0.462, p<0.001), and Trailmaking A (R²=0.328, p<0.001) and B tests (R²=0.379, p<0.001). Controlling for age and education level, PASE was found to significantly predict Animal Naming test performance (R²=0.309, p<0.001). **Conclusion:** Results suggest that peak exercise intensity, as determined by 6MWT HR_{PEAK}, significantly contributes to executive function and self-reported physical activity levels with verbal fluency.

842 Board #21 May 31 2:00 PM - 3:30 PM

Physical Activity, Fitness And Cognitive Function Among Community-dwelling Elderly -baseline Data Of Fujisawa Plusten Project.

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PURPOSE: Physical activity (PA) are important for maintenance and improvement of cognitive health as well as prevention of non-communicable diseases. We are conducting a 2-year (2015-2017) community-wide campaign to promote PA in Fujisawa city, Kanagawa, Japan. The campaign contains multilevel interventions. As a part of these interventions, community-dwelling elderly groups who commit doing exercise together at least once a week were registered. We analyzed the baseline data and examined the relationship between PA, fitness levels and cognitive function. **METHODS:** Participants were 157 elderly group. Physical activity levels were assessed using a triaxial accelerometer for 1 week. We used steps and duration of moderate-to-vigorous PA as indicators of PA level. In terms of fitness level, one foot standing, grip power, chair stand test and sit & reach test were examined. Cognitive function were assessed by Cognitive Assessment for Dementia iPad version 2 (CADi2) which consists of 10 simple questions and is self-administered. We dichotomized CADi2 score as less than 9 (low) and 9 or 10 (high) and compared physical activity level, physical fitness level between the two groups using unpaired t-test. **RESULTS:** The sample consisted of 104 women (age: 76.0±6.9 yrs, mean±SD) and 53 men (74.4±5.1 yrs). CADi2 score (median (25-75%tile)) was 9 (8-10) in women and 9 (9-10) in men, respectively. Other results were shown in the table. **CONCLUSION:** Fitness level of low-score elderly of cognitive function is tend to lower compared to high-score elderly. Longitudinal observation with intervention is necessary to know further relationships. Supported by Comprehensive Research on Aging and Health Science Research Grants for Dementia R&D from the Japan Agency for Medical Research and Development (AMED).

	Women			Men		
	CADIZ Score		p-value	CADIZ Score		p-value
	high	low		high	low	
Steps (/day)	5264±2506	4206±2548	0.057	6225±2936	4632±3282	0.12
MVPA (min/day)	73.9±34.8	60.8±38.2	0.098	69.1±29.4	58.2±35.8	0.29
One foot standing (seconds)	33.6±23.2	16.3±17.9	<0.001	28.2±24.0	25.0±23.9	0.7
Grip power (kg)	21.0±4.7	17.4±5.1	<0.001	33.7±5.6	28.4±4.3	0.005
Chair-stand test (/30 seconds)	22.5±7.7	20.3±5.8	0.18	24.7±6.2	19.9±5.2	0.029
Sit & reach test (cm)	38.4±9.0	33.0±8.7	0.005	29.5±11.7	32.3±5.4	0.45

843 Board #22 May 31 2:00 PM - 3:30 PM
Exercise And Cognition Among Individuals At Risk For Or Diagnosed With Alzheimer'S Disease: A Meta-analysis

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Exercise training is gaining attention regarding its role in the prevention and treatment of Alzheimer's disease (AD). **PURPOSE:** The purpose of our meta-analysis was to evaluate: the effect of exercise on cognitive function in individuals at risk for or diagnosed with AD; potential moderators of the cognitive effects of exercise; and whether the cognitive effects of exercise are dependent upon *Frequency, Intensity, Time, and Type (FITT)* of the exercise. **METHODS:** Databases were searched for trials that measured pre- and post-exercise cognitive function in adults at risk for or diagnosed with AD. Analyses followed random-effects assumptions. **RESULTS:** 19 studies with 23 interventions qualified with 1,256 subjects (71.1% women; 28.3% men) that were 77.0±7.5yr and who completed 9.2±4.3yr of school. A majority of the sample was at risk for AD due to mild cognitive impairment (64%), another 1% was at risk due to a parent diagnosed with AD, and 35% had AD. Exercise interventions were performed at vigorous intensity for older adults (3.7±0.6 metabolic equivalents) for 3.4±1.4 d·wk⁻¹, 45.2±17.0 min-session for 18.6±10.0 wk. A majority were aerobic exercise training (AET) interventions (65%) and 35% other types (i.e., concurrent [31%] or resistance exercise training [4%]). Only questionnaires were used to assess cognitive function with the Mini-Mental State Examination most commonly used (61%). Overall, there was a positive, moderate effect of exercise on cognitive function versus control (standardized mean difference [SMD]=0.47, 95% confidence interval [CI]=0.26, 0.72; P=59.6%). The within group analysis revealed exercise improved cognitive function (SMD=0.20, 95% CI=0.11, 0.28; P=0%), whereas cognitive function declined in the control group (SMD=0.18, 95% CI=0.36, 0.00; P=65.1%). Furthermore, AET had a strong, positive effect on cognitive function (SMD=0.66, 95% CI=0.30, 1.02), whereas the other exercise types did not (SMD=0.19, 95% CI=-0.12, 0.49). **CONCLUSIONS:** Our findings suggest that exercise may reverse the decline in cognitive function that occurs among older adults who are at risk for or have AD, with favorable exercise effects that are largely mediated by AET. Future randomized clinical trials that include objective measurements of cognitive function are needed to confirm our novel findings.

844 Board #23 May 31 2:00 PM - 3:30 PM
Feasibility Of Square-stepping Exercise To Improve Mobility And Cognition In Long-term Care And Retirement Living.

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Square-stepping exercise (SSE) is a visuospatial working memory task with a cued stepping response; it has demonstrated mobility and cognitive benefits in older adults. **PURPOSE:** To explore whether a SSE program is feasible in long-term care (LTC) and retirement living (RL) facilities in populations with diverse mobility and cognitive abilities. **METHODS:** A cluster-randomized trial was conducted; 4 sites (2 LTC and 2 RL) were randomized to SSE [2x/wk for 12-wks by trained kinesiologists (kings)] or control (CON). Recruitment, attendance, program fidelity, and feedback were monitored throughout the program. **RESULTS:** All residents were invited to participate; in the intervention sites, there were 192 and 144 beds for the LTC and

RL, respectively. Recruitment was via information sessions. Intervention participants (n=30) were 80.5 ± 13.2 yrs old, 77% female, and had 12.2 ± 3.2 years of education. In LTC (n=15) there was an average of 5.5 residents in attendance at each session ranging from 3-9 over 19 sessions. LTC residents attended an average of 45.6% sessions (range: 10.5-79.0%); 6 attended >50% of sessions. In RL (n=15) there was an average of 7.8 residents in attendance at each session ranging from 3-12 over 24 sessions. RL residents attended an average of 21% of sessions (range: 8.3-75%); 8 attended >50% of sessions. To maintain a pragmatic approach, SSE was modified following feedback: sessions were reduced from 60 to 45 min; residents who used gait aids were assisted by kins; and in LTC program, progression was limited. Residents in RL became peer-coaches to assist kins and act as moderators. Anecdotal feedback from kins and residents was positive, with comments about SSE being fun but also a 'good' challenge; both sites have continued the program. **CONCLUSIONS:** Recruitment for this study was considered a success from the perspective of the LTC and RL facilities. Attendance was variable; it is understandable with a variety of mobility and cognitive abilities that achieving perfect attendance is unlikely. It is reasonable, with program modifications and flexibility in program progression, for this to be a feasible program for adults living in LTC and RL facilities to engage physically, cognitively and socially. **FUNDING:** Western Centre for Studies in Family Medicine, Schlegel Villages and Ontario Graduate Scholarship.

B-60 Basic Science World Congress/Poster -
Sports, Performance, and Injury

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

845 Board #24 May 31 2:00 PM - 3:30 PM
Factors Influencing Visual Cognitive Performance Training

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It is recognized that visual cognitive abilities is an important characteristic of athletic performance, however, testing, training and determination of factors that influence this ability has been elusive. **PURPOSE:** The purpose of the Nutrition, Vision and Cognition in Sport Study (IONsport) is to determine the factors that explain the large difference in visual cognitive performance and training responses between elite and non-elite athletes. **METHODS:** College age men and women performed 15 visual cognitive training sessions in 10 visits to the laboratory (all 10 visits within 15 days). On the days of training, all food intake was documented along with measures of body composition, sleep patterns, fluid intake and recent exercise. Longer term assessments of these and other factors were measured prior to initiating training. Mean nutritional intakes were calculated for the 10 days of food records. **RESULTS:** Excluding results from the initial training session in which variability was high, participants increased visual cognitive performance by 27.5% (P<0.001) which was not significantly different (P>0.05) between men (32.1%) and women (24.1%). Linear regression was performed using select nutritional candidates (based on literature evidence and using mean 10 day intake) and non-nutritional factors to predict trained visual cognitive performance. Nutritional copper (r²=0.237, p=0.01) and percent body fat (r²=0.11, P=0.027) entered the significant model (P=0.001). Mean visual cognitive performance improvement for copper intakes that were 16-47%, 50-109% and 132-346% of the Dietary Reference Intake (Recommended Dietary Allowances, RDA) were 10.1%, 22.6% and 43.1%, respectively. **CONCLUSION:** These results suggest that dietary copper intake at or below the RDA may impair visual cognitive training performance and more broadly suggest that visual cognitive performance is more than an innate ability.

846 Board #25 May 31 2:00 PM - 3:30 PM
Different Influences Of Aerobic Exercise Types On Cognitive Control Of Athletes

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Acute exercise has been shown to improve executive function, and in particular performance on tasks that measure inhibitory control. However, few studies have compared laboratory-based exercise sessions to more complex modes of exercise, such

as soccer, that involve attention to multiple aspects of the environment and for which performance success depends on the active engagement of executive control processes. **PURPOSE:** To compare the effects of acute treadmill exercise versus futsal (indoor soccer) on performance and electroencephalographic event-related potentials measured during an inhibitory control task. **METHODS:** Twelve experienced soccer players (24.8±2 years) completed three counterbalanced 20-minute sessions of: 1) seated rest; 2) moderate intensity treadmill exercise; and 3) a game of futsal. Once heart rate (HR) returned to within 10% of pre-activity levels, participants completed the Stroop Color Word Conflict Task while reaction time (RT) and P300 event-related potentials were measured. **RESULTS:** HR did not significantly differ during treadmill exercise (122.4±5.4 bpm) compared to futsal (126.7±6.7 bpm). Reaction time during Stroop performance was significantly faster following the futsal game (765±29 ms) compared to seated rest (835±28 ms), but was not significantly different than treadmill exercise (784±22 ms). However, the P300 amplitude at three midline recording sites was significantly greater following futsal ($F_z=5.77±2.87$; $C_z=4.84±1.66$; $P_z=4.25±1.43$ μV) compared to both the treadmill exercise ($F_z=4.96±2.66$; $C_z=4.02±2.58$; $P_z=3.7±1.02$ μV) and seated-rest conditions ($F_z=4.19±1.58$; $C_z=3.12±1.69$; $P_z=3.09±1.42$ μV). **CONCLUSIONS:** These findings suggest that single bouts of indoor soccer among college-aged soccer players, compared to treadmill and seated-rest conditions, may engender the greatest effect on brain networks controlling attention allocation and classification speed during the performance of an inhibitory control task. Future research is needed to determine if cognitively engaging forms of sport-related aerobic exercise may differentially impact executive control processes in less experienced and older adult participants.

847 Board #26 May 31 2:00 PM - 3:30 PM
The Effects of Repeated, Consecutive High-Intensity Exercise on Cognitive Performance in Well-Trained Team Sports Players

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Improvements in cognitive performance and mood are generally accepted following moderate intensity exercise; however, the impact of high-intensity exercise is less clear. Given that professional team sports are performed at high or maximal intensity, which can be further compounded during periods of intensified periods of competition, investigations into the effect of such exercise on cognition are needed. **PURPOSE:** To determine the effect of repeated high-intensity exercise on cognitive function, mood and perceptions of both physical and mental energy, and fatigue. **METHODS:** In a counterbalanced crossover design, twenty-four well-trained, sub-elite rugby players (mean ± SD age, height, mass were 20.7 ± 1.9 yrs, 181.7 ± 5.5 cm, 88.2 ± 9.0 kg, respectively) completed a series of repeated sprints (20 x 20 m, three times per day for two consecutive days) or a seated control. Prior to and following each set of sprints or equivalent control duration, a selection of cognitive tests including simple reaction time, four-choice reaction time (FCRT), Corsi blocks and Stroop task (ST) were completed in addition to visual analogue scales assessing mood, energy and fatigue. Repeated-measures ANOVAs were conducted with pairwise comparisons where necessary ($\alpha = 0.05$). **RESULTS:** No changes were observed in any cognitive, mood, energy or fatigue measures after one single high-intensity session. However, compared to the control, ST accuracy was lower in the exercise condition (-0.6%, $P < 0.05$) which was largely due to a sharp decline at bout 3 on day 1 that continued throughout day 2. Additionally, FCRT was slower on day 2 (+2.2%) whilst feelings of alertness (-12%), contentedness (-5%), and physical (-22%) and mental (-24%) energy were reduced and ratings of physical (+22%) and mental (+40%) fatigue increased (all day 2 vs. day 1, $P < 0.05$). No changes were observed in the control condition. **CONCLUSION:** Intensified periods of exercise have detrimental effects on cognitive performance, mood and perceptions of physical and mental energy, and fatigue. The deleterious effects on these parameters could be contributing to increased injury rates during fixture congestion alongside decrements in performance. Player rotation may help alleviate these effects whilst also prompting further research into cognitive recovery strategies.

848 Board #27 May 31 2:00 PM - 3:30 PM
Injury-Related Reductions in Skilled Visuomotor Learning Revealed by Single Trial Analysis and Response Time Variability

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 (No relationships reported)

Classical psychometric tests emphasize measures of central tendency as it relates to response times, contact times, and errors. More sophisticated techniques, however, may complement neurophysiological measures of neuroplasticity in response to behavioral interventions or changes in intrinsic state. **PURPOSE:** To determine whether learning on a skilled lower extremity visuomotor task was affected by prior ACL injury. **METHODS:** Eighteen healthy women between 18 and 32 yr participated. Nine women served as controls; nine others had unilateral ACL reconstruction between 6 months and 5 years from the start of the investigation. All participants completed 120 trials of a choice reaction test with a Stroop-like effect and randomly-ordered stimulus presentation order (3 sets of 40 repetitions with 30 sec rest between sets and 1 sec intertrial interval) (The Quick Board, LLC Memphis TN). Response time, contact time, and error count was recorded for each leg during each trial. **RESULTS:** In total, controls performed 525 trials with the dominant leg and 555 trials with the non-dominant leg. ACLs performed 550 trials with the injured leg and 530 trials with the uninjured leg. Average time to set completion, response time, contact time, and error count did not differ by group or leg or measurement (mean or median). ACLs displayed better initial response times but failed to improve to the same extent as controls (6.1% improvement, $y = -1.51x + 1110.2$, $R^2=0.74$ for non-injured; 2.7% improvement, $y = -0.97x + 1004.8$, $R^2=0.62$ for ACL). Greater improvements in response time were generally observed in the (initially worse performing) non-dominant leg. In the less frequently injured (3/9) dominant leg, virtually no improvement (1.4%) in response time was observed in ACLs overall, resulting in a 341.5% relative improvement in controls. The variability of single trial response time increased from the dominant to the non-dominant leg and from the healthy to injured leg. **CONCLUSIONS:** Single trial analysis revealed injury-related deficits in skilled visuomotor learning years after ACL rupture and rehabilitation despite the apparent recovery of the musculoskeletal system. This suggests a central neurological association with musculoskeletal injury that may affect neuroplasticity in the affected and unaffected extremity.

849 Board #28 May 31 2:00 PM - 3:30 PM
Unique Leg-specific Executive And Motor BOLD Activity With Visually-guided Imagery Following ACL Injury

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 (No relationships reported)

Given the change in sensorimotor system activation during limited movements of the injured leg after unilateral ACL rehabilitation, we asked whether the frontostriatal network might be involved during visually-guided action-imagery. **PURPOSE:** To determine whether injured individuals displayed different activity during a proprietary cognitive motor-oriented imagery test. **METHODS:** Healthy women (18-32 yr, n=19) provided written informed consent. Ten served as controls; nine others experienced unilateral ACL rupture, repair, and rehabilitation between 6 months and 5 years from the start of the study. All participants completed a proprietary attention-switching task for 4 trials of 10 repetitions. The test required subjects to react to congruent and incongruent signals prompting them to jump and land with the right or left leg. Subjects wore a camera to record first person perspectives of test performance. Brain images were acquired with a three tesla Siemens Trio MRI with TIM system. Subjects watched the cues and their first person performance while imagining themselves physically reacting/jumping in response to the cues. A three-dimensional magnetization-prepared rapid gradient-echo (MP-RAGE) sequence acquired whole-brain structure. Voxel size was set at 1.0mm³ for structural scans and 3.0mm³ for functional scans. Significant clusters were included if meeting a six-voxel cluster threshold. A false discovery rate (FDR) threshold was set at $q=0.05$. Map clusters were then converted to voxels of interest, and small cluster suppression highlighted the most affected brain regions. **RESULTS:** Occipital activity increased in response to visual cues. BOLD signal increased in the prefrontal cortex, primary somatosensory cortex, and the primary, pre, and supplementary motor areas ($p < 0.01$). Activity was lower in ACLs than controls, particularly when using the injured leg. However,

activity was increased in the right dorsolateral prefrontal cortex in both groups, with more pronounced increases in the injured group; the highest dIPFC activity was observed when participants imagined jumping and landing with their injured leg.
CONCLUSIONS: Prefrontal regions of the brain display heightened activity after ACL individuals, whereas motor regions tend to display decreased activity compared to controls.

850 Board #29 May 31 2:00 PM - 3:30 PM
Cardiovascular Dynamics During The Cold Pressor Test In Recently Concussed College Athletes

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Concussion patients who are experiencing symptoms appear to have impaired cardiovascular responses during sympathoexcitatory tests such as handgrip exercise and head-up tilting. However, it is not known if impaired cardiovascular responses are present during a cold pressor test (CPT).

PURPOSE: We tested the hypothesis that recently concussed college athletes would have a blunted cardiovascular response during a CPT.

METHODS: Four college athletes (age: 19 ± 1 years, 2 women) who were within 7 days of concussion diagnosis and still reporting symptoms and four healthy controls (age: 27 ± 4 years, all men) underwent a CPT. During the CPT, the participant's right hand was submerged in an ice slurry mixture for 120 seconds. Heart rate (ECG) and blood pressure (photoplethysmography) were continuously measured and averaged at baseline and every 30 seconds during the CPT.

RESULTS: Heart rate was increased at 30 seconds (20 ± 5 bpm, $P = 0.001$) and 60 seconds (26 ± 13 bpm, $P < 0.001$) in the healthy controls but remained unchanged throughout the CPT in the concussed athletes (peak increase at 120 seconds: 10 ± 5 bpm, $P = 0.257$). Mean arterial pressure was elevated throughout the CPT in the healthy controls with a peak increase of 27 ± 6 mmHg at 120 seconds ($P < 0.001$). The peak increase in mean arterial pressure of 9 ± 6 mmHg in the concussed athletes was observed at 120 seconds, but did not reach statistical significance ($P = 0.079$). Systolic blood pressure was elevated at 60 seconds and throughout the remainder of the CPT in healthy controls reaching a peak increase of 28 ± 6 mmHg at 120 seconds ($P < 0.001$). Systolic blood pressure in concussed athletes did not increase at any point of the CPT ($P > 0.196$ for all time points). Diastolic blood pressure in healthy controls was elevated throughout the CPT and reached a peak increase at 120 seconds (21 ± 4 mmHg, $P < 0.001$). In concussed athletes, diastolic blood pressure was elevated only at 120 seconds (7 ± 5 mmHg, $P = 0.014$) of the CPT.

CONCLUSIONS: These preliminary data show that recently concussed athletes have a blunted cardiovascular response to the CPT. These data support evidence indicating that concussed patients who are experiencing symptoms have impaired cardiovascular responses to sympathoexcitatory stimuli.

851 Board #30 May 31 2:00 PM - 3:30 PM
Effects of Multiple Sports Related Concussions On Neurocognition and Cerebral Vascular Function

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PURPOSE: To determine the differences in neurocognition (NC) and cerebral vascular reactivity (CVR) between athletes with multiple sports related concussions (mTBI) and matched controls (C).

METHODS: Twelve athletes (22 ± 0.5 y SEM) who reported multiple sports related concussions (≥ 3) and 12 matched [age, sex, body mass index (BMI), and athletic status] healthy concussion free controls (23 ± 0.5 y) were recruited. **Neurocognitive methods** Each participant completed neurocognitive testing (NC) including WASI II, HVLIT R, Grooved Pegboard, DKEFS, Connors' CPT test II, WAIS-IV subsets, and BRIEF. **CVR methods** Participants were fitted with a custom breathing circuit attached to a computer-controlled gas-blending device to evaluate baseline end-tidal carbon dioxide (P_{aCO_2}). To alter brain blood flow a P_{aCO_2} gas challenge, which consisted of two square wave increases of 10 mmHg above baseline P_{aCO_2} and a ramp protocol that decreased P_{aCO_2} to 32 mmHg and then increased linearly to 50 mmHg over a 7 min. period was utilized while P_{aO_2} was maintained at 100 mmHg. Each participant underwent brain imaging using a 3T MRI for concurrent structural and functional (BOLD) imaging. CVR (% BOLD signal change/mmHg CO_2) was computed by using a robust linear least squares fit to the correlation between the two time courses.

RESULTS: As expected mTBI and C were similar in age (22 ± 1 vs. 23 ± 1 y, $P = 0.07$), height (173 ± 3 vs. 174 ± 3 cm, $P = 0.76$), weight (76 ± 6 vs. 80 ± 6 kg, $P = 0.37$) and BMI (24 ± 1 vs. 26 ± 1 kg/m², $P = 0.18$). Baseline P_{aCO_2} (38 ± 1 vs. 36 ± 1 mmHg, $P = 0.44$) was

not significantly different. Whole brain gray matter CVR was also not significantly different in mTBI vs. C groups for the full sequence (0.380 ± 0.014 vs. 0.379 ± 0.014 %BOLD/mmHg, $P = 0.94$), squares waves only (0.380 ± 0.017 vs. 0.390 ± 0.017 , $P = 0.68$) and ramp only (0.377 ± 0.013 vs. 0.375 ± 0.013 , $P = 0.92$). Differences in NC testing (mTBI vs. C) were DKEFS Trail Making-motor speed (11.4 ± 0.3 vs. 12.5 ± 0.3 , $P = 0.02$); DKEFS Color Word Inference inhibition (13.0 ± 0.4 vs. 11.8 ± 0.4 , $P = 0.05$); and Connors' CPT Test II Commission (%) (58.2 ± 2.8 vs. 51.4 ± 2.8 , $P = 0.04$).

CONCLUSIONS: The data from this study suggest that multiple sports related concussions do not have long-term effects on CVR, however NC data showed reduced reaction time and attention.

Supported by National Football League Charities

852 Board #31 May 31 2:00 PM - 3:30 PM
The Effect of Industrial Hyperthermia on Firefighters' Cognitive Function in Warm Humid Environment

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Firefighting is a physically and mentally strenuous job requiring rapid, appropriate decision making in extremely hot environmental conditions. Intact cognitive function is imperative to firefighters' effectiveness and safety. **PURPOSE:** To investigate the effect of industrial hyperthermia [rectal temperature (T_{re}) $\geq 38^\circ\text{C}$] on cognitive performance while wearing a firefighters' encapsulating protective ensemble after exercise in a warm, humid environment. **METHODS:** Eight healthy male subjects (VO_{2max} : 52.83 ± 5.60 mL.kg⁻¹.min⁻¹; Age: 26 ± 4 yrs) performed computer-based cognitive tests (Go/No-Go) before and after exercise under hyperthermic conditions (30°C / 70% relative humidity). Exercise included 40-min treadmill walking at 40 % VO_{2max} or until $T_{re} \approx 39^\circ\text{C}$ while wearing a firefighters' protective ensemble. For the Go/No-Go tests, participants were required to button-press to a target stimulus, and withhold button-presses to a non-target. The test appears as a 2×2 grid with one star in each square. A letter is presented in one square for duration of 500 milliseconds (ms), followed by an inter-stimulus interval of 1500ms. The first test (P-Go) required participants to respond to the target letter P and withhold response to the non-target letter R. The second test (P-No-Go) was a reversal, with R as the target and P as the non-target. Both tests had 160 trials (320 total), and constant ratio of targets to non-targets (80:20). Comparisons were drawn using paired-samples t-test with statistical significance shown at $p < 0.05$. **RESULTS:** Following hyperthermia, participants' reaction time (RT) was reduced in both tests (Go/No-Go) and exhibited a non-significant increase in percentage performance error (PE) compared to normothermic condition. The mean differences found between hyperthermic and normothermic conditions are: T_{re} : $1.46 \pm 0.44^\circ\text{C}$, $p = 0.0001$; P-Go RT: -17.22 ± 18.89 ms, $p = 0.0365$; P-No-Go RT: -36.31 ± 28.11 ms, $p = 0.0081$; and PE: $1.02 \pm 2.20\%$, $p = 0.2333$. **CONCLUSION:** Cognitive function was not altered negatively by hyperthermia. However, the hyperthermia condition resulted in accelerated reaction time which may have been influenced by change in human mood following mentally stressful hyperthermic conditions. Accelerated reaction time may cause a non-significant change in firefighters' performance.

853 Board #32 May 31 2:00 PM - 3:30 PM
Annual Baseline Drift in Professional Rugby League Players

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Purpose: Annual baseline testing within professional Rugby League has been mandatory since 2004. The question: "Do annual baselines drift over time or as a result of a concussion in rugby league players?" is unanswered. If they do drift, what is the magnitude and in what tasks and is this correlated with associated concussions. This study evaluated if baselines drift over time and if so is this related to concussive injury or accumulating injury.

Design: Retrospective study

Method: Participant players were those who held a professional contract between the 2006-2012 season. It is mandatory to provide an annual baseline test using CogSport and following any diagnosed concussion, with full symptom resolution, a valid return to play test. Concussion test data was provided by CogState Australia from tests performed over 7 seasons.

Results: Over the 7-year period 4762 players suffered 470 concussions (2.65/1000 hours, 95% Confidence Interval 2.4 to 2.9). Reaction time on a choice reaction time task (Identification) slowed with previous concussions (0.017, .001 to .029, $P=0.05$) but not seasons. Accuracy on a working memory task (One Back) decreased with concussion (-0.05 to -0.05, $P=0.001$) and on an episodic memory task (One Card Learning) decreased with previous concussion (-0.041, -0.049 to -0.34, $P=0.001$) and season (-0.006, -0.007 to -0.005, $P=0.001$).

Conclusions: Over seven seasons, item scores within the CogSport test varied as a function of previous concussion and time suggestive of a subtle deterioration in cognitive performance with prior concussions. Individual items within the CogSport test were influenced by differing factors and more detailed examination of the scores and co-factors is warranted.

854 Board #33 May 31 2:00 PM - 3:30 PM
Change in Serum Protein S100B Following a Collegiate American Football Game

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Protein S-100 Beta (S100B) is a calcium handling protein found in astrocytes. Following traumatic injury to the brain, S100B can be measured in blood serum as an indicator of brain damage severity. **PURPOSE:** To determine if S100B is increased in the serum of football players following a game in which traumatic head injury was not reported yet subconcussive hits were experienced by the players. **METHODS:** S100B was measured in the serum of 15 football players before and after two collegiate varsity football games. Of the 15 players, seven received a large amount of playing time, and eight received no playing time and served as the control group. In addition, the change in serum level of S100B was correlated to the number of total hits (described as impact to the head or body) each player sustained to determine if S100B serum levels rose in correlation with the number of hits each player experienced. **RESULTS:** No concussions or significant head injuries were reported by any of the players or certified athletic training staff, yet S100B (Pre-game 1: $0.051 \mu\text{g}\cdot\text{L}^{-1} \pm 0.056$ vs. Post-game 1: $0.084 \mu\text{g}\cdot\text{L}^{-1} \pm 0.055$, $p=0.019$) (Pre-game 2: $0.088 \mu\text{g}\cdot\text{L}^{-1} \pm 0.071$ vs. Post-game 2: $0.170 \mu\text{g}\cdot\text{L}^{-1} \pm 0.151$, $p=0.028$) increased significantly in those who played. S100B (Pre-game 1: $0.031 \mu\text{g}\cdot\text{L}^{-1} \pm 0.008$ vs. Post-game 1: $0.022 \mu\text{g}\cdot\text{L}^{-1} \pm 0.009$, $p=0.069$) (Pre-game 2: $0.052 \mu\text{g}\cdot\text{L}^{-1} \pm 0.009$ vs. Post-game 2: $0.041 \mu\text{g}\cdot\text{L}^{-1} \pm 0.017$, $p=0.161$) did not increase significantly in those who did not play. Pearson Correlation showed there was a moderate correlation between the change in S100B and the number of hits each player experienced ($R^2=0.419$; $p=0.009$). **CONCLUSION:** Serum S100B concentration does increase in response to subconcussive injury in a manner dependent on the number of hits the athlete withstands. Despite the increase in S100B levels caused by a football game, the increase in S100B was found to be similar to that found in runners, soccer players, or basketball players but greater than that found in swimmers and cyclists. This indicates sustaining subconcussive hits from playing football may cause damage to the brain but be no more damaging than playing other sports resulting in external forces being applied to the brain.

855 Board #34 May 31 2:00 PM - 3:30 PM
Affective Responses During High-intensity Exercise Detect Changes In W'

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The feeling scale (FS) provides a valid measure of positive or negative feelings (i.e., affect) during dynamic exercise; however, research on constant work rate (CWR) exercise has been confined to lower intensities. Exercise >critical power (CP) is characterized by a time-dependent utilization of the finite work capacity >CP (W'), resulting in predictable time limits to exhaustion (t_{LIM}). Glycogen depletion (GD) evokes declines in W' , independent of changes in CP, resulting in earlier t_{LIM} . **PURPOSE:** To determine if GD evokes a more rapid time-dependent change in affect correlating to physiological responses during exhaustive CWR exercise. **METHODS:** In counterbalanced-order, 15 participants completed CWR exercise at 10% >CP in glycogen loaded (GL) and GD conditions. The FS, pulmonary gas exchange, capillary lactate, and electromyography (EMG) of the vastus lateralis were evaluated. **RESULTS:** A 62.3 ± 22.5 s reduction in t_{LIM} ($p < 0.05$) and a 3.2 ± 1.2 mmol·L⁻¹ reduction of end-exercise blood lactate concentration ($p < 0.01$) was evoked by GD. A greater decline in slope relative to time for the FS was observed for GD (-1.87 ± 1.12) vs. GL (-1.24 ± 0.91) ($p < 0.01$), correlating with earlier t_{LIM} in both the GL ($r = 0.78$)

and GD ($r = 0.76$) conditions. A 13.4% increase in iEMG occurred in the GD trial ($p < 0.05$). Oxygen uptake ($\dot{V}O_{2max}$) kinetics for ~½ of the sample exhibited a continuous primary phase until exhaustion (i.e., extreme domain) whereas a O_2 slow component was observed with the remaining participants (i.e., severe domain). Exercise in the extreme domain evoked 43% greater decline in affective responses ($p < 0.01$) and a 274.6 ± 78.1 s reduction in t_{LIM} ($p < 0.01$) and the gain in $V_E/\dot{V}CO_2$ relative to t_{LIM} was 6.9% greater for those exercising in the extreme domain ($p < 0.001$). **CONCLUSION:** Affective responses during severe and extreme exercise is sensitive to changes in metabolic responses occurring with a compromised W' .

856 Board #35 May 31 2:00 PM - 3:30 PM
Vitamin D and Neuropsychological Skills of Cross Country Skiers at 64° North

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Vitamin D insufficiency and deficiency are well-documented in populations living north or south of approximately 35° N or S latitude, respectively; these are even more pronounced during winter months. Athletes have been shown to be more susceptible to insufficiency and deficiency than non-athletes. Vitamin D has been linked to mental cognition. Winter-sports athletes residing in the circumpolar north may experience sub-optimal vitamin D levels and depressed cognitive abilities during the competitive season.

PURPOSE: To determine if significant differences of vitamin D concentrations and manual dexterity exist in winter athletes mid- and post-season in the circumpolar North. **METHODS:** Fifteen competitive cross country skiers residing at 64° N were recruited for this study. Blood samples were taken in early February ("mid-season") and in late April ("post-season"). Subjects completed the Purdue Pegboard Test (PPT), an assessment of mental cognition and manual dexterity, at the time of the blood draws. Plasma vitamin D concentration was measured as 25-hydroxyvitamin D [25(OH)D] using an ELISA. Significance was determined by permutation test with 95% confidence interval. **RESULTS:** Subjects exhibited significantly lower mean concentration of plasma 25(OH)D in post-season ($\mu=3.39$ ng/mL, $SD=4.53$) as compared to mid-season ($\mu=5.94$, $SD=3.37$). PPT revealed significantly higher scores in three of four tests in post-season ($\mu=18.00$, $SD=1.31$; $\mu=16.89$, $SD=1.12$; $\mu=46.64$, $SD=3.40$) versus mid-season ($\mu=17.04$, $SD=1.82$; $\mu=15.98$, $SD=1.62$; $\mu=41.69$, $SD=4.37$) with no significant differences in the remaining test. **CONCLUSION:** Post-season mean plasma 25(OH)D concentration was significantly lower than mid-season. This could be explained by significantly reduced intake of vitamin D supplements post-season. PPT scores improved significantly in two of four tests in the post-season suggesting that 25(OH)D may not necessarily be linked to cognitive function measured with PPT. However, mean 25(OH)D concentrations from both mid- and post-season fell below the Institute of Medicine's definition of "deficient" suggesting that subjects' improvement on PPT may have been attributable to another factor or factors such as reduced stress levels.

Supported by NIH, Award Numbers UL1GM118991, TL4GM118992, or RL5GM118990.

857 Board #36 May 31 2:00 PM - 3:30 PM
The Effects of Self-selected Music as a Diverting Activity Between Two Bouts of Fatiguing Isokinetic Leg Extensions

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Previous studies have shown music's ability to act as an ergogenic aid. However, there is limited research investigating the effects of music as a diverting activity in fatiguing exercise protocols. **PURPOSE:** To investigate the effects of listening to music as a diverting recovery intervention on peak torque and percent torque decline.

METHODS: Thirty-nine recreationally trained men ($n = 18$; 22.3 ± 2.7 y; 177.6 ± 8.8 cm; 80.7 ± 10.0 kg) and women ($n = 21$; 22.2 ± 1.7 y; 162.2 ± 5.2 cm; 62.6 ± 9.9 kg) performed 4 experimental visits consisting of 2 bouts of 50 maximal isokinetic leg extensions at $180^\circ\cdot\text{s}^{-1}$. Between each bout of maximal exercise, 2 minutes of recovery involving one of the 4 interventions (no music, white noise, self-selected slow tempo music, and self-selected fast tempo music) was completed. Torque values were collected during the pre-intervention and post-intervention maximal isokinetic strength tests. Percent torque decline was calculated for both the first and second set of 50 repetitions.

RESULTS: There were no significant ($p > 0.05$) 3-way interactions for peak torque or percent torque decline. There was a significant 2-way (time \times sex) interaction ($p < 0.05$) for peak torque. The decrease in peak torque from the pre-intervention test to

the post-intervention test was significantly greater for men (pre = 138.1 ± 3.68 Nm; post = 127.4 ± 3.2 Nm) than for women (pre = 84.7 ± 3.4 Nm; post = 80.4 ± 2.9 Nm), regardless of intervention. There was a significant main effect ($p < 0.05$) for percent torque decline, where the torque decline was greater for the post-intervention test (45.8 ± 1.2%) than the pre-intervention test (43.2 ± 1.3%). There were no significant interactions or main effects involving diverting conditions ($p > 0.05$).

CONCLUSIONS: These findings indicate that listening to self-selected music, slow or fast tempo, was not an effective diverting activity.

B-61 Free Communication/Poster - Activity Interventions and Programming in Adults II

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

858 Board #37 May 31 3:30 PM - 5:00 PM How Sociodemographic Characteristics Of Activity Monitor Users Relate To Device Use And Perceived Physical Activity.

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Wearable activity monitors (AM) have been well accepted in some randomized controlled trials and have contributed to an increase in levels of physical activity (PA) in some, but not all participants. The sociodemographic profiles of users may be associated with the length of time (number of months) they wear the device, and how they perceive it impacts their PA behavior.

PURPOSE: To assess whether sociodemographic characteristics of AM users are related to 1) duration of device use, and 2) perceived changes in PA behavior.
METHODS: Current (n=1355) and former (n=590) AM users from across the United States were recruited online and completed a web-based survey. Sociodemographics, health information, and AM use were queried. Moderate to vigorous PA (MVPA) score was calculated using the Godin Leisure Time PA Questionnaire. Respondents also reported how AM use influenced their PA. Descriptive statistics are reported as medians, means ± standard deviations, and frequencies. AM users were categorized based on the median use time: AM use for > 6 months or ≤ 6 months. Age, income and MPVA score were categorized by quartiles. Chi-squared analyses were used to compare groups for all categorical variables.

RESULTS: Respondents were 18-81 years old (33.0 ± 12.2) with 73.1% women. A majority were current AM users (69.7%) and BMI was 26.7 ± 6.6. The number of months of AM use among current users was 10.1 ± 11.6, and 6.8 ± 6.4 among former users. Age ($\chi^2(3)=38.8$), income ($\chi^2(3)=22.0$), MVPA ($\chi^2(3)=22.4$) and relationship status (partnered vs single; $\chi^2(1)=14.7$) were all significantly different across the device-use categories ($p < 0.001$). A majority of current (76%) and former (53.2%) users perceived that the AM contributed to increased PA. Across all respondents, purchasing an AM themselves, as opposed to receiving it as a gift, was associated with a perceived increase in PA after device use ($p < 0.05$).

CONCLUSION: Duration of activity monitor use was associated with the sociodemographic characteristics of users, with a majority perceiving an increase in their physical activity as a result of use. This supports the need for further research to explore how sociodemographic data can be used to tailor interventions to specific populations using technology-based objective monitoring.

859 Board #38 May 31 3:30 PM - 5:00 PM Predictive Indicators of Early Fitness Club Membership Termination in Japan: A Cohort Study

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Approximately 40% of fitness club members in Japan have been reported to opt for early termination (within one year) of their membership. Identifying common

indicators among members who choose early termination may allow for the development of prevention strategies. **PURPOSE:** Identifying the characteristics of those who opt for early termination via a cohort study. **METHODS:** Across 17 fitness clubs, members completed a self-report questionnaire at baseline and follow-up.

The survey included the following indicators 1) baseline characteristics; 2) purpose of membership; 3) health status; and 4) psychological factors (perceived benefit of exercise, perceived barriers to exercise, and exercise self-efficacy). Participants were followed to determine whether they terminated their memberships. Odds ratios (OR) and 95% confidence interval (95%CI) for the incidence of early termination adjusted for age and gender were obtained using a logistic regression model. **RESULTS:** There were 1,839 participants (average age 37.9 years, 520 males and 1319 females) were involved in this observational study. During the follow-up period (six months on average), 428 participants early terminated. For every five-year increase in age, the gender-adjusted OR (95% CI) was 0.91 (0.87-0.94) for early termination. Members that joined an fitness club to relieve stress had an adjusted OR of 1.33 (1.06-1.68) for early termination. Additionally, the participants who joined an fitness club to improve their health had an adjusted OR of 0.81 (0.65-1.01) for early termination. The participants who agreed with the statement "recognition of one's ability to others," the benefits of exercise, had a higher adjusted OR for early termination 1.46 (1.11-1.91). Similarly, the participants who agreed with the statement "improve appearance" had a higher adjusted OR for early termination 1.33 (1.03-1.72).

CONCLUSIONS: The predictive indicators for early fitness club termination included young age, perceived exercise benefit for stress reduction, "recognition of one's ability by others" and "improve appearance". Lastly, perceived benefit of health improvement may prevent early termination.

860 Board #39 May 31 3:30 PM - 5:00 PM Presence of Master Plans Supportive of Active Living in U.S. Municipalities

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PURPOSE: Community planning documents can play an important role in promoting the design and maintenance of communities to support active living. This study estimates the prevalence (overall and by municipality characteristics) of (1) community wide planning documents and (2) inclusion of objectives within plans supportive of active living.

METHODS: Data from the 2014 National Survey of Community-Based Policy and Environmental Supports for Healthy Eating and Active Living (CBS HEAL) were analyzed. CBS HEAL collects data through a survey of local officials for a nationally representative sample of US municipalities with a population of at least 1000 people (n=2005 representing a 45% response rate). Prevalence of a comprehensive or general Plan, 3 specific plan types (land use, transportation, and bicycle or pedestrian (stand-alone or part of a general Plan)), and 3 objectives (implementing Complete Streets policies, promoting street connectivity, or encouraging mixed-use development) were analyzed using survey weights to create national estimates.

RESULTS: Overall, 64% of US municipalities in our sample had a comprehensive or general plan. Plan is types ranged from 76% for a land use plan to 48% for a bicycle/pedestrian plan and 46% for a transportation plan. 67% of municipalities with plans had an objective for encouraging mixed-use development, 54% for the promotion of street connectivity, and 37% for the implementation of a Complete Streets policy. Across all plan types, municipalities with a larger population, that were urban, located in the West, with a median college graduate education level and a lower poverty prevalence had a higher prevalence of plans than their counterparts. Among municipalities with a plan, similar patterns by municipality characteristics were observed for the presence of objectives with one exception, presence of objectives by poverty level did not differ significantly.

CONCLUSIONS: Helping communities, especially smaller or rural municipalities and those with lower median education levels, address issues related to the adoption and creation of planning documents supportive of active living can be an important step toward creating more walkable communities.

861 Board #40 May 31 3:30 PM - 5:00 PM Exercise Trials In Co-morbid Adults: A Missed Opportunity For Behavior Change?

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(No relationships reported)

PURPOSE: Exercise (EX) trials in adults with co-morbid conditions such as type 2 diabetes offer an opportunity to address behavior changes needed to increase physical activity (PA) and improve long-term health. The aim of this study was to determine whether it was feasible to include a low-dose PA behavior change intervention in

an EX trial. **METHODS:** For the original EX trial, participants were randomized to one of four groups, to test the interactive effects of metformin and post-exercise ingestion of protein versus carbohydrate on mitochondrial protein synthesis, and the blunting effect of metformin on EX response. Participants were ≥ 55 years of age, had fasting glucose values ≥ 100 mg/dl, hemoglobin A1c 5.7-6.4%, two hour postprandial glucose 140-200 mg/dl, or a family history of type 2 diabetes. All participants received supervised EX sessions, three times per week for 12 weeks. For the behavior change intervention, participants were randomized to receive a one-hour PA counselling session, or not, held after completion of the 12 week EX intervention. The session was based on social-cognitive theory, and the primary goal was to increase post-intervention PA maintenance through discussion of PA benefits, PA goal setting, and identifying and overcoming PA barriers. Self-reported PA was measured using the International PA Questionnaire (IPAQ), pre, post and three-months after the EX intervention. **RESULTS:** There was no additional time burden for participants or the principal investigators of the original EX trial. Baseline, post-intervention PA questionnaires, and the counselling session were done while participants were in the laboratory doing their oral glucose tolerance test, and the follow-up PA questionnaire was completed by mail or online. PA questionnaire completion rates were high; 30/31 (96.7%) completed baseline, 100% (N=17) completed post-intervention PA questionnaire and counselling session (if randomized to receive it), and 7/8 (87.5%) have completed the three-month follow up PA questionnaire. **CONCLUSIONS:** Based on the high completion rates and no added time commitment, including behavior change strategies as part of an exercise trial is feasible. This trial is ongoing, and upon completion, effectiveness of the counselling session for increasing PA at three-month follow-up will be examined.

862 Board #41 May 31 3:30 PM - 5:00 PM
Effects Of Removing Electronic Devices From An Athletes' Sleeping Environment On Sleep And Anxiety
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 (No relationships reported)

Studies have suggested that the light emitted from electronic devices can impair sleep. However, it is unclear whether removing electronic devices from the sleeping environment in the evening and overnight provides an extended sleep opportunity. **Purpose** To investigate the effects of removing electronic devices in the evening and overnight on measures of sleep and anxiety during a seven-night training camp. **Methods** Twenty-six water-polo athletes (12 males, 14 females, aged 17±1 y) attending a training camp were allocated to either a no-device group (no electronic devices could be used after dinner or overnight; ND) or a control group (unrestricted electronic device use; CON). Athletes in the ND group also completed a modified version of the Nomophobia Questionnaire (Yildirim, 2015), which measured anxiety related to being unable to use electronic devices. Sleep was monitored with wrist actigraphy in both groups. One-way ANOVA calculated between-group differences and repeated measures ANOVA calculated within-group differences across each night. Cohen's *d* effect sizes were calculated for anxiety scores. **Results** Athletes in the ND group went to bed earlier than those in the CON group on the first night of camp (21:40±0:48 h vs. 22:20±0:48 h; $p=0.049$). Athletes in the ND group also spent longer in bed (520±41 min vs. 478±41 min; $p=0.015$) and slept for longer (474±55 min vs. 433±41 min; $p=0.044$) than the CON group on the first night. However, there were no differences between groups for any other nights. Electronic device-related anxiety in the ND group did not significantly change from the first (61±27) to the last night of the camp (49±18), although a moderate effect size for the change in scores over time ($d=0.50$) suggested a trend towards decreased anxiety over time. **Conclusion** Removing electronic devices from athletes overnight resulted in sleep extension on the first night of the training camp. It is possible that the lack of differences between the two groups for the remaining six nights was due to athletes in the ND group seeking other means of delaying bedtime (e.g. by engaging in other activities). Future research is needed to better understand the effects of electronic device use in young adults and athletes, particularly in relation to evening electronic device use habits.

863 Board #42 May 31 3:30 PM - 5:00 PM
Effects of Sitting and Three Treadmill Desk Speeds on Cognitive Function, Typing Speed and Accuracy
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Active workstations have become a common method of combating the prolonged sedentary setting of the workplace and potentially decrease the risk of chronic diseases and health conditions due to inactivity. However, there is no evidence to indicate an optimal treadmill speed to increase physical activity without compromising employee

productivity. **PURPOSE:** The purpose of this study was to determine whether four workstations including sitting, walking on a treadmill at 1.0 mph, 1.3 mph and 1.7 mph affect typing speed, typing accuracy, and cognitive function in college students. Additionally, this study aimed to determine optimal speed for treadmill desk users. **METHODS:** Forty college-age students (n=20 males, n=20 females) were recruited into the study. Participants completed a health history and informed consent. The university Institutional Review Board approved the study. Participants completed one counterbalanced trial with one cognitive test and one typing test at each of the four workstations with a two-minute break between each test and workstation. Each participant sat, walked at 1.0 mph, 1.3 mph and 1.7 mph while performing the Stroop test for cognitive function and a typing test to assess speed and accuracy. The order of the four workstations and order of the tests were randomized. **RESULTS:** No significant differences were found in the Stroop test for the percent correct for normal ($p=0.277$) or interference responses ($p=0.940$) or the average response time for normal ($p=0.909$) or interference response time ($p=0.808$) responses between the workstations. No significant differences in average type speed in words per minute ($p=0.673$), the average error count ($p=0.764$) or the average adjusted speed in words per minute ($p=0.836$) for the typing tests at each workstation. **CONCLUSION:** Cognitive performance, typing speed and accuracy are not affected by sitting or walking on a treadmill desk. Data suggests cognition and typing productivity are not compromised by using a treadmill desk. Results indicate active workstation users are able to choose various walking speeds (1.0 mph, 1.3 mph and 1.7 mph) to minimize the sedentary nature of an occupational setting without concern of impaired workplace performance.

864 Board #43 May 31 3:30 PM - 5:00 PM
Immersive Cycling Environment Yields High Intensity Heart Rate Without High Perceived Effort In Novice Exercisers
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Reported Relationships: J.S. Gottschall: Ownership Interest (Stocks, Bonds); FITOLOGY, LLC.

Exercise prescription is a multifaceted topic with the singular goal of defining a protocol that maximizes health and adherence. The ACSM guidelines reference previous results that there is an intensity threshold to continually improve fitness and reduce disease risk. The threshold for well-trained individuals is 95-100% max heart rate (HR) whereas the threshold for less-trained individuals is only 70-80% max to achieve the same benefits. Exercising at these intensities can be uncomfortable and unpleasant leading to low compliance. However, past research has demonstrated that engaging distractions such as an instructor, music, or digital images can enhance enjoyment while diminishing rate of perceived exertion (RPE). It is therefore possible that an instructor-guided workout with digital images synchronized to music could be the ideal combination to reach higher intensities with a lower perception of effort. **PURPOSE:** Our aim was to compare an audio (AUD; music only) environment with an immersive (IMM; music + digital images) environment during group fitness cycling classes in both well-trained and less-trained individuals. **METHODS:** To date, 6 elite participants (more than 10 hours PA/wk) and 6 novice (less than 2 hours PA/wk) completed 8 AUD and 8 IMM classes in 8 wks. Both class formats were approximately 40 minutes in duration with parallel strength and speed intervals led by an instructor. We collected HR (% time in 80-100% max zone) during each class and survey data (RPE, satisfaction, enjoyment) immediately after each class. **RESULTS:** For the elite participants, % time in the max zone and RPE were significantly greater during AUD (54 + 8%; 18 + 1) compared to IMM (46 + 9%; 15 + 2; $p < 0.05$). In contrast, for the novice participants, RPE was significantly less during IMM (16 + 2) compared to AUD (18 + 1; $p < 0.05$) while the % time in the max HR zone did not differ between the two conditions (AUD = 62 + 11%; IMM = 64 + 12%; all values mean + sd). Satisfaction ratings were high for both groups and both conditions, but the novice participants rated IMM as more enjoyable than AUD. **CONCLUSION:** Both AUD and IMM group fitness cycling formats are an ideal way to meet the exercise guidelines with high satisfaction. IMM may promote adherence in novice participants compared to AUD as HR intensity did not differ, RPE was less and enjoyment was greater.

865 Board #44 May 31 3:30 PM - 5:00 PM
Use Of Sit-To-Stand Workstations: Impact On Physical Activity
 Shiann Wickham, Catherine Patrick, Larissa Boyd, Melissa Powers. University of Central Oklahoma, Edmond, OK.
 (No relationships reported)

USE OF SIT-TO-STAND WORKSTATIONS: IMPACT ON PHYSICAL ACTIVITY
 Shiann Wickham, Catherine Patrick, Larissa Boyd, Melissa Powers University of Central Oklahoma, Edmond, Oklahoma
 Prolonged sitting affects daily total physical activity. Standing in order to break long periods of sitting may be beneficial to an individual's health. **PURPOSE:** The purpose

of this pilot study was to determine whether physical activity would change when using a sit-to-stand workstation in a workplace environment. **METHOD:** Volunteers from the faculty of the University of Central Oklahoma included apparently healthy male and female adults ($N = 11$, $M = 39.09 \pm 10.445$ years). Participants were asked to use sit-to-stand workstations for a minimum of three hours per workday. The International Physical Activity Questionnaire (IPAQ) was used to measure self-reported daily physical activity. **RESULTS:** Dependent t -tests were used to analyze changes in self-reported physical activity over 5 months. Non-significant ($p > .05$), meaningful improvements were seen in METmin/wk for walking ($d = .19$), total physical activity ($d = .14$), moderate activity ($d = .01$), and vigorous activity ($d = .02$). Total minutes of sit time per week ($d = .25$) and average daily minutes sitting ($d = .25$) decreased ($p > .05$). **CONCLUSION:** Sit-to-stand workstations do provide an increase in daily physical activity levels. Although the results were non-significant, they do indicate a small decrease in time spent sitting along with small improvements in walking and total physical activity. Decreasing employee sitting time can increase the amount of physical activity achieved throughout the day. Future research should evaluate the use of sit-to-stand workstations in a larger, more diverse group of employees.

Table 1
Paired t -test Comparisons of Subjectively Measured Physical Activity Before and After 5 Months of Sit-to-Stand Workstation Use

	Pre		Post		t	p
	M (SD)	95% CI	M (SD)	95% CI		
Walking (met-min-wk)	699.00 (537.72)	[337.75, 1060.25] [1309.37, 5356.99] [453.54, 2681.01] [347.88, 2335.76] [1348.25, 2889.94] [192.61, 412.85]	802.78 (626.05)	[382.19, 1223.36]	.50	.63
Total PA (met-min-wk)	3333.18 (908.30)		3764.32 (3491.25)	[1418.87, 6109.77]	-.63	.55
MPA (met-min-wk)	1567.27 (1657.81)		1590.91 (1303.82)	[714.99, 2466.83]	-.05	.96
VPA (met-min-wk)	1341.82 (1479.50)		1370.91 (2379.25)	[227.50, 2969.32]	-.07	.95
Weekly ST (min-wk)	2119.10 (1147.42)		1838.18 (618.48)	[1422.68, 2253.68]	.72	.49
Daily ST (min-d)	302.73 (163.92)		262.60 (88.36)	[203.34, 321.95]	.72	.49

Note. MET = metabolic equivalent; min. = minutes; wk. = week; d = day; PA = physical activity; MPA = moderate physical activity; VPA = vigorous physical activity; ST = sit time; SD = standard deviation; CI = confidence interval.

866 Board #45 May 31 3:30 PM - 5:00 PM

Bicycling for Exercise Helps Maintain a Youthful Metabolic Cost of Walking in Older Adults

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(No relationships reported)

Impaired walking performance is a key determinant of morbidity among older adults. A distinctive characteristic of impaired walking performance among older adults is a greater metabolic cost compared to young adults. Specifically, healthy older adults have been shown to have a 15-20% greater metabolic cost of walking compared to young adults. However, a recent study suggests that older adults who routinely run for exercise have a lower metabolic cost of walking compared to older adults who walk for exercise. Yet, it remains unclear if other aerobic exercises such as bicycling elicits similar improvements on walking metabolic cost among older adults. **PURPOSE:** To determine if regular bicycling exercise affects metabolic cost of walking in older adults. To our knowledge, there has been no research looking at metabolic cost of walking in older adults who bicycle for exercise. **METHODS:** 13 young adults (23 ± 2 years), 16 "older walkers" (71 ± 5 years) who walk ≥ 30 min, 3x/week, and 17 "older bicyclists" (68 ± 3 years) who bicycle ≥ 30 min, 3x/week, walked on a level treadmill at four speeds (0.75, 1.25, 1.60, and 1.75 m/s). Using an open circuit expired gas analysis, we measured $\dot{V}O_2$ and $\dot{V}CO_2$ in the last 2 minutes of each 6 minute trial to determine metabolic cost (J/kg/s). We compared metabolic cost in the three groups. **RESULTS:** Across the range of walking speeds, older bicyclists had a 9-17% lower

metabolic cost of walking compared to older walkers (3.24 ± 0.14 vs. 3.80 ± 0.16 J/kg/s, respectively; $p = .006$) and similar metabolic cost of walking compared to young adults ($p = .973$).

CONCLUSIONS: Bicycling exercise mitigates the age-related deterioration of walking metabolic cost, whereas walking for exercise appears to have a minimal effect on improving metabolic cost of walking in older adults. We suspect the greater aerobic intensity of bicycling exercise may maintain muscle mitochondrial efficiency in aging and thus helps explain the lower metabolic cost of walking in older bicyclists versus older walkers.

Supported by Humboldt State University RSCA Grant #AY 15/16

867 Board #46 May 31 3:30 PM - 5:00 PM

Exergaming Intervention in Sedentary Middle-Aged Adults Improves Lower Extremity Functional Fitness and Exercise Self-Efficacy

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Interactive video game technology has been extensively utilized in rehabilitative settings. However, few studies have explored the potential benefits of interactive video games as a within-the-home exercise instrument for middle-aged adults who do not have a gym membership or who otherwise cannot regularly make it to their local fitness center. Features of interactive "exergaming" (modeling proper exercise biomechanics, increasing self-monitoring of behavior, encouraging participants to set health-related goals, and rewarding regular use) may help increase self-efficacy (SE), which in turn could promote physical activity and functional fitness (FF).

PURPOSE: To compare FF and SE in relation to exercise tests and self-reported questionnaires in sedentary men and women before and after regularly participating in interactive video game play ($n = 12$, 56 ± 4 yrs, 162.1 ± 10.9 cm, 79.2 ± 19.1 kg, $39.6 \pm 7.7\%$ fat mass).

METHODS: All subjects were initially screened and underwent a battery of FF tests and SE questionnaires. Subsequent observations took place in a monitored laboratory setting where subjects engaged in self-selected, low- to moderate-intensity exergaming involving aerobic, resistance, flexibility, or neuromotor training for 20 min/3d/wk between August 2015 and June 2016. After 8 weeks, FF and SE were retested.

RESULTS: Exercise using interactive video game technology significantly increased 30-second Sit-To-Stand repetitions ($14.2 - 16.8$, $p < 0.05$). Additionally, all participants reported with 100% confidence they would continue to exercise for at least 20 min/3d/wk for up to 8wks post-study if they owned an interactive video game system within their home.

CONCLUSIONS: Exergaming improved lower extremity functional strength and endurance as well as participants' confidence in their ability to continue exercising beyond this study in previously sedentary middle-aged adults. Interactive video game systems should be considered a viable option for convenient, enjoyable, within-the-home exercise programs to assist individuals in meeting ACSM physical activity guidelines.

868 Board #47 May 31 3:30 PM - 5:00 PM

Association between Increased Activity and Wellbeing under Weight Stable Conditions

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The increasing prevalence of physically inactive adults within the United States continues to be a health burden, as inactivity is linked to several non-communicable diseases. Even modest increases in activity can improve health benefits, even without weight loss. However, little is known about the psychosocial outcomes of exercise in weight stable conditions.

PURPOSE: The purpose of this research is to evaluate the effects of time spent in aerobic activity on self-reported psychosocial outcomes in previously sedentary young adults when weight is maintained.

METHODS: 65 previously sedentary overweight/obese adults (54% male, 31.3 ± 7.3 years), were randomized into a high flux (35 kcal/kg/week) or low flux (17.5 kcal/kg/week) exercise group for a 6-month aerobic intervention. All sessions were on site and consisted of 3-5 sessions per week for approximately 1 hour (dependent on body weight). Additionally, weight maintenance ($\pm 3\%$) was required for the entire 6 months. Exercise trainers monitored heart rate (HR) every 5 minutes to ensure intensity

between 70-75% of maximal HR and all sessions were timed and recorded. To evaluate wellbeing, participants completed assessments relating to mood (POMS) and health status (SF-36) at baseline and at intervention completion.
RESULTS: The average exercise time in the high (n=32) and low (n=33) flux group was 220.0 ± 54.6 minutes and 155.9 ± 28.6 minutes per week, respectively. Quintiles were created based off average time per week of aerobic exercise (±SD) (mean values for least time to most time: 137.3 ± 19.2, 175.6 ± 8.8, 249.4 ± 39.4 minutes). There was a linear trend (p for trend <.05) across quintiles for SF-36 (Role Emotional) subscale for time spent in routine activities due to emotional wellbeing, after adjusting for age and sex. No other significance was seen across the 6-month psychosocial wellbeing assessments.
CONCLUSION: These results indicate that an increase in time spent exercising will allow for less time spent in routine tasks due to emotional wellbeing. No other significance was found within the POMS or SF-36 evaluations. While these results are consistent with previous findings, more research is necessary to determine if exercise duration contributes to spending less time on daily activities in weight stable adults.

869 Board #48 May 31 3:30 PM - 5:00 PM
Physical Activity of Parents and Children Playing Together and the Effects of Varying Structured Activity
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Parents are key for promoting physical activity (PA) in children. Family Gym provides a free, 90 minute weekly opportunity for families with young children (ages 3-8) to be active together. Family Gym is located in a community center in a Boston, MA low-income, minority neighborhood.
PURPOSE: To examine the PA levels of parents and children during Family Gym sessions and to determine the effect of varying lengths of structured activity sessions for parents and children.
METHODS: Twelve children (4.8 ± 1.9 yrs) and their parents (27.2 ± 9.4 yrs) participated in group sessions which included free play followed by staff structured activities that were either short (S) (n = 8, averaging 4.4 ± 1.4 minutes per session) or extended (E) (n = 9, averaging 18.9 ± 3.5 minutes per session) in duration. PA levels of each participant were measured using an Actigraph GT9X accelerometer worn at the waist. Percent of time spent in sedentary behaviors (%sed), and in light (%LPA), and in moderate-to-vigorous (%MVPA) PA were estimated using the Troiano cut points for parents, using Pate cut points for children 3 to 5 yrs, and Puyau cut points for children 6 to 8 yrs. Paired t-tests were used to test for differences in PA levels in S versus E sessions. Independent t-tests were used to compare PA between parents and children.
RESULTS: Parents and children did not differ in %sed (p>.05). Compared to children, parents had significantly more %LPA during the S and E sessions (parents, 69.0 ± 10.5 and 63.3 ± 15.5 vs. children, 33.4 ± 23.1 and 30.1 ± 19.5, respectively; p<.05) and less %MVPA (parents, 16.3 ± 6.8 and 10.8 ± 4.9 vs. children, 56.0 ± 24.2 and 57.6 ± 25.7, respectively; p<.05). Parents had less %MVPA in E versus S sessions (10.8 ± 4.9 vs 16.3 ± 6.8, respectively; p = 0.036) while there was no difference between the E and S sessions for %sed (E, 24.1 ± 14.5 vs. S, 14.2 ± 10.4; p = 0.215) or %LPA (E, 63.3 ± 15.5 vs. S, 69.0 ± 10.5; p = 0.421). There were no differences between E and S sessions for children's %sed, %LPA, and %MVPA.
CONCLUSIONS: Parents are not as active as their children in an open play environment. However, open play appears to be as effective as structured activity for increasing %MVPA in children. Organized but unstructured programming is needed to increase PA in parents in group play settings with their children.
 Funded by the Creative Economy Initiatives Fund, UMass

870 Board #49 May 31 3:30 PM - 5:00 PM
Exergaming Intervention in Sedentary Individuals Improves Attitudes Towards Exercise and General Health
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 (No relationships reported)

Interactive video game technology has been utilized in rehabilitative settings. However, research is limited in its possible role as a within-the-home exercise instrument for those who do not have a gym membership, or who otherwise cannot regularly make it to their local fitness center. **PURPOSE:** To compare quality of life and emotional well being before and after eight weeks of exercise using interactive

video game technology in sedentary community members. **METHODS:** 12 Sedentary, middle-aged men and women (56±4 years, 162.0±10.9 cm, 79.2±19.1 kg, % fat mass 39.6±7.7%) exercised under monitored conditions using interactive video game technology at a low to moderate intensity level for 20 minutes a day, three days a week for eight weeks. Participants were allowed to choose which activities they participated in each visit. The SF-36 questionnaire for assessing general health was administered before and after the intervention. Participants took a Subjective Exercise Experience Survey (SEES) with a scale ranging from 1 (not at all), 4 (moderately) to 7 (very much so) after the completion of the study. **RESULTS:** Self-reported SF-36 physical functioning scores approached significance (84.6 before to 90.4 after, p < 0.08) after eight weeks of exercise. Review of the SEES taken after an exergaming session at the end of the study showed that after exergaming subjects felt slightly tired, but not at all drained. They also reported feeling positive and not at all discouraged post exercise. **CONCLUSION:** Virtual gaming platforms may be utilized by sedentary community members in place of regular physical activity. Eight weeks of exergaming might improve physical functioning and have a positive effect on sedentary individuals attitudes toward exercise and general health. Supported by Departmental Funds.

871 Board #50 May 31 3:30 PM - 5:00 PM
Comparing The Effects Of Intrinsic And Extrinsic Motivational Support On Physical Activity Level During Exercise
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Exercise plays an important role in health maintenance; however, it is unclear what the best motivation is for maintaining a long-term exercise plan. **PURPOSE:** To examine the effects of intrinsic and extrinsic motivational support programs on physical activity levels in older Japanese subjects.
METHODS: Forty-one older subjects (age, 73.2 ± 7.3 years; body mass index, 26.9 ± 3.2; male, n = 17; female, n = 24) were randomly assigned to an intrinsic motivational support (IMS) or an extrinsic motivational support (EMS) group. Both groups participated in a 12-week exercise program that met once a week. Each 60-min exercise session included warm-up period, dual-task "square-step", and cool-down period. Subjects in the EMS group were given a monetary reward (JPY500=US\$5) every week if they achieved each target values of average daily step counts during 7 days between sessions. Subjects in the IMS group received a program that was designed using a self-determination theory to enhance competence, self-determination, and relatedness. The motivations to exercise were assessed by a questionnaire (BREQ-2) and the amount of physical activity was measured by a three-axis accelerometer before and after the program. BREQ-2 evaluates five types of motivations to exercise (i.e., amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation).
RESULTS: Moderate-to-vigorous physical activity (MVPA) was defined as 77.0 ± 28.4 min at baseline and 86.4 ± 37.0 min at post in the IMS group and 72.4 ± 33.3 min at baseline and 96.7 ± 39.0 min at post in the EMS group. No significant time x group interaction was found in the MVPA values. In the IMS group, there was a significant trend (P = 0.08) in the score for intrinsic regulation to exercise (15.0 ± 2.7 points at baseline, 16.0 ± 2.0 points at post). In total subjects, the amount of physical activity was not significantly correlated with any of the five types of intrinsic motivations for exercise.
CONCLUSIONS: These results suggest that the exercise program with intrinsic motivational support and extrinsic motivational support both enhanced physical activity level in study participants and that effectiveness did not differ between the two programs. This research was designed to examine 1-year follow-up test for these legacy effects.

872 Board #51 May 31 3:30 PM - 5:00 PM
Association between Physical Activity and Weight Loss: Mediation Effects of Dietary Restraint and Disinhibition
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The complex relationship between eating behaviors and physical activity, and their effects on weight loss, is not well understood.

PURPOSE: To examine the indirect effects of moderate-to-vigorous physical activity (MVPA) on weight loss through changes in eating behaviors (dietary restraint and disinhibition) in response to a behavioral weight loss intervention (BWL).

METHODS: Subjects ($n=221$; 42.8 ± 9.2 years; $BMI=32.7\text{kg}/\text{m}^2\pm 3.6$) with complete data were included in this secondary mediation analysis. The 18-month BWL included prescribed energy intake of 1200-1500kcal/d and MVPA to 300min/wk. Weight, Restraint (flexible (FR), rigid (RR)), Disinhibition (internal (ID), external (ED)) and MVPA were assessed at 0, 6, and 18 months. Restraint and Disinhibition were measured by questionnaire. Objective MVPA was defined as bouts >10 min in duration and >3.0 METs.

RESULTS: Weight decreased [6mo:- $9.07\pm 6.26\text{kg}$; 18mo:- $8.1\pm 8.5\text{kg}$] and MVPA increased [6mo: 673.9 ± 1199.1 MET-min/wk; 18mo: 428.6 ± 101.4 MET-min/wk] ($p<0.001$). RR [6mo: 2.85 ± 1.89 ; 18mo: 2.50 ± 1.94] and FR [6mo: 2.13 ± 1.76 ; 18mo: 1.73 ± 1.73] increased and ID [6mo:- 2.41 ± 3.11 ; 18mo:- 1.74 ± 3.25] and ED [6mo:- 1.05 ± 1.65 ; 18mo:- 0.82 ± 1.59] decreased over time. Change in FR and ID, but not RR or ED, partially mediated the effect of MVPA on weight loss at 6 months. At 18 months, change in FR, RR, and ID, but not ED, partially mediated the effect of MVPA on weight loss.

CONCLUSIONS: The influence of MVPA on weight loss may be partially explained by improvements in eating behaviors. Interventions designed to focus on changing these specific eating behaviors in combination with MVPA may improve weight loss in adults with obesity.

Mediator Analyses: Effect of Eating Behavior Changes on the Association Between Change in PA and Weight Loss		
Mediators:	Baseline to 6 months Indirect Effect (95% CI)	Baseline to 18 Months Indirect Effect (95% CI)
Δ Flexible Restraint	(-0.3857, -0.0338)*	(-0.7386, -0.0957)*
Δ Rigid Restraint	(-0.2110, 0.0457)	(-0.7464, -0.1408)*
Δ Internal Disinhibition	(-0.3856, -0.0442)*	(-1.1561, -0.2469)*
Δ External Disinhibition	(-0.1691, 0.0196)	(-0.2185, 0.2031)

*indicates significance

Supported by NIH (HL008840)

873 Board #52 May 31 3:30 PM - 5:00 PM
Using Focus Groups To Culturally Tailor A Diabetes Intervention In A Pacific Northwest Tribal Reservation

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BACKGROUND: Despite having many health programs available, native men on the Colville Indian Reservation do not regularly participate.

PURPOSE: This qualitative study was designed to gain an understanding of how to effectively recruit and retain American Indian men in a Diabetes Prevention Study.

METHODS: Before recruitment, IRB approval was received from Washington State University and the Colville Tribes. Forty participants (31 males, 9 females) volunteered for five focus groups held in Omak, Nespelem, Keller and Inchelium. Verbal permission was given by participants for audio taping the discussion. Each participant completed a survey prior to the focus group to gather additional data related to diet and exercise. No identifying information was collected on the survey or in the focus groups. Questions elicited opinions about nutrition, physical activity (PA) and culture related to participation in a healthy lifestyle program, including perceived obstacles to participation. Participants were also asked whether their emotional state, including stress, trauma, historical trauma and depression may influence their decisions to participate in the program and in making personal health decisions. Dinner was served at each focus group and all received two \$25.00 Walmart gift cards.

RESULTS: Participants identified a lack of quality produce at local grocery stores as a primary reason for poor eating habits. The men reported that they did not like to shop or cook, but thought recipes and video demonstrations would be helpful. Everyone thought inter-community competition would be motivation to increase PA and decrease weight. They recommended using native cultural activities in the program i.e., traditional dancing, hunting, fishing and gathering roots and berries to increase relevance. Obstacles identified included their emotional state, weather and seasons, as well as a lack of facilities and time.

CONCLUSIONS: Changing our intervention based on these suggestions is the next step. A secondary benefit mentioned in the focus groups is using cultural activities to encourage men, which will also keep those activities alive for the youth in the tribe. Colville tribal men do have an interest in their health and would like to participate in our program if we make it culturally-based and at a time that is convenient.

874 Board #53 May 31 3:30 PM - 5:00 PM
Factors that Associate With Better Exercise Compliance in Mobile App Based Program: The Virtual Trainer Project

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Exercise-related mobile apps and wearable movement detection devices have become popular tools for active lifestyle promotion. Behavioral modification theories such as goal setting, stimulus control, incentive scheme, and self-determination theory could be easily integrated into mobile apps program design so as to make these exercise motivational strategies more interesting and appealing. Limited studies have evaluated these strategies for promoting better exercise compliance. **PURPOSE** To evaluate factors that contribute to a better exercise compliance in a mobile-app based exercise promotion program called the Virtual Trainer (VT) project. **METHODS** A VT mobile app that integrated various lifestyle modification theories, such as goal setting (exercise prescription module), know-how (educational materials dissemination), stimulus control (constant exercise reminding messages and health tips), incentive (exercise credit-points accumulated for prize redemption), feedback system (online health & fitness assessment), and self-determination theories (personalized exercise training scheduling), was designed and prescribed to 126 Chinese adults (age=20.98 +/- 5.35 yrs.) for a 8-12 weeks exercise intervention program. Exercise compliance was computed from ratio of completed exercise session that recorded from the VT system against planned exercise session at the beginning. At end of intervention a questionnaire was completed by participants to report ratings that they perceived as useful for encouraging exercise participation. Responses were compared between the high compliance group (100% compliance) and low compliance group (<70% compliance). **RESULTS** High compliance group accounted for 67% of total whereas low compliance group 15%. Mean compliance rate for low compliance group was 44.9%. Regarding VT built-in psychological factors the high compliance group reported significantly higher rating in educational contents ($p<.01$), feedback system ($p<.05$), stimulus control ($p<.05$), whereas other factors were not different between groups. **CONCLUSION** Among various behavioral modification theories the stimulus control, know-how, and feedback system are more effective strategies in promoting exercise compliance when integrated with mobile technology.

875 Board #54 May 31 3:30 PM - 5:00 PM
Exergaming by Sedentary Middle-Aged Adults Did Not Alter Self-Reported Dietary Intake and Physical Activity

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Self-regulation and self-control is a critical consideration to ensure the cogency of the final result in long-term, exercise-related studies since they act as confounding variables that can impact the outcome. Although researchers inform subjects to maintain unwavering lifestyle habits during an experiment, sedentary older people who barely focused on healthy dietary intake and exercise tend to alter their eating and exercise habits due to health awareness evoked by the research experiment.

PURPOSE: To investigate the change in dietary nutrients and physical activity after sedentary middle-aged adults have participated in regular, consistent exergaming.

METHODS: 12 sedentary, middle-aged men and women (56 ± 3.6 years, 162.0 ± 10.9 cm, 79.2 ± 19.1 kg, % fat mass 39.6 ± 7.7 %) used interactive exercise exergaming under monitored conditions at a low to moderate intensity level with self-selected exercises for 20 minutes a day, 3 days a week for 8 weeks. A three-day diet record was used to assess dietary intake and the Yale Physical Activity Survey (YPAS) to estimate energy expenditure and to document the frequency and intensity of various activities before and after the study for each subject.

RESULTS: No significant differences were found between before and after the exercise intervention for total energy intake or any dietary nutrient. The only variable in the YPAS analysis to change was the standing score which significantly increased after exergaming ($5.00-7.33$, $p<0.05$). However, total energy expenditure per day ($p=0.10$) as well as the activity dimension index ($p=0.12$) did not change.

CONCLUSION: Dietary intake and overall physical activity did not change. This indicates a strong control for confounding variables, which can impact final results besides the exercise due to exergaming. The increase in standing score suggests that participation in exergaming can lead to more awareness for healthier lifestyle habits.

876 Board #55 May 31 3:30 PM - 5:00 PM

Myplate Enhances Physical Activity Along With Nutritional Knowledge In College Students: A Pilot Study

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Purpose: The objective of this study was to investigate whether MyPlate, used as a nutritional assessment and an educational platform, can improve nutritional knowledge, eating attitudes and physical activity levels compared to food records. **Methods:** One hundred twenty university students (18-22 years old) with a normal Body Mass Index (BMI) were recruited and randomly yet equally assigned into one of three groups after signing an IRB approved informed. The groups were: MyPlate group (MG), food records group (FG), and control group (CG). All participants attended two nutritional seminars and completed a modified and validated general nutrition knowledge questionnaire (GNKQ), Eating attitude test (EAT-26) at the beginning and the end of the 4-week study period. A detailed exercise log was also obtained from each participant for the entire period of study. **Results:** Participants in the MG group showed a significant improvements in their nutritional knowledge ($p < 0.05$), eating attitude ($p < 0.05$) and physical activity ($p < 0.05$) compared with other groups. Vegetable consumption elevated from start to finish in the MG ($p < 0.05$) along with a trend towards elevated wholegrain consumption. Males tended to show a more positive eating behavior compared with females in all groups. No significant differences were observed in eating attitude, and physical activity in FG compared with CG. **Conclusion:** MyPlate appears to be an effective tool to improve physical activity, nutritional knowledge and promote positive eating behaviors and therefore wellness.

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Comparison of Mindful and Slow Eating Strategies on Acute Energy IntakeAnna Peluso¹, Kelliann K. Davis, FACSM², Bethany Barone Gibbs², Elizabeth M. Venditti², John M. Jakicic, FACSM². ¹Greensboro College, Greensboro, NC. ²University of Pittsburgh, Pittsburgh, PA. (Sponsor: Kelliann K. Davis, FACSM)

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Purpose: Mindfulness and slow eating techniques are commonly recommended to aid in weight loss within behavioral weight management programs; yet, the role of these eating strategies on acute energy intake (EI) and satiety are not clear. The purpose of this study was to investigate the effects of mindful and slow eating strategies on acute EI and satiety. **Methods:** 24 subjects (median BMI: 29.1 (24.3 – 36.7), median age: 24.0 (21.0 – 31.8)) were randomized to one of three eating conditions (EAT, SLOW, or MIND). For the EAT condition, subjects were instructed to eat as they normally would for both test meal sessions. For the SLOW condition, subjects were instructed to eat as they normally would for their first test meal session and to slow their eating for their second test meal session. For the MIND condition, subjects were instructed to eat as they normally would during their first test meal session and were given brief instructions on mindful eating for their second test meal session. For each condition, subjects were provided ad-libitum access to a test meal and EI was calculated based upon food consumed during this period. Subjects rated their level of satiety following each meal. **Results:** There were no significant differences in EI between eating strategy conditions (EAT: 848 (704-1071) kcals, MIND: 673 (485- 846) kcals, SLOW: 756 (611-1076) kcals) ($p = 0.786$). There was a trend toward a decrease in energy intake in the MIND condition (mean change in energy intake: -64.4 ± 178.4 kcals) compared with the EAT (mean change in energy intake: 98.3 ± 169.6 kcals) condition and a prevention of increased intake in the SLOW (mean change in energy intake: 2.6 ± 107.9 kcals) condition ($p = 0.133$). There were no significant differences in ratings of satiety between conditions. **Conclusion:** Neither mindful nor slow eating strategies significantly decreased acute EI or satiety, although a decrease in EI achieved through a brief mindfulness practice and prevention of increased intake through slow eating may be clinically meaningful for weight management. Future studies should aim to investigate the potential benefits of slow eating and mindfulness for weight management.

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Adherence-related Psycho-perceptual Responses To High-intensity Interval Training In Physically Inactive Middle-aged Adults

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High-intensity interval training (HIIT) has recently been advocated as a time efficient alternative to traditional continuous exercise for combating physical inactivity related morbidities. Previous studies have demonstrated the physiological health benefits of HIIT, but relatively little is known about the adherence related psycho-perceptual responses to this form of exercise in physically inactive individuals. **PURPOSE:** To compare the adherence-related psycho-perceptual responses after a single session of HIIT versus moderate-intensity continuous exercise (MICE) and vigorous-intensity continuous exercise (VICE) in physically inactive middle-aged adults. **METHODS:** Using a repeated measures randomized cross over design, twelve middle-aged apparently healthy physically inactive males (mean age: 46.8 ± 7.5 years; BMI: 23.4 ± 2.1 kg m⁻²; VO_{2max}: 39.5 ± 5.6 mL kg⁻¹ min⁻¹) undertook three main trials (7-days apart) consisting of: HIIT (10 x 1-min run at 100% VO_{2max} interspersed with 1-min active recovery at 50% VO_{2max}), MICE (40-min run at 65% VO_{2max}) and VICE (20-min run at 80% VO_{2max}). Participants' adherence-related psycho-perceptual responses including: (i) Self-efficacy assessed via a 5-item task-specific questionnaire; (ii) Perceived enjoyment responses measured via the Physical Activity Enjoyment Scale (PACES) and (iii) exercise modality preference were assessed upon completion of the trials. [hg1] One-way repeated measures ANOVA was used to identify within-subject differences. Pairwise comparison was conducted with LSD corrections. **RESULTS:** There was a significant main effect between the trials. Participants displayed significantly lower exercise task self-efficacy scores towards HIIT (42.7 ± 25.3) and VICE (49.2 ± 23.9) than MICE (63.4 ± 18.3 , both $P < 0.01$) based upon pairwise comparison. Additionally, only 17% of participants (2 out of 12) reported a preference to engage in HIIT as opposed to either MICE and VICE. No significant difference was found for perceived enjoyment responses between the trials. **CONCLUSION:** Our finding suggests that HIIT does not promote self-efficacy and may not be an adherable exercise strategy for health promotion in physically inactive middle-aged individuals. Future research examining the long-term adherence to HIIT in this population is warranted.

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Social Impact Bonds - Applicability In Preventive Medicine

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Social impact bonds (SIBs) are a relatively new financial model which suggests the entry of private investors into the public sector, in fields which are under the responsibility of government establishments. The private investor goal is to initiate a social program agreed upon together with the government. The investor will receive payment only according to the program's success in achieving its objectives. The growing rate in obesity and related chronic diseases calls for new creative and innovative solutions. **PURPOSE:** To assess the applicability of SIB in preventive medicine and health promotion programs. **METHODS:** Reviewing of all the available academic and governmental publications on existing SIBs and analyzing the reasons for their success and failure. **RESULTS:** Sixty SIBs were launched between 2010-2016 in 15 countries mainly UK, USA, Australia, and Israel focusing on issues of: education, prisoners' rehabilitation, unemployment, health and family care. Out of 22 projects whose data has been delivered, 21 show a very positive outcome. The first SIB ever launched was to reduce recidivism. The project matured in 2016 was declared a success and returned in full the investors' capital. **CONCLUSIONS:** The SIB is a novel model that has the potential to make a dramatic change in the strategy of funding health promotion programs (e.g., obesity epidemic). The model is applicable in preventive medicine and health promotion programs given that a clear and fair contract is signed between the public authority and the private investor. To note, SIBs can be a primary catalyzer in health promotion programs, but cannot substitute government's responsibility for permanent solutions.

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Health Promotion Intervention On Rural Roads In Sweden - A Case Study Of Cycling SafetyRuggero L. Ceci¹, Christopher J. Patten². ¹Swedish Transport Administration, Stockholm, Sweden. ²Swedish National Road and Transport Research Institute, Borlänge, Sweden. (Sponsor: Christopher Dunbar, FACSOM)

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PURPOSE: In Sweden, as well as in many countries in Scandinavia and in northern Europe, there is a growing trend to allocate the daily exercise routines to cycling and walking in the form of work commuting. This has led to an increase of bikers with light race bikes and garment for race bike training along the roads and streets of major cities like Stockholm and Gothenburg and elsewhere. The health gained from this new trend is of course an important factor to consider and the Swedish authorities, cycling organizations and researchers are actively engaged in the development and evaluation of this health trend. One crucial factor in this development is the safety of the bikers on the public roads with mixed traffic. A cyclist is often overtaken by cars and other vehicles and does not have control over the distance between them and the other vehicles. However, if the cyclist had control over the distance between themselves and the motor vehicle/object, how much space would they give themselves? To investigate how road safety factors such as proximity to vehicles passing the bikers on a rural roads a study was conducted.

METHODS: The experiment was conducted in an indoor athletics arena at Lugnet stadium in Falun where 48 participants were assigned to one of three groups. Group one with a balanced order of the object-proximity variable (n = 24); group two with the object-proximity variable ordered closest first and moving outward from the track (n = 12); and group three with object-proximity variable ordered furthest away first and moving inward towards the track (n = 12). The participants were donned with a bicycle helmet with a GoPro camera, a second camera was attached to the handlebars. Independent variables were object proximity to the bicycle lane (cm) measured from the center of the lane; dependent variables were lateral position in cm to moving objects, cycling speed and heart rate.

RESULTS: The preliminary results suggest that bicycle lane must be at least 140 cm broad to accommodate a 'comfortable' passing distance (for the cyclist). The equivalent passing speeds equates to a car speed of approximately 40 km/h. If the car speeds were higher, the bicycle lane will need to be broader.

CONCLUSIONS: This would suggest that the current minimum bicycle lane breadth (in Sweden) of 70 cm would appear to be woefully under-dimensioned.

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Relationship Between Affective Responses And Adherence To High Intensity Interval Training In Obese African-American WomenAlvin L. Morton¹, Kelley Strohacker¹, Michael J. McKenzie, FACSOM², Melicia C. Whitt-Glover, FACSOM³, David L. Mount⁴, Lyndsey M. Hornbuckle¹. ¹University of Tennessee, Knoxville, TN. ²Winston-Salem State University, Winston-Salem, NC. ³Gramercy Research Group, Winston-Salem, NC. ⁴Mind Body Institute Beyond, Winston-Salem, NC. (Sponsor: Melicia C. Whitt-Glover, FACSOM)

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Introduction: A previous parent study showed significantly better adherence for high intensity interval training (HIIT; 31% dropout) compared to steady state (SS; 73% dropout) in a sample of inactive, obese African-American (AA) women (N=27; age: 30.5±6.8 yrs; 5274±1646 steps/day; BMI: 35.1±5.1 kg/m²). However, the relationship between affective responses and adherence is unclear.

Purpose: To conduct exploratory and descriptive analyses of affective responses over time between SS vs. HIIT conditions, and between study completers vs. non-completers.

Methods: Subjects were randomized into a 16-week treadmill exercise intervention, consisting of 4 weeks of conditioning, then 12 weeks of SS or HIIT training. The intervention consisted of three, 32-min bouts/week. SS bouts consisted of continuous exercise at 60-70% of maximal heart rate (HR_{max}). The time-matched HIIT bouts alternated 3-min lower-intensity intervals (60-70% HR_{max}) with 1-min high-intensity intervals (80-90% of HR_{max}). Core affect was assessed using the Feeling Scale (FS), pre- and post-exercise, as well as after the 8th, 20th, and 32nd minute of exercise. Possible FS scores range from -5 (very bad) to 5 (very good). Mean in-task FS scores are reported for the average of three sessions of week 5 and the last week of participation. Descriptive and frequency analyses are presented over the entire week.

Results: SS completers reported FS values of 5.00±0.00 both at week 5 and week 16. HIIT completers reported mean in-task FS values of 2.88±1.19 at week 5 and 3.82±0.63 at week 16. At week 5, SS and HIIT non-completers reported FS values of and 4.08±0.86 and 2.91±1.77, respectively. During the final week of participation

(8.7±3.3 wks), SS and HIIT non-completers reported FS values of 3.88±1.13 and 3.16±1.18, respectively. Of 221 SS and 586 HIIT bouts completed, 11 (5.0%) and 42 (7.2%) contained ≥ one negative in-task FS score, respectively.

Conclusion: While HIIT subjects consistently reported lower FS values relative to SS subjects, mean values were positive and similar to those observed for SS exercise in prior studies. Further, despite lower FS values, HIIT subjects had less dropout. Thus, it seems that HIIT is feasible in this population. These pilot data suggest the need for further research on contributors to adherence to HIIT in low-active, obese AA women.

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Effect Of Frequent Daily Walking Bouts On Sedentary Time And Self-perceived Fatigue In Free-living Adults

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PURPOSE: Breaking up sedentary time with frequent short bouts of activity has been suggested as a novel strategy to reduce sedentary behaviors, but whether this strategy will be effective at reducing sedentary time in free-living conditions is unknown. In this pilot study, objective measures of physical activity and self-reported measures of fatigue and vigor were compared over 3-days among the following free-living conditions (1) microburst activity (MICRO: 5-min of brisk walking every hour for 9 hours), (2) one 45-min bout of brisk walking (ONE), and (3) a sedentary control condition (SED).

METHODS: Eighteen sedentary overweight adults (12F/6M, mean±SD; age=32.2±6.1 yo, BMI= 30.8±2.5 kg/m²) completed each condition (MICRO, ONE, SED) in a randomized crossover study. The percentage of time spent in sedentary, light-intensity (LPA) and moderate-to-vigorous intensity physical activity (MVPA) were measured by accelerometry (ActiGraph GT3X+). At the end of each day, participants self-reported their level of fatigue and vigor using visual analog scales (VAS).

RESULTS: Both MICRO (7.5±3.3%, p=0.04) and ONE (9.5±3.3%, p<0.0001) increased the percentage of time spent in MVPA during waking hours compared to SED (5.2±2.4%). However, MVPA decreased between the first (10.1±2.5%) and the third day (8.2±2.5%, p=0.02) of ONE, while no changes occurred in MICRO. ONE (79.3 ± 5.9%, p<0.0001), but not MICRO (83.1±5.4%) reduced the percentage of time spent sedentary during waking compared to SED (84.4±5.7%). The fact that LPA was lower with MICRO (10.6±4.1%) than with ONE (12.9±5.4%, p=0.03) suggests a spontaneous displacement from LPA towards sedentary time. Participants reported feeling less "worn out" (34.3±25.9 vs. 42.8±26.1, p=0.04), "bushed" (33.8±25 vs. 41.6±24.1, p=0.05), and had a lower desire to close their eyes (37.3±27.5 vs. 44.1±26.6, p=0.05) and lie down (39.5±28.0 vs. 47.6±27.7, p=0.055) during MICRO compared to ONE conditions.

CONCLUSIONS: Performing a continuous bout of brisk walking per day seems to be more potent at increasing MVPA and reducing time spent sitting, however, the effects may not be long lasting. Small lifestyle changes such as those induced by microbursts of activity may be easier to implement in at-risk populations. Long term studies are needed to confirm this hypothesis.

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Effects Of Whole 30 Dietary Program On Body Composition And Crossfit PerformanceValden Luis Matos Capistrano Junior¹, Renata Alves Carnauba², Natália Marques², Ana Beatriz Baptistella², Renata Desiree Beserra de Sena¹, Angela Siqueira Furtado Martin¹, Adriana Pereira Sampaio¹, Diego de Castro e Silva Lacerda¹, Valéria Paschoal², Andreia Naves². ¹VC Nutrition Clinic research, Fortaleza, Brazil. ²VP Research Institute, São Paulo, Brazil. Email: valdenjunior@hotmail.com

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PURPOSE: To evaluate the influence of Whole30 program on body composition and CrossFit performance in trained individuals.

METHODS: Sixty four subjects (age range: 21-54years) attended to nutrition education class to learn food items and recommended volumes comprising the Whole 30 program (allowed foods: meats, seafood/ fish, eggs, fruit, vegetables and mono and polyunsaturated fats; forbidden foods: sugar, sweeteners, alcohol, flour, oat, quinoa, corn, rice, starch, beans, soy, milk and dairy products) and underwent a 15-day training protocol (4 days/ week). On day 1 and day 15 of the training protocol, performance was measured as the minimum time taken to perform CrossFit workout. The body composition was evaluated by portable ultrasound during the days 1 and 30 of the dietetic program. The collected measures were chest (C), triceps (TR), subscapular (SB), medial axillary (MA), suprailiac (SI), abdomen (AB) and medial thigh (MT), and the fat percentage was automatically calculated by the Body View Software. Samples were tested for normal distribution and groups were compared by either Student's t-test or Wilcoxon Mann Whitney test. The type 1 error was set at p<0.05.

RESULTS: After 30 days of Whole 30 program, there was a significant reduction on the sum of 9 skinfolds (67.76±21.21 vs 53.89±16.32, $p < 0.0001$), total fat (23.24±6.73 vs 19.66±6.37, $p < 0.0001$) and trunk fat (47.07±16.14 vs 36.51±11.91, $p < 0.0001$); and a significant gain of body fat-free mass (76.76±6.73 vs 80.34±6.37, $p < 0.0001$). When subgroup analyses were performed by sex, it was found that the relative loss of body fat (sum of 9 skinfolds, total fat and trunk fat) were similar. Regarding performance, a time reduction to perform the Crossfit workout was observed (14'18" vs 12'33", pre and post dietetic intervention, respectively).

CONCLUSIONS: The Whole 30 dietary program promoted body fat reduction and fat-free mass gain in trained Crossfit individuals. Additionally, after 30 days of dietary program, there was observed improvement in performance by reducing the time taken to perform the CrossFit workout.

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Variation In Daily Physical Activity During An Exercise Intervention Period In Older Adult Japanese

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Previous studies have reported that healthy middle-aged adults spend less time on physical activity during the weekend than during the weekday. However, there are few reports about this topic that include older Japanese adults.

PURPOSE: To examine variation in the amount of daily physical activity during an exercise intervention for older Japanese adults. Variations between the sexes were also examined in this study.

METHODS: Forty-one healthy adults (female: $n = 24$; male: $n = 17$; age: 73.2 ± 7.3 years) participated in an exercise intervention (UMIN000020678). The exercise program was conducted once a week for 3 months. Daily physical activity was measured using three-axis accelerometers (OMRON: HJA-750C). Physical activity data were categorized into two types: locomotive or household activity. For each day of the week, we compared locomotive and household activity between male and female participants using one-way ANOVA. Statistical significance was set at $P < 0.05$.

RESULTS: For all participants, physical activity amounts for each day of the week (Monday-Sunday) was $21.7\text{-}23.0$ Mets-h/day. There were no significant ($P < 0.05$) differences among the days of the week. The average total amount of daily physical activity through all 7 days of the week was higher for female subjects (24.2 ± 4.5 Mets-h/day) than for male participants (20.0 ± 3.9 Mets-h/day). The average amount of locomotive activity was higher for male participants (5.42 ± 1.81 Mets-h/day) than for female participants (4.8 ± 2.0 Mets-h/day). However, the average amount of household activity was higher for female participants (19.3 ± 3.7 Mets-h/day) than for male participants (14.6 ± 3.5 Mets-h/day).

CONCLUSIONS: The results suggest that there is no significant variation in daily physical activity amounts in older Japanese adults during our exercise intervention. Furthermore, female participants in this intervention had higher total amounts of daily physical activity because of higher household physical activity amounts, even though male participants had higher locomotor activity.

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Effects Of Consecutive And Non-consecutive Days Of Resistance Training On Erythrocytes Responses

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Exercise has been shown to alter blood parameters depending on the intensity, duration and type of activity. However, most of the documented changes stem from research using aerobic training with little exploration in resistance training (RT). **PURPOSE:** To determine the effects of 12 w of either 3 consecutive (C) or non-consecutive (NC) d/w of RT on erythrocyte responses. **METHODS:** Thirty healthy and recreationally active men [25 (SD 2) y] were randomly assigned to either C or NC for 12 w. Both groups performed 3 sets x 10 repetitions at pre-determined 10 repetition-maximum of leg press, latissimus pulldown, leg curl, shoulder press and leg extension for each RT session. Blood was sampled in untrained state pre (UT Pre), immediately post 3rd day of RT (UT 0 h), 24 h post 3rd day of RT (UT 24 h) in week 1, and also in trained state pre (T Pre), immediately post 3rd day of RT (T 0 h), 24 h post 3rd day of RT (T 24 h) in week 12. Whole blood was analyzed for red blood cell (RBC) counts, hemoglobin (Hb), hematocrit (Hct), mean cell volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), mean plasma

volume (MPV), and red cell distribution width (RDW). Analysis was conducted using Generalized Estimating Equations. **RESULTS:** Both groups were similar in age, weight [65 (10) kg], height [1.72 (.06) m], BMI [22.2 (2.7) kg/m²], systolic and diastolic blood pressures [114 (5)/69 (8) mm Hg], fasting glucose [4.5 (.3) mmol/L] and physical activity level [2144 (1428) MET-min/w] pre-RT. No interaction was found for all measures ($p = .350\text{-}.944$). There were no group differences except for Hb, MCHC, and RDW ($p = .001\text{-}.022$). Differences were due to the means (SE) of Hb [C: 15.150 (.194) > NC: 14.396 (.267) g/dL], MCHC [C: 35.071 (.217) > NC: 34.060 (.231) g/dL], and RDW [C: 12.553 (.163) < NC: 13.530 (.328) %] being lower in one group than the other at baseline. C and NC showed similar profile across respective time points. Hct, MCV and MCH increased at UT 0 h ($p = <.001\text{-}.033$) but Hct lowered at UT 24 h ($p = .006$) while MCH remained elevated at UT 24 h ($p = .042$) compared to UT pre. RBC and Hb lowered at UT 24 h compared to UT Pre ($p = .002\text{-}.029$). MCV and MPV increased ($p < .001\text{-}.037$) while MCHC lowered ($p = .022$) at T 0 h compared to T Pre. **CONCLUSION:** Both groups demonstrated similar post-RT responses in erythrocytes profile.
 Supported by NIE AcRF RI 5/14 YFF

886 Board #65 May 31 3:30 PM - 5:00 PM
No Difference in Body Composition and Strength between Consecutive and Non-consecutive Days of Resistance Training

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PURPOSES: Health authorities worldwide recommends 2-3 d/w of resistance training (RT) for health, preferably spread 48-72 h apart. However, it is common among fitness buffs, top athletes and weekend warriors to RT on consecutive days. Yet, effects of recovery period in between RT sessions on many physiological variables are unclear. Therefore, the purpose of this study is to determine the effects of 12 w of either 3 consecutive (C) or non-consecutive (NC) d/w of RT on body composition and strength. **METHODS:** Thirty young, healthy and recreationally active men [25 (SD 2) y] were randomly assigned to either C or NC for 12 w. Both groups performed 3 sets x 10 repetitions at 10 repetition-maximum (RM) of leg press (LP), latissimus pulldown (LAT), leg curl (LC), shoulder press (SP) and leg extension (LE) for each RT session. Body composition using dual-energy X-ray absorptiometry and 10RM for the RT were determined pre- and post-RT. Differences were analyzed using 2x2 mixed design repeated measures ANOVA (with aligned rank transformation for nonnormal data with or without equal variances). **RESULTS:** Both groups were similar in age, weight [65 (10) kg], height [1.72 (.06) m], BMI [22.2 (2.7) kg/m²], systolic and diastolic blood pressures [114 (5)/69 (8) mm Hg], fasting glucose [4.5 (.3) mmol/L] and physical activity level [2144 (1428) MET-min/w] pre-RT. No interaction was found for all measures of body composition and 10RM ($p = .242\text{ to } .999$). There were no group differences ($p = .143\text{ to } .948$) except bone mineral density (BMD), which was higher in C (11.81 kg/m²) than NC (11.08 kg/m², $p = .025$). However, C and NC improved their BMD similarly following RT [+0.19 kg/m²; 95% CI of gain (.11, .28), $p = <.001$]. Both groups also gained weight ($p < .001$; C: 65.7 to 67.0 kg; NC: 63.8 to 65.7 kg) due to lean body ($p < .001$; C: 50.5 to 52.0 kg; NC: 48.6 to 50.6 kg) and bone mass gains ($p = .003$; C: 2.50 to 2.53 kg; NC: 2.30 to 2.32 kg) with an insignificant fat loss ($p = .438$). Body fat % reduced similarly for both groups ($p = 0.029$; C: 18.7 to 18.0%; NC: 19.8 to 18.9%) with no change in fat distribution in the limbs and trunk ($p = .172\text{ to } .898$). Both groups improved 10RM similarly for all exercises ($p < .001$ for all; 55 kg for LP, 22 kg for LAT, 13 kg for LC, 6 kg for SP and 20 kg for LE). **CONCLUSIONS:** Both groups improved body composition and strength similarly post-RT.
 Supported by NIE AcRF RI 5/14 YFF

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A Mobile Application for Improving Gait Characteristics in Community-Dwelling Older Adults

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PURPOSE: Evaluate the efficacy of a mobile health promotion application (app) to improve gait characteristics related to increased fall risk in older adults. **METHODS:** Community-dwelling older adults ($N=38$; age 72.42 ± 12.58) were recruited and randomly assigned to experimental ($n=20$; app with exercise) or control ($n=18$; app without exercise) condition. Pre/post gait analysis at self-selected (SS) and fast walking speeds was measured using the GAITRite® Electronic Walkway. Gait variables included ambulation time (AT), velocity, cadence, step length and width, base of support, cycle time, single and double support time. Statistical analysis included a

mixed-model ANOVA ($p < .05$). RESULTS: No main effects were found. Significant improvements (group x time) were observed for the experimental group at fast walking speed for AT ($\lambda = .878$, $F(1, 36) = 5.01$, $p = .031$, $ES = .122$); velocity ($\lambda = .886$, $F(1, 36) = 4.61$, $p = .039$, $ES = .114$); and step length ($\lambda = .864$, $F(1, 36) = 5.64$, $p = .023$, $ES = .136$). Significance at SS speed included AT ($\lambda = .892$, $F(1, 36) = 4.37$, $p = .044$, $ES = .108$) single support ($\lambda = .887$, $F(1, 36) = 4.59$, $p = .039$, $ES = .113$); and double support time ($\lambda = .886$, $F(1, 36) = 4.63$, $p = .038$, $ES = .114$). The remaining variables were non-significant. CONCLUSION: The mobile health promotion app can significantly improve AT, velocity, step length and body support time during the gait cycle at varying speeds to potentially reduce the risk of falls in older adults. Funded by The Retirement Research Foundation.

888 Board #67 May 31 3:30 PM - 5:00 PM
Nurses' Physical Activity Study: Caring For You So You Can Care For Others

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Nurses face multiple negative stressors and report the greatest stress of all health care workers. The stress can have a negative effect on the health of nurses (e.g., obesity, fatigue, decrease in quality of life and satisfaction with life, and burnout). Stress is common among nurses with negative impacts on a nurse's health as well as the quality of care patients receive. It is important for nurses to implement self-care strategies techniques (e.g., physical activity) to lower feelings of stress.

PURPOSE: To examine the relationship between physical activity levels and measures of health among nurses in eastern NC.

METHODS: Nurses ($n = 62$, 94% females; 85% White; age = 42.2 ± 11.7) were assessed for physical activity via the Fitbit Flex activity tracker over a 7 day period and the International Physical Activity Questionnaire. Nurses reported burnout, stress, and fatigue using self-reported questionnaires. Body mass index was measured by dividing weight (kg) by the participant's squared height (m).

RESULTS: BMI was significantly correlated with moderate-to-vigorous physical activity ($r = -.28$), steps ($r = -.029$), and vigorous intensity physical activity ($r = -.32$). Fatigue was significantly correlated with moderate-to-vigorous physical activity ($r = -.27$). Stress was significantly correlated with steps ($r = -.27$), moderate intensity physical activity ($r = -.25$), and light intensity physical activity ($r = -.40$). Significant associations were also found between quality of life and light intensity physical activity ($r = .40$), moderate intensity physical activity ($r = .30$), and steps ($r = .29$). A relationship was found between high intensity physical activity and burnout ($r = -.23$, $p < .001$) and between steps and compassion fatigue ($r = -.26$, $p < .05$).

CONCLUSIONS: Findings demonstrated that stress, fatigue, and burnout were lowly correlated with physical activity among nurses. Thus, a physical activity intervention among nurses may be needed to fully see the effects of physical activity on nurses' health, and ultimately patient health and safety.

889 Board #68 May 31 3:30 PM - 5:00 PM
Evaluation of a Screening Device that Incorporates the ACSM'S Newly Revised Screening Guidelines

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 (No relationships reported)

Major revisions in the ACSM's screening guidelines will be included in the 10th edition of the ACSM's Guidelines for Exercise Testing and Prescription (GETP). The primary goal of the revised guidelines is to streamline the screening procedures published in the 9th ed. of the GETP by (a) eliminating the assessment of risk factors and stratification of individuals into low, moderate and high risk categories, and (b) possibly reducing the number of individuals needing to obtain medical clearance. A pre-activity screening questionnaire (PASQ) that incorporated the revised guidelines was administered to employees who participated in the 2016 University of South Florida FIT program.

PURPOSE: To evaluate the PASQ by obtaining feedback from FIT participants and the exercise professional who administered the PASQ. **METHODS:** After completing the PASQ, participants were sent an e-mail asking them to complete a survey to determine if the terms and questions in each of the following five sections of the PASQ were clear and understandable: (1) Instructions, (2) Current Physical Activity, (3) Medical Conditions, (4) Signs/Symptoms, and (5) Acknowledgement/Signature. **RESULTS:** Of the 20 participants, 15 (75%) completed the survey including 10 new and five returning FIT participants. All participants indicated "yes" when asked if the terms and questions were clear and understandable in all of the five sections except one participant. This individual indicated that the definitions of moderate and vigorous intensity (in Section 2) were not clear and understandable and commented that there

was not much variance in the activity levels. Regarding level of difficulty to complete the PASQ, 10 indicated "very easy" and five indicated "easy". The professional who administered/interpreted the PASQ indicated the process was easier and more time efficient than the PASQ used for the FIT program in previous years that incorporated the screening guidelines from the 9th ed. of the GETP. Three of the five returning FIT participants also indicated that the PASQ was easier and faster to complete than the previous PASQ. In addition, none of the FIT participants needed to obtain medical clearance compared to previous years in which 25-35% of the participants did. **CONCLUSION:** The PASQ was found to achieve the primary goal of the ACSM's revised guidelines.

890 Board #69 May 31 3:30 PM - 5:00 PM

Perceived Enjoyment Responses to High-intensity Interval Exercise and Continuous Exercise in Physically Inactive Young Men

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Exercise enjoyment is purported to predict future exercise engagement. While the physiological benefits associated with high intensity interval exercise (HIIE) have been well documented, limited information exists regarding individuals' enjoyment of this form of exercise in comparison to traditional continuous exercise modalities, particularly in physically inactive individuals. **PURPOSE:** To quantify rating of perceived enjoyment using the physical activity enjoyment scale (PACES) following HIIE, moderate-intensity continuous exercise, and vigorous-intensity continuous exercise in physically inactive young men. **METHODS:** Twelve physically inactive apparently healthy young men (mean age: 24.33 ± 1.72 years; body mass index: 23.49 ± 4.64 kg m⁻²; VO_{2max} : 44.86 ± 6.55 mL kg⁻¹ min⁻¹) participated in the study. Using a randomized cross over design, participants undertook three running trials consisting of HIIE (10 x 1 min at 100% VO_{2max} interspersed with 10 x 1 min active recovery at 50% VO_{2max}), moderate-intensity continuous exercise (40 min at 65% VO_{2max}) and vigorous intensity continuous exercise (20 min at 80% VO_{2max}). After the completion of all trials, participants were asked to rate their perceived enjoyment using PACES. Statistical analysis was calculated using one-way ANOVA with repeated measures to examine within-subject effect. **RESULTS:** There was no significant difference in perceived enjoyment rating following HIIE (92.42 ± 13.77), moderate-intensity continuous exercise (87.67 ± 15.38), and vigorous intensity continuous exercise (90.58 ± 16.38) ($p = 0.10$). **CONCLUSIONS:** Acute enjoyment responses to HIIE and continuous exercise were similar in physically inactive young adults. Future research is warranted to compare the chronic enjoyment responses to HIIT and continuous exercise in this population.

891 Board #70 May 31 3:30 PM - 5:00 PM

Food Insecurity and Physical Activity Insecurity among Rural Oregon Families

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Obesity rates are higher among rural compared to urban children in the U.S. for reasons that are incompletely understood. Emerging data suggest a relationship between food insecurity (FI) and physical activity (PA) insufficiency among children in the U.S., both factors that have been associated with obesity. Rates of child FI are known to be higher among rural compared to urban households, but research is mixed regarding rural/urban differences in PA. As such, exploring the relationships between FI, PA insufficiency, and obesity may help us better understand the rural/urban differences in child obesity rates.

PURPOSE: To examine the association between FI risk and family diet and PA behaviors associated with child obesity, among a sample of families residing in rural Oregon.

METHODS: Families ($n = 144$) were recruited through six elementary schools (K-5/6) in low-income, rural, Oregon communities. Families completed surveys including a FI risk screener and the Family Stage of Change Survey (FSOC), a measure of readiness to change family-level diet ($n = 6$ items), sleep ($n = 1$ item) and PA ($n = 5$ items) behaviors shown to predict child obesity. Logistic regression was applied to examine associations between FSOC scores and FI risk.

RESULTS: Among families at risk for FI (40.2%), a higher proportion were non-white (77.8% versus 22.2%; $p = 0.036$) and had lower adult education levels (30.4% versus 11.8% with a high school degree or less; $p = 0.015$) compared to families not at risk for FI. Of the 12 FSOC items, only one significant difference emerged between families at risk and not at risk for FI: families at risk for FI scored lower on an item reflecting their readiness to provide and support opportunities for structured PA ($p < 0.001$).

Logistic regression analyses showed the odds for FI risk were 55% lower among families reporting higher readiness to provide and support structured PA opportunities ($p=0.003$).

CONCLUSIONS: FI risk is associated with rural families' readiness to provide PA and support structured PA opportunities for their children. A better understanding of factors relating to readiness and ability to provide structured PA and its relationship to FI may inform future obesity prevention efforts for at-risk families.

Supported by a grant from the National Institute of Food and Agriculture, USDA, award # 2011-68001-30020.

892 Board #71 May 31 3:30 PM - 5:00 PM
Impact of Visual Feedback on Exercise Intensity and Motivation

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(No relationships reported)

PURPOSE: Determine if visual feedback motivates college-aged students to maintain a higher exercise intensity during an indoor cycling class and to ascertain the favored type of visual feedback.

METHODS: Thirty participants took part in a within-subject design experiment. Participants were assigned a heart rate monitor and identification number to record and monitor exercise intensity during each class session. Participants completed three cycling classes that were randomly assigned as a no visual feedback (NF), individual feedback (IF), or group feedback condition (GF). A Spielberger Trait Anxiety survey was completed before the first session and the Spielberger State Anxiety survey was completed before every cycling session. For each condition, participants stated if they enjoyed the heart rate feedback received and using the heart rate monitors. At the end of the study, participants specified the visual biofeedback condition they preferred.

RESULTS: The group feedback condition spent a higher percentage of time above 80% of their age-predicted heart rate maximum. Participants spent 17.5% of their time in the 80-90% heart rate zone and 2.8% in the 90-100% zone. No feedback and individual feedback groups spent 13.2% and 15.1% in the 80-90% heart rate zone and 0.9% and 2.7% in the 90-100% zone. A 1-way repeated measures ANOVA indicated a statistically significant difference between the time spent in the 60-70% heart rate zone between the three conditions. The group feedback condition had the highest average heart rate (138.1 bpm), maximal heart rate (174.4 bpm), and heart rate predicted caloric expenditure (293.5 kcal). A positive correlation was found between the group feedback RPE and enjoyment of group feedback ($r=0.55$, $p=0.01$). The RPE of individual feedback was positively correlated with working harder due to wearing a heart rate monitor ($r=0.54$, $p=0.01$) and receiving individual feedback ($r=0.57$, $p=0.01$). Twenty-one (70%) participants preferred group feedback, 4 participants (13.3%) favored the individual feedback, 1 participant (3.3%) chose no feedback, and 4 participants (13.3%) had no preference.

CONCLUSIONS: Participants favored group feedback over individual feedback and no feedback. Visual feedback was associated with higher exercise intensity and greater enjoyment of the exercise session.

893 Board #72 May 31 3:30 PM - 5:00 PM
Impact Of Sit-to-stand Workstation Use On Physical Fitness: A Pilot Study

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Recent studies indicate sedentary lifestyles have a negative impact on physical fitness. Modifying sedentary daily activities could maintain and improve optimal health. The introduction of sit-to-stand workstations within the workplace provides sedentary employees an opportunity to alternate between sitting and standing positions.

PURPOSE: The purpose of this pilot study was to determine if using a sit-to-stand workstation would improve physical fitness. **METHOD:** Eleven healthy male and female full-time faculty (age = 39.09±10.45 years) volunteered to use a sit-to-stand workstation for a minimum of three hours per workday for one year. Muscular fitness was assessed as hand-grip strength, partial curl-up test, and push-up test. Flexibility was measured using the sit-and-reach test, while estimated $\dot{V}O_{2max}$ was determined through the Queens College Step Test. Balance was evaluated by a timed one-leg stance with eyes closed. **RESULTS:** Six participants completed this one year pilot study. Three participants withdrew from the study due to inconvenience or difficulty using the workstation; one withdrew due to retirement. One additional participant was unable to complete post-testing. Independent samples *t*-tests indicate no difference at baseline in any physical fitness variable between those who completed the study and those who withdrew ($p > .05$). Due to the sample size, no significant differences were observed in physical fitness over the one year period ($p > .05$); however, potential meaningful changes were observed using Cohen's *d* calculations for effect size. Hand-grip strength increased by 3.17 kg ($d = 0.11$, +4.82%), while the number of curl-ups performed

increased by 3.5 ($d = 0.17$, +9.46%). Estimated $\dot{V}O_{2max}$ increased by 1.12 kg/ml/min¹ ($d = 0.31$, +2.57%) and one leg stance with eyes closed increased by 2.62 seconds ($d = 0.15$, +15.20%). **CONCLUSION:** Improvements in strength, balance, and $\dot{V}O_{2max}$ suggest sit-to-stand workstations may have a positive impact on employees' physical fitness. Participants who withdrew due to difficulty of use indicate a need for examining desk selection, instruction of use, and motivational techniques. Further investigation of a larger population should focus on potential physical fitness benefits and functionality for the user of sit-to-stand workstations.

894 Board #73 May 31 3:30 PM - 5:00 PM
Soccer Training Improves Metabolic and Cardiovascular Health in 50-70-yr olds with pre Type 2 Diabetes

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Type 2 Diabetes Mellitus is a pathological condition, which partly is provoked by an inactive lifestyle. **PURPOSE:** To examine effects of soccer training vs. dietary advice on glucose control, metabolic and cardiovascular health status in patients with pre-T2DM. **METHODS:** Fifty 50-70 yr-old untrained participants (26 women and 24 men; age: 61±1 yrs; height: 171±1 cm, weight: 85.7±2.3 kg; $\dot{V}O_{2max}$: 22.1±0.8 ml·min⁻¹·kg⁻¹; mean arterial pressure (MAP): 103±2 mmHg) suffering from pre-T2DM were randomized into a soccer training (SOC; n=26) and control (CON; n=24) group. Both group received standardized dietary advice during a 16-wk intervention period. Additionally, SOC completed two sessions/wk of soccer training. Training consisted of small-sided games being increased progressively from 30 to 60 min per session during the 16-wk intervention period. Pre and post-intervention, the participants completed a maximal oxygen uptake ($\dot{V}O_{2max}$) bike test, an oral glucose tolerance test (OGTT), a DXA-scan, as well as assessments for blood lipid profile, blood pressure and resting heart rate. **RESULTS:** Post-intervention plasma glucose at rest and at 120 min in the OGTT were lowered ($P<0.05$) in SOC and CON, with a greater effect ($P<0.05$) in SOC compared to CON (-2.3±0.3 vs -1.2±0.4 mmol·L⁻¹). After 16 wks $\dot{V}O_{2max}$ was improved ($P<0.05$) by 4.3±0.5 ml·min⁻¹·kg in SOC, which was more than in CON (-0.6±0.5 ml·min⁻¹·kg). In SOC, body fat content and plasma triglycerides were lowered by -3.4±0.6 kg and -0.31±0.06 mmol·L, respectively, and with changes scores greater ($P<0.05$) compared to CON. Moreover, SOC improved ($P<0.05$) resting heart rate, lean body mass and waist circumference to a greater degree than CON. **CONCLUSIONS:** Soccer training in combination with dietary advice improves glucose control, as well as metabolic and cardiovascular health to a greater degree than dietary advice alone in 50-70 yr old patients with pre-T2DM.

Supported by a grant from the Faroese Research Council.

895 Board #74 May 31 3:30 PM - 5:00 PM
Do University Fitness Classes Meet Acsm'S Daily Activity Recommendations

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(No relationships reported)

Purpose: The obesity crisis facing the American population is well documented. The American College of Sports Medicine (ACSM) recommends individuals exercise for 30 minutes five days a week at moderate intensity. College and University activity courses may be one avenue for obtaining such activity. **Methods:** To determine if college activity courses meet this requirement, physical activity was monitored in 78 students during their class activity period. The students were men and women between the ages of 18-35. Actigraph GTX9 accelerometers were used to estimate caloric expenditure as well as time spent in sedentary, light, and moderate intensity zones. **Results:** 3 out of the 8 fitness courses measured provided students with 30 minutes or more of physical activity, meeting ACSM recommendations. **Conclusion:** While college activity courses are a good supplement to an individual's physical activity regimen, many courses should not be considered sufficient to provide all of the daily exercise a student needs.

B-62 Free Communication/Poster - Aging in Skeletal Muscle and Bone

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

896 Board #75 May 31 3:30 PM - 5:00 PM
Chronic Systemic Inflammation, Physical Activity and Skeletal Muscle in Elderly

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(No relationships reported)

PURPOSE: It is hypothesized that chronic systemic inflammation is influenced by physical activity level and is involved in the age-related decline in muscle function. The impact of physical activity behaviours on the level of C-reactive protein (CRP) and tumour necrosis factor alpha (TNF- α) in elderly women is investigated. The impact of chronic systemic inflammation on muscle mass and the cellular and molecular mechanisms behind the putative inflammation-mediated action on human muscle cells are explored.

METHODS: Total amount of sedentary time, 30-minute periods of sedentary time and breaks in sedentary behaviour and time spent in moderate-to-vigorous physical activity (MVPA) were assessed using accelerometry in a cohort of 89 elderly women. Serum HsCRP and TNF- α were measured. The proliferative and metabolic capacity of human muscle cells obtained from vastus lateralis and exposed to CRP are assessed. **RESULTS:** No variables of sedentary behaviour were significantly associated with the level of CRP or TNF- α . In contrast, time spent in MVPA was inversely associated with the level of CRP, independently of sedentary behaviour and waist circumference, but not TNF- α . Serum CRP levels were inversely associated to skeletal muscle mass. Elevated serum CRP levels were associated to reduced proliferative rate of human muscle cells and changes in the regulation of the size muscle cells.

CONCLUSIONS: Elevation in the inflammatory status in elderly is influenced by the amount of time spent in MVPA and exerts detrimental effects on skeletal muscle mass.

897 Board #76 May 31 3:30 PM - 5:00 PM
Biomarkers of Senescence in Aging Skeletal Muscle

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(No relationships reported)

PURPOSE: Cells enter into a state of senescence in response to certain stressors, such as aging and age-related diseases. It is proposed that senescent cells drive pathogenesis (e.g., atherosclerosis). Hence, it is possible that senescent cells underlie sarcopenia. Biomarkers of senescence include p53, p21, p16, IL-6, and senescence associated beta-galactosidase (SA β -gal). These biomarkers have been extensively investigated using in vitro cell culture experimentation. The purpose of this study was to explore the role of senescence as a potential driver of age-associated sarcopenia. We hypothesized that biomarkers of senescence will be increased in aging skeletal muscle and it is highly associated with sarcopenia.

METHODS: To identify biomarkers of senescence in aging skeletal muscle, the extensor digitorum longus (EDL) and tibialis anterior (TA) muscles were excised from male C57BL/6 adult (<12 months, N=11) and elderly (>28 months, N=11) mice. The EDL was then used to assess ex vivo whole muscle physiology while the TA was used for histological and biochemistry analyses. Western blotting was performed to determine the expression of p53, p21 and p16, and an ELISA was performed to detect IL-6 content. Senescent cells were determined by SA β -gal staining. **RESULTS:** Muscle wet weight and absolute force production were significantly reduced in the elderly group. Aging resulted in a significant increase in p21 and IL-6, but did not alter p53 or p16 expression. Because the identification of senescent cells by SA β -gal staining was very low the statistical comparison between adult and elderly was not performed.

CONCLUSIONS: Taken together, selective biomarkers of senescence are present in muscles from elderly mice. Because p21 and IL-6 both increased in the elderly muscle, it is possible that these proteins play a role in the development of age-associated sarcopenia.

898 Board #77 May 31 3:30 PM - 5:00 PM

The Effect of Weighted Vest Use During Caloric Restriction on Bone Health in Obese Older Adults

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(No relationships reported)

PURPOSE: To explore the effects of weighted vest use during caloric restriction on bone density and turnover.

METHODS: 37 obese older adults underwent a 5.5 month dietary weight loss intervention (1000-1300kcal/d) with (D+V; n=20) or without (D; n=17) weighted vest use (10+ hrs/d). Bone mineral density (BMD) of the total hip, femoral neck and lumbar spine, and biomarkers of bone turnover (OC, BALP, PINP, CTX) were measured. General linear models, adjusted for baseline values of the outcome and gender, were used to examine intervention effects.

RESULTS: Mean age of participants was 70.1 \pm 3 years, 78% were female, 78% were Caucasian, and baseline BMI was 35.3 \pm 2.9 kg/m². Average weight loss was 11.2 \pm 4.3 kg and 11.0 \pm 5.9 kg in the D+V and D groups ($p=0.94$), and average weighted vest use was 6.7 \pm 2.3 hrs/day. No significant changes in BMD or biomarkers were observed, although trends were noted for total hip BMD and BALP. Loss in total hip BMD was greater in the D group compared with D+V (Δ : -18.7 [29.3, -8.1] mg/cm² versus -6.1 [-15.7, 3.5] mg/cm²; $p=0.08$). BALP increased in the D+V group by 3.8% (Δ : 0.59 [-0.33, 1.50] U/L) and decreased by -4.6% in the D group (Δ : -0.70 [-1.70, 0.31] U/L, $p=0.07$).

CONCLUSIONS: Weighted vest use during weight loss may attenuate loss of hip BMD and increase bone formation.

Funding for this study was provided by the Arthritis and Musculoskeletal Disease Research Center, and Center for Integrated Medicine at Wake Forest School of Medicine, and the Translational Science Center of Wake Forest University. An in-kind product donation was made by Jason Pharmaceuticals, Inc.

899 Board #78 May 31 3:30 PM - 5:00 PM

Age-dependent Genomic Responsiveness Following Stretch-shortening Contraction Training In Rats

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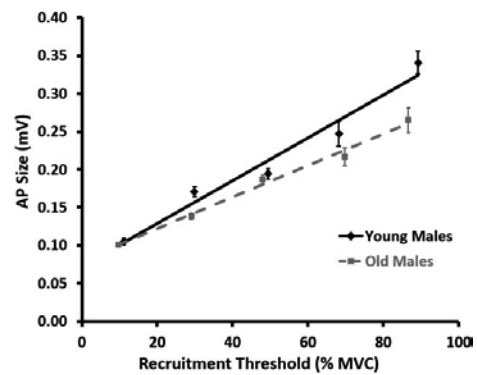
When administered repeatedly, "resistance-type" exercise training may result in adaptation; but, if not properly prescribed, may also result in maladaptation. Maladaptation is characterized by diminished muscle performance and/or muscle mass enhancement. Nevertheless, the genomic response owing to age-dependent adaptation or maladaptation has not been fully established. **PURPOSE:** Our aim was to characterize the genomic responses to adaptation or maladaptation following stretch-shortening contraction (SSC) training with aging. **METHODS:** Dorsiflexor muscles of F344xBN hybrid rats (N=8 per group) were exposed to 1 month of training using a custom-built dynamometer *in vivo*. Transcriptional microarray analysis was conducted in the tibialis anterior 24 hours following the final session. Genes fulfilling the criteria of fold change < -1.1 and > 1.1, $p < 0.05$, and False Discovery Rate $p < 0.05$ were considered significant and analyzed by Ingenuity Pathway Analysis (IPA). **RESULTS:** Concomitant with age-dependent adaptive and maladaptive functional outcomes, transcriptional microarray analysis of muscles from young rats differentially expressed 475 genes following SSC training, while muscles of old rats differentially expressed 1095 genes. Bioinformatic analysis revealed that cellular function and maintenance was a major biological process and tissue development was a major physiological function overrepresented with genes altered by SSC training in young rats, while small molecule biochemistry was a major biological process and organismal development was a major physiological function overrepresented in old rats. Furthermore, in young rats, upstream regulator analysis predicted the activation of CREB1 (z-score 3.144) involved in transcriptional regulation and growth with a parallel inhibition of TSC2 (z-score -2.538) a negative regulator of cell size. In contrast, old rats displayed activation of MAP4K4 (z-score 4.526) involved in apoptotic signaling with concurrent inhibition of PPARC1A (z-score -4.347) that's involved in mitochondrial biogenesis and hypertrophy. **CONCLUSIONS:** The results highlight an altered age-dependent genomic pattern of responsiveness subsequent to SSC training, and emphasizes the molecular features which accompany these disparate outcomes.

900 Board #79 May 31 3:30 PM - 5:00 PM
Regression Equation To Predict Body Fat In Elderly Women Using Body Circumference Measures
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 (No relationships reported)

Purpose: The purpose of this study was to develop and validate an equation to estimate body composition in elderly women above 60 years of age using body circumference measures. **Methods:** The sample consisted of 60 women individuals with an average age of 68.23 ± 5.84 years, 63.97 ± 10.65kg, 1.542 ± 0.52m from the Vitória metropolitan area. The group was split into two subgroups: a regression group (n=50) used to develop the equations and a validation group (n=10) used for cross reference. A multiple linear regression was used to develop the equation. Both equations were compared using the Student's *t* test for paired samples. The reliability of the equations was analyzed by the *Blant and Altman* method. **Results:** The regression group had the following descriptive metrics: age 67.62 ± 5.87 years, body weight 64.27 ± 11.11kg, height 1.53 ± 0.11m; and percent body fat 41.73 ± 5.69%. The validation group had the following descriptive metrics: 71.3 ± 4.8 years, body weight 62.49 ± 8.34kg, 1.55 ± 0.53m; and percent body fat 41.75 ± 4.04%. Body circumferences variables were used to develop equations to predict body fat. Using the stepwise selection criteria, the following equation was developed: % body fat = 0.343 (hip) + 0.289 (waist) - 0.0714 (handle)². Several parameters validated the strength of the equation: R² = 0.997; EPE = 3.29; EPE ≤ 3.5%; and validation of the model based on the partial significance (F) of the subset of variables that showed the strongest effect. **Conclusion:** It is possible to develop an accurate and specific equation to estimate of body fat percent in elderly women using circumference measurements. The more important is that is easy to use by health professionals.

901 Board #80 May 31 3:30 PM - 5:00 PM
Motor Unit Action Potential Size In Young And Old Males
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PURPOSE: To examine the effect of aging on action potential size (AP_{size}) of motor units (MUs) across the relative recruitment threshold (rRT). **METHODS:** Nineteen young (YM: age = 21.68 ± 2.31 yrs., BMI = 26.07 ± 4.89 kg·m⁻²) and eighteen older (OM: 63.55 ± 8.02 yrs., BMI = 27.94 ± 4.12 kg·m⁻²) untrained males participated in this study. Upon completion of a familiarization, subjects performed 2 maximal voluntary isometric ramp contractions (MVCs) of the knee extensors using an isokinetic dynamometer while 4 surface electromyography (sEMG) signals were recorded from the vastus lateralis using a 5-pin surface array sensor. The raw sEMG signals were decomposed into their constituent MU action potential trains to determine the rRT and AP_{size}. rRT was defined as the relative force level (%MVC) when the MU began firing, and AP_{size} was considered the maximum peak-to-peak amplitude (mV). Linear regression was used on the pooled and individual data for YM and OM separately to examine the relationship between rRT and AP_{size}. For the pooled data, bin widths of 20% were used for rRT. The means for individual slope coefficients (SLP_c; mV/%MVC) were compared between the YM and OM using independent samples *t*-tests. **RESULTS:** A total of 810 MUs were detected (YM: 389; OM: 421). The regression equations for the pooled data were - YM: $y = 2.82e^{-03}x + 7.18e^{-02}$; R² = 0.965 and OM: $2.09e^{-03}x + 8.01e^{-02}$; R² = 0.991. SLP_c was greater in YM compared to OM (+40.8%; *p* = 0.013). A qualitative, visual inspection of the regression lines for the pooled data (figure below) suggest that AP_{size} for MUs at a higher rRT (i.e., >60%) were most affected in OM. **CONCLUSIONS:** Our findings indicate that aging negatively affects the relationship between rRT and AP_{size}. Specifically, AP_{size} for later-recruited MUs was substantially decreased in OM which may indicate a MU-specific decrease in sarcolemma area and/or excitability due to aging.



902 Board #81 May 31 3:30 PM - 5:00 PM
IGF-1 Response In Middle-aged And Older Men During Continuous And Intermittent Cycling At Lactate Threshold
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 (No relationships reported)

Insulin-like growth factor-1 (IGF-1) is a trophic factor promoting growth and survival in various types of cells including muscle cells and neurons. In our recent study, young men showed comparable IGF-1 responses in continuous and intermittent exercise at lactate threshold, whereas stress responses were smaller in the intermittent exercise. It is yet unclear if the exercise format affects the IGF-1 response in older individuals. **PURPOSE:** To compare changes in the circulating level of IGF-1 in middle-aged and older men during continuous and intermittent cycling at lactate threshold. **METHODS:** Six men, middle-aged and older (57.8 ± 11.6 years), randomly performed two cycling tests at lactate threshold load (108.8 ± 27.3 W) and a control test with rest on separate days. The cycling tests comprised a 20-min continuous cycling (CC) and an intermittent cycling (IC) consisting of 20 repetitions of 1-min bouts separated by 30-sec rests. The control test was administered with a schedule identical to CC. During each session, blood samples were drawn via peripheral cannulation at rest, at 25, 50, and 100% of cycling time, and 10 min after cycling. A blood concentration of IGF-1 and those of lactate, cortisol, and catecholamines were measured at each time point. Two-way analyses of variance for repeated measures with post-hoc tests, if appropriate, were performed to mainly compare changes between CC and IC. **RESULTS:** Significant interactions were found in all the indices (*p* < .05). Changes in IGF-1 concentration were comparable between CC (102.0 ± 29.3 to 116.0 ± 30.2 ng/ml, *p* < .05) and IC (104.2 ± 33.6 to 112.0 ± 38.6 ng/ml, *p* < .05). In contrast, although concentrations of lactate and norepinephrine increased in both CC and IC (*p* < .05), the effect was greater for CC (*p* < .05). Furthermore, dopamine concentration increased only in CC (*p* < .05) while cortisol concentration decreased in IC (*p* < .05) but not in CC. **CONCLUSIONS:** As previously shown in young men, intermittent cycling at lactate threshold evoked an IGF-1 response comparable to its continuous counterpart in men middle-aged and older, but the two cycling formats induced different stress responses. These results suggest that moderate intermittent exercise has the potential to stimulate the IGF-1 pathway without considerable stress in older individuals. Supported by JSPS 25242065.

903 Board #82 May 31 3:30 PM - 5:00 PM
Ageing Affects Cell Cycle Regulation In Human Skeletal Muscle Undergoing Atrophy And Regrowth
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 (No relationships reported)

Cellular senescence is an irreversible arrest of cell division, which could influence the regenerative potential of skeletal muscle stem cells (satellite cells) during aging. The molecular mechanism of senescence is complex and involves epigenetic control of the Polycomb repressive complexes, as well as CDKN2A (p16) and TP53 tumor mediated repression of cyclin dependent kinases and G1 cell cycle arrest. **PURPOSE:** To investigate the effect of ageing on satellite cell cycle regulation in human skeletal muscle undergoing atrophy and regrowth induced by short-term immobility and subsequent reloading. **METHODS:** Myofiber atrophy was induced by application

of a knee-brace for a period of 4 days in young (Y, ~20 yrs, n=9) and aged (O, ~70 yrs, n=9) individuals. Muscle regrowth after atrophy was induced by 6 days of re-ambulation supplemented by one session of supervised unilateral resistance training for the disused leg 3 days after brace removal. Muscle biopsies (VL) were collected pre and at 1d, 2d and 4d of immobility and after additional 6 days of re-mobilization (10d). Protein and mRNA expression levels of CDKN2A (p16), CDKN1A (p21), CDKN1B (p27), TP53 and PCNA were determined using real-time RT-PCR and Western blotting, respectively. Satellite cell content was determined by immunohistochemical expression of Pax7. **RESULTS:** Satellite cell content increased in Y at 4d and 10d with no changes in O ($p < 0.05$). p16 mRNA was upregulated at 2d and 4d in O compared to Y and at 10d in Y and O compared to pre ($p < 0.05$). TP53 mRNA was upregulated at 2d in O and at 4d in Y and O compared to pre, while downregulated at 10d in Y and O compared to 4d ($p < 0.05$). p27 mRNA was downregulated in Y and O at 4d and 10d compared to pre ($p < 0.05$). p16 protein increased in O at 1d (7.2-fold) and 2d (3.9-fold) compared to Y and decreased to pre levels in Y and O at 10d ($p < 0.05$). PCNA protein was upregulated in Y (5.5-fold) but blunted in O (1.6-fold) at 10d compared to pre ($p < 0.05$). **CONCLUSION:** p16 and TP53 early (2-4 days) were selectively upregulated during immobility in O compared with Y subjects, suggesting that cellular senescence and SC cycle arrest could be implicated in the defective regenerative response in O compared to Y. Further analysis of epigenetic modifications may provide further explanation for the present findings.

904 Board #83 May 31 3:30 PM - 5:00 PM
Age-Related Reductions in Muscle Quality Influence the Relative Differences in Strength and Power
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Recent studies have demonstrated that age-related changes in the relative differences in isokinetic strength and power may reflect fast twitch fiber alterations. It is possible skeletal muscle ultrasound (US) imaging may reflect these changes. **PURPOSE:** The purpose of this study was to examine the influence of muscle quality on the relative differences in strength and power in younger and older adults. **METHODS:** Twenty young (20.1±1.5 yrs) and 20 older (69.5±3.1 yrs) healthy, recreationally active men performed two plantar flexion maximal voluntary isometric actions (MVCs) and three maximal isokinetic actions on a calibrated isokinetic dynamometer. Panoramic brightness-mode US images of the medial and lateral gastrocnemius were taken to determine subcutaneous fat corrected echo intensity (EI) to represent muscle quality. Isokinetic peak torque (PT), mean power (MP), and peak power (PP) at 0.52 rad·s⁻¹ and 2.09 rad·s⁻¹ were normalized as %MVC. Six separate 2-way mixed factorial analyses of variance were used to evaluate absolute and normalized PT, MP, and PP. Independent samples t-tests were used to compare isometric PT, EI, %decrease in PT and %increase in MP and PP between the younger and older men. Pearson's correlation coefficients were used to examine the relationship between EI and the %decrease in PT, %increase in MP, and %increase in PP. An alpha of $P \leq 0.05$ was used to determine statistical significance. **RESULTS:** The younger men exhibited greater absolute isometric PT, isokinetic PT, MP, and PP at 0.52 rad·s⁻¹ and 2.09 rad·s⁻¹ ($P = 0.001-0.003$). After normalizing to isometric PT, age-related differences were eliminated. The older men exhibited higher EI ($P < 0.001$), greater %decrease in PT (43.6% vs. 38.9%; $P = 0.006$), and lower %increase in MP (167.5% vs. 186.3%; $P = 0.049$) and PP (125.5% vs. 144.5%; $P = 0.006$). Echo intensity was significantly related with the %decrease in PT ($r = 0.605$; $P < 0.001$), %increase in MP ($r = -0.419$; $P = 0.009$), and %increase in PP ($r = -0.605$; $P < 0.001$) from 0.52 rad·s⁻¹ to 2.09 rad·s⁻¹. **CONCLUSIONS:** The absolute age-related reductions in isokinetic strength and power are eliminated with normalization. However, the relative differences from slow to fast velocities may reflect the age-related decreases in fast-twitch fiber and subsequent alterations in muscle quality.

905 Board #84 May 31 3:30 PM - 5:00 PM
Exercise Reduce The Rate Of mtDNA Deficiency And Mutation In Aged Muscle
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 (No relationships reported)

Calorie restriction and exercise can relieve the oxidative damage in skeletal muscle caused by the aging, but it is still unclear that whether these two factors improved the rate of deficiency and mutation of mtDNA in skeletal muscle by the increase of mitochondrial repair enzyme (OGG1).

Purpose: Study the effect from the calorie restriction and exercise to the mitochondrial repair enzyme OGG1, nuclear-encoded COX I and mitochondria-encoded COX IV, and thus exploit the variation of the rate of mitochondrial deficiency and mutation (RMD) in aging mouse.

Method: Grouping 32 mice in 24 months into 4 groups: control (C), calorie restriction (CR, 60% diet of control group), exercise (E, running in treadmill in the angle of 5, the intensity of 64% VO₂ max for 60 min, the rate of 15m/min and the frequency of 5 days a week for 12 weeks) and calorie restriction combined exercise (CR+E). Decollated the model animal 24 h after the last intervention, and then collected the red muscle (gastrocnemius) and white muscle (rectus femoris) in hind legs.

Results: The rate of mutation and deficiency (ultraviolet spectroscopy and gel-imaging) was significantly lower in E (red: 0.089±0.007, $P < 0.05$; white: 0.091±0.006, $P < 0.01$) and CR+E (red: 0.081±0.004, $p < 0.01$; white: 0.089±0.006, $p < 0.01$) than in C. The level of α -OGG1 (Western-blotting) in CR+E (1.302±0.086) was significantly higher than that in CR (0.859±0.073, $P < 0.05$). The level of β -OGG1 was higher in CR+E (1.302±0.086) than in C (0.816±0.062, $P < 0.01$). In red muscle, the level of COX I (Western-blotting) was significant higher in E (1.02±0.043, $P < 0.01$) and CR+E (0.94±0.091, $P < 0.01$) than in C compare to C (0.790±0.052), the level of COX IV was significant higher in CR+E (0.848±0.152, $P < 0.01$) than in C (0.578±0.051). In white muscle, the level of COX I was significantly lower in E (0.807±0.072) than in C (0.990±0.080, $P < 0.01$), and the level of COX IV was significant lower in CR+E (0.740±0.104, $p < 0.01$) than in C (0.903±0.081).

Conclusion: Exercise and calorie restriction reduce mtDNA deficiency, increase the level of OGG1 in skeletal muscle, increase mitochondrial biogenesis in red muscle, but not in white muscle, thus enhance the ability of aging skeletal muscle to resist the oxidative damage. (This report is supported by NSFC 31271275. Corresponding author: wenli34@hotmail.com)

906 Board #85 May 31 3:30 PM - 5:00 PM
Does Running And Bone Mineral Density Affect Blood Pressure In Non- And Post-menopausal Women
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 (No relationships reported)

The literature is mixed as to the benefits of weight bearing activities such as running on osteogenic responses for non- (N-MEN) and postmenopausal (MEN) women. **PURPOSE:** Therefore, this study was designed to compare bone mineral density (BMD) in N-MEN and MEN women with a running (RUN) history and those who were not runners (N-RUN). **METHODS:** A repeated measures design was employed as 100 Women (30 N-RUN/N-MEN; 12 N-RUN/MEN; 42 RUN/N-MEN; 16 RUN/MEN) were evaluated for differences and relationships between BMD, blood pressure (BP) and body composition. **RESULTS:** Although the MEN women were older (MEN 55.6 yrs. vs N-MEN 36.2 yrs.) the MEN women did not differ for body fat% (MEN 38.5%; N-MEN 34.5%, $p < 0.05$) but did differ for BMD (MEN 1.11 vs N-MEN 1.23). Weight and central adiposity as measured by waist circumference was related to BMD in both RUN ($r = 0.43$; $p < 0.01$) and N-RUN ($r = 0.28$; $p < 0.05$). Age was the only factor that produced a difference ($p < 0.05$) in BMD in the N-MEN and MEN. The RUN/MEN had a trend toward a higher BP than the other groups and this may have contributed to their BMD response not being higher than the N-RUN. **CONCLUSIONS:** Although further study is needed to validate the findings in this study, these data indicate that a history of running does not result in a higher BMD or lower BP in MEN women. This may have been partially because body composition was not different between the groups and therefore the runners were not placing greater stress on the bone response.

907 Board #86 May 31 3:30 PM - 5:00 PM
Notch Reduces Muscle Injury in Aged Mice Following Downhill Running
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PURPOSE: It is known that Notch signaling regulates skeletal muscle repair and is suggested to be inhibited in aged muscle. However, little is known about the effects of Notch on muscle injury following exercise in aged mice. The purpose of this project is to determine the impact of Notch signaling on aged skeletal muscle injury following downhill running (DHR). **METHODS:** C57B/J6 and CBF1 mice (20-25 mo old) served as controls or performed a bout of DHR (~11m/min, -15% grade) until exhaustion. A Notch inhibitor (GSI) or Notch force-activator (FA) reagent were injected into the left gastrocnemius and PBS (control) was injected into right gastrocnemius starting at 24h post exercise. Haemotoxylin and Eosin staining was used to quantify muscle injury. **RESULTS:** In C57B/J6 mice, DHR induced injury in GSI (4D: $P = < 0.001$; 5D: $P = < 0.001$; and 6D: $P = < 0.001$) and PBS-treated (4D: P

= 0.016; 5D: P = 0.004) muscles. Relative to PBS, GSI increased muscle injury two-fold 4D-6D post-exercise (P < 0.001). DHR did not induce significant muscle injury in CBF1 mice (P = 0.12). FA reduced muscle injury compared to PBS (P = 0.04). **CONCLUSIONS:** Notch inhibition appears to increase muscle injury post-exercise, while Notch activation appears to reduce injury. Supported by UNC Charlotte Faculty Research Grant

908 Board #87 May 31 3:30 PM - 5:00 PM
Adiponectin Is Inversely Associated With Estimated Intramuscular Fat Index In Middle-aged And Elderly Adults

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(No relationships reported)

Adiponectin is a fat tissue-derived adipokine, and it has beneficial effects on lipid metabolism, and plays a protective role in the development of metabolic syndrome. Adiponectin is inversely associated with insulin resistance, and low levels of adiponectin are correlated with visceral adipose tissue (VAT). Age-induced intramuscular fat accumulation is implicated in insulin resistance and type 2 diabetes. Therefore we hypothesized that intramuscular fat is also associated with adiponectin. **PURPOSE:** The present study aimed to determine the relationship between adiponectin and estimated intramuscular fat index in middle-aged and elderly adults. **METHODS:** Twenty-two physically active middle-aged and elderly adults (mean age 68.7±4.4 years, mean body mass index 22.2±2.2 kg/m²) participated in this study. We assessed echo intensity as the intramuscular fat content index by using ultrasonography. Echo intensity of the vastus lateralis at the mid-thigh was measured, which was calculated based on the mean of grey scale. Blood samples were collected for the measurement of adiponectin. Waist circumference was measured at the level of the navel as the VAT index. **RESULTS:** Echo intensity was 70.2±6.2 a.u. and adiponectin was 12.4±8.8 µg/mL in the subjects. Adiponectin was inversely correlated with echo intensity (r=-0.43, p<0.05), and waist circumference (r=-0.46, p<0.05). After controlling for waist circumference, there remained a significant inverse association between adiponectin and echo intensity (r=-0.47, p<0.05). **CONCLUSION:** This suggests that adiponectin affects intramuscular fat content; independent of VAT. This study was supported by KAKENHI grant #23650432 and the Descente and Ishimoto Memorial Foundation for the Promotion of Sports Science.

909 Board #88 May 31 3:30 PM - 5:00 PM
Age-related Changes In Contractile Function Of Mouse Soleus And Edl Muscles

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(No relationships reported)

PURPOSE: Rodent models are often studied to gain insight into aging in human muscle. However, lifespan is not consistent across rodent species or strains, and muscular impairments may not occur at the same relative age (i.e., % survival). We have previously reported ~25% loss of muscle force in rats in early-stage aging, despite smaller (8-15%) declines in muscle mass. It has been suggested that mice, despite shorter lifespans, exhibit less sarcopenia than rats. The goal of the present study was to study the contractile responses of two muscles in aging mice of the same absolute age (24 months), but greater relative age (75% survival, ~ 75 yo in humans), as the rats we have previously studied. **METHODS:** *Ex vivo* contractility was studied in the soleus (SOL) and extensor digitorum longus (EDL) muscles of adult (n=6, 12 mo.) and aged (n=7, 24 mo.) male, C57Bl/6 mice. All muscles underwent force-frequency relation (FFR) testing and fatigue. Force, muscle quality (force/cross-sectional area (CSA)) and contractile properties for twitch and peak tetanic stimulation were determined for each muscle. **RESULTS:** Overall analysis of the FFR revealed a significant main effect of muscle and age x frequency and age x frequency x muscle interactions (all P < 0.001). Muscle mass did not differ with age, although there was a trend toward an effect in SOL (P = 0.062). Age significantly (P = 0.035) reduced twitch force in the EDL, but not the SOL, and maximum tetanic force showed no effect of age in either muscle. Twitch contractile properties did not differ with age or muscle. However tetanic rates of force development and relaxation in the EDL were reduced with age (P = 0.065 & 0.098, respectively), differences which became significant when normalized to force (P = 0.018 & 0.035, respectively). No differences in muscle fatigue were found in either muscle. **CONCLUSIONS:** Relative to aging rats, aging mice exhibit modest changes in muscle mass and force in both the EDL and SOL. Changes in force appear largely determined by changes in mass. Since many studies of human aging indicate that

loss of force exceeds loss of strength, these data suggest that mice may not fully recapitulate all aspects of aging human muscle. Future studies should make efforts to examine muscles other than the EDL and SOL to determine if other muscles more closely model aging human muscle.

910 Board #89 May 31 3:30 PM - 5:00 PM
Dysregulated Extracellular Matrix Remodeling Of Aged Human Skeletal Muscle Following Damaging Exercise.

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Aged skeletal muscle has a diminished capacity to regenerate following injury. Effective regeneration of skeletal muscle necessitates the widespread remodeling of its extracellular matrix (ECM). Tenascin C is an ECM protein that is markedly increased following skeletal muscle damage, and is critical for effective ECM remodeling and subsequent muscle regeneration. **PURPOSE:** To assess markers of muscle damage and extracellular matrix remodeling in skeletal muscle of old (65+ yrs) and young (18-30 yrs) adults. We hypothesized that tenascin C expression would be dysregulated in older adults following exercise-induced muscle damage. **METHODS:** 10 young (22.7 ± 2.25 yrs) and 8 old (70.9 ± 7.5 yrs) participants completed 300 lengthening contractions (LC) on a biodes dynamometer to induce muscle damage. Soreness and muscle function were measured and muscle biopsies taken pre-exercise and at 3, 24, and 72 hours post-exercise from the vastus lateralis muscle. **RESULTS:** Both age groups performed a similar amount of work during LC (young: 44,718 ± 13,730 vs old: 49,038 ± 10,217 J; p=0.47). Soreness increased in both groups, with no differences between age groups (p=0.1). Additionally, both age groups demonstrated a marked decrease in functional measures following LC, which remained reduced out to 72 hours post-exercise (p<0.05). As expected, young subjects showed significantly higher absolute values in each of the functional measures compared to old at the pre-exercise time point. However, young subjects showed a significantly higher percentage of torque (53.6 ± 5.19 vs 34.5 ± 7%), and power (57.4 ± 23 vs 34.4 ± 19%) loss following LC compared to old subjects. Expression of tenascin C was significantly elevated in both old and young groups 24h following LC (p<0.001). Overall, there was a significant main effect of group, with the older group demonstrating greater tenascin C expression. However, there was no significant timexgroup interaction, indicating that tenascin C responds similarly between young and old muscle following LC. **CONCLUSION:** Elevated expression of Tenascin C may contribute to the reduced capacity of aged muscle to adapt following muscle damage. These data also demonstrate increased functional sensitivity in young muscle compared to old following a damaging bout of lengthening contractions.

911 Board #90 May 31 3:30 PM - 5:00 PM
IMCL:EMCL and rVO2 Changes following Vitamin D Repletion and Aerobic Training In Aged Individuals

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Extramyocellular (EMCL) and intramyocellular (IMCL) lipid is associated with muscle metabolic dysfunction in aging. We recently reported a positive linear relationship between vitamin D status and IMCL in aged individuals that was independent of body mass and physical activity. The combined effect of vitamin D and exercise on muscle lipid has not been investigated. **PURPOSE:** Compare the magnitude of changes in myocellular lipid stores and local muscle oxygen consumption rate following combined treatment of vitamin D repletion and aerobic training (DAT) compared with vitamin D repletion alone (D), aerobic training alone (AT), and control conditions (Ctl). **METHODS:** Aged subjects (>60 YO) with vitamin D insufficiency (25(OH)D < 32 ng/mL) were randomized to a double blinded, 2X2, four group design. Vitamin D₃ (10,000 IU X 5 days/week) or placebo was provided for 12 weeks with 1 additional week (7 consecutive days) of aerobic training or no training. Gastrocnemius IMCL and EMCL were measured with magnetic resonance spectroscopy and fat segmentation. Hybrid near-infrared and diffuse correlative spectroscopy measured local tissue blood flow, oxygen saturation, and VO₂ during and following (recovery) a gastrocnemius fatiguing protocol. All measurements were completed at week 0 and at end-study. **RESULTS:** Ten males and 9 females completed all measures. Mean age and BMI were 67.2±6 YO and 25.9±4 kg/m², respectively. Mean 25(OH)D concentrations increased significantly in subjects receiving vitamin D (45±16) vs. placebo (10±5)(p<0.05). Although not significant by group, DAT (n=5) experienced a mean reduction in IMCL:EMCL ratio of 33%, compared to a 9% reduction in AT (n=4), 6% reduction in D (n=6) and a gain of 12% in Ctl (n=4). This corresponded to a 26% increase in rVO₂ during full exercise recovery in DAT compared to an 11%, 24%, and 11% reduction in AT, D, and Ctl, respectively.

Abstracts were prepared by the authors and printed as submitted.

CONCLUSIONS: These data suggest a trend that vitamin D, when combined with exercise, may potentiate the metabolic benefits of exercise by affecting muscle lipid deposits and altering tissue-level VO_2 . These data also provide an indication of effective metabolic response to a dietary supplement and exercise intervention. Future work will examine muscle mitochondrial function as a potential target of action of vitamin D + exercise on muscle metabolism.

912 Board #91 May 31 3:30 PM - 5:00 PM
Relationships of Muscle Quality among Back, Lower and Upper Limbs in Older Individuals
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The ratio of fat tissue within a skeletal muscle (i.e. intramuscular fat) is accessed as muscle quality. It is well known that muscle quality becomes worse with aging by increasing of intramuscular fat and/or decreasing of muscle tissue. It is shown that intramuscular fat is related to physical dysfunction and insulin resistance. However, this result was given from only a selected region such as quadriceps femoris. It is not well understood that the relationships may also be found the other regions of muscle such as posterior of the thigh, low back or upper limb. **PURPOSE:** The purpose of this study was to assess the relationships of muscle quality among low back, anterior and posterior region of the thigh, and upper limbs in older men and women. **METHODS:** Seven men (age, 74 ± 5 years; height, 161 ± 7 cm; weight, 60 ± 7 kg) and fifteen women (age, 80 ± 8 years; height, 147 ± 5 cm; weight, 48 ± 8 kg) participated in this study. B-mode transverse ultrasonographic images were taken from rectus femoris (RF), biceps femoris (BF), multifidus (MF) and triceps brachii (TB). Echo intensity (EI) as an index of muscle quality was calculated in these muscles. We measured physical performance tests, i.e. isometric knee extension peak torque, functional reach, one-leg stand, 30-sec chair stand, hand grip strength, 5-m normal/maximal walk, and timed up and go, and blood biochemistry. **RESULTS:** There was significantly difference in EI in MF between men and women (men, 48.1 ± 7.3 a.u. vs. women, 59.5 ± 10.3 a.u., $P < 0.05$), but not in the other regions. Significant relationships were confirmed among EIs in RF, BF and TB ($r = 0.46$ to 0.50 , $P < 0.05$), but not in MF and other muscles ($r = 0.23$ to 0.39). Mean EI of upper and lower limbs ($[(EI \text{ in RF}) + (EI \text{ in BF}) + (EI \text{ in TB})] / 3$) as a dependent variable was explained by leptin and insulin as a result of stepwise regression analysis ($R = 0.55$, adjusted $R^2 = 0.45$, $P < 0.01$), and EI in MF as another dependent variable was explained by age and 30-sec chair stand ($R = 0.81$, adjusted $R^2 = 0.61$, $P < 0.01$). **CONCLUSIONS:** These results suggest that the pattern of muscle quality is inconsistency between limbs and trunk. Furthermore, the factor to explain muscle quality may be different depending on the regions of the muscle.

913 Board #92 May 31 3:30 PM - 5:00 PM
Relationship Between Quadriceps Femoris Echo Intensity And Functional And Morphological Characteristics In Older Men And Women
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The age-related decrease in human skeletal muscle mass; i.e. sarcopenia, has received much attention, but an age-related decrease in muscle quality; i.e. the ratio of adipose tissue to muscle tissue, has received noticeably less. A few studies have shown that muscle quality, as determined by ultrasonographic echo intensity, is negatively associated with functional capacity, but the best parameters by which to predict muscle quality have not yet been established for older individuals. **PURPOSE:** The purpose of this study was to assess the relationships between quadriceps femoris (QF) echo intensity and demographic, functional and morphological characteristics of older men and women.

METHODS: Sixty-four healthy men ($n=27$; age, 72.9 ± 5.0 years; height, 164.1 ± 6.2 cm; weight, 60.6 ± 6.8 kg) and women ($n=37$; age, 71.5 ± 5.3 years; height, 152.8 ± 4.8 cm; weight, 50.8 ± 6.8 kg) aged 62-88 years participated in this study. The echo intensity and muscle thickness of the QF at the mid-thigh were calculated using ultrasonography. Sit-up, supine-up, sit-to-stand, 5-m maximal walk and 6-min walk tests were performed.

RESULTS: As expected, QF muscle thickness in men was significantly larger than women (men, 3.1 ± 0.6 mm; women, 2.7 ± 0.6 mm, $P = 0.01$); however, no significant differences were observed in QF echo intensity between sexes (men, 63.0 ± 8.7 a.u.; women, 69.9 ± 7.4 a.u.). QF echo intensity was significantly correlated with QF

muscle thickness as a result of simple linear regression analysis (men, $r = -0.734$, $P = 0.001$; women, $r = -0.565$, $P = 0.001$). Stepwise multiple regression analysis with QF echo intensity as a dependent variable revealed QF muscle thickness, age and sit-to-stand test in men ($R = 0.875$, adjusted $R^2 = 0.734$), and QF muscle thickness and sit-to-stand test in women ($R = 0.648$, adjusted $R^2 = 0.383$), to be significant independent variables.

CONCLUSIONS: These results suggest that functional ability and greater muscle size are essential factors in the maintenance of muscle quality; however, an age effect was present only in men.

914 Board #93 May 31 3:30 PM - 5:00 PM
Age-Dependent Responsiveness to Stretch-Shortening Contraction Training and Low Volume Isometric Contraction Training in Rats
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A growing body of research has highlighted the benefits of high-intensity exercise. However, concern exists that such high-intensity training, especially in resistance training, is potentially deleterious at advanced age. Recently, we have addressed this issue in part by demonstrating in a rat model of resistance-type training, that training with maximally activated stretch-shortening contractions (SSCs) has no detrimental effect on performance and increases muscle mass at advanced age provided the frequency of training is moderated (i.e. 80 SSCs 2 days per week rather than 3 days per week). A major question remained from this research - whether reducing or altering other parameters when training with high-intensity contractions would also demonstrate similar outcomes at old age. **PURPOSE:** To determine whether decreasing repetition number (i.e. 40 SSCs 3 days per week) and/or changing contraction mode (i.e. 4 isometric contractions (ISOs) 3 days per week and 8 ISOs 2 days per week) induces muscle mass and performance gains in young (3 months old) and old (30 months old) male Fischer Brown Norway hybrid rats. **METHODS:** Dorsiflexor muscles (9-10 per group) were exposed to 1 month of training using a custom-built dynamometer. Dynamic performance was monitored, tibialis anterior muscle mass was normalized to tibia length, and muscle quality determined by dividing performance by normalized muscle mass. ANOVA was used for statistical analysis; significance was set at $p < 0.05$. **RESULTS:** Independent of training protocol, peak force increased by ~20% for young rats while peak force was not significantly altered for old rats. In contrast with performance, muscle mass gains were dependent on the training protocol. For young rats, the normalized muscle mass increase of 18 ± 2% after 40 SSCs 3 days per week training was greater than the increases of 7 ± 2% and 11 ± 1% after 4 ISOs 3 days per week or 8 ISOs 2 days per week training, respectively ($p < 0.05$). For old rats, only 40 SSCs 3 days per week training induced a muscle mass gain, 12 ± 3% ($p < 0.001$), without a decrease in muscle quality relative to values for the other training protocols. **CONCLUSIONS:** These findings demonstrate the extreme adaptability of muscle to various training protocols at a young age and the selectivity at old age especially in regards to muscle mass gain.

B-63 Free Communication/Poster - Altitude/Hypoxia

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

915 Board #94 May 31 2:00 PM - 3:30 PM
"BEet On Alps": Ergogenic Effects Of Dietary Nitrate Supplementation During Prolonged Exposure To Hypobaric Hypoxia
 SIMONE PORCELLI¹, Letizia Rasica², Desy Salvadego³, Simona Mrakic-Spota¹, Fabrizio Gelmini², Giangiacomo Beretta², Mauro Marzorati¹. ¹Italian National Research Council, Segrate (MI), Italy. ²Università degli Studi di Milano, Milan, Italy. ³University of Udine, Udine, Italy.
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PURPOSE: Several studies have demonstrated that dietary nitrate supplementation reduces O_2 consumption (VO_2) during steady-state exercise and enhances endurance performance in young healthy subjects, both in normoxia and acute hypoxia. No data have been provided during acclimatization to high altitude, a condition that affects exercise tolerance and may change nitric oxide bioavailability. Aim of this study was to investigate the effects of dietary nitrate supplementation on oxygen cost of exercise and exercise tolerance during a prolonged sojourn at high altitude.

METHODS: In a double-blind randomized crossover study, fourteen young (29±4 yr) healthy subjects were supplemented for three days with beetroot juice (2x70mL/day, 8.4 mmol nitrate/day [BEET-IT]) or nitrate-depleted juice (PLA). At the end of each supplementation period, subjects performed on a cycle ergometer one 8 min moderate-intensity constant work rate (MOD) exercise and a high-intensity (HIGH) constant work rate exercise up to exhaustion. Experimental sessions were conducted in a refuge at 3269m a.s.l. after 7 and 14 days of exposure to hypobaric hypoxia.

RESULTS: [Nitrate] and [nitrite] were significantly higher in BEET-IT than in PLA. In MOD, oxygen cost of exercise was significantly reduced in BEET-IT vs. PLA (12.7±1.8 vs. 11.8±1.4 mL·min⁻¹·w⁻¹, p<0.01). In HIGH, VO₂ was significantly lower in BEET-IT than in PLA after 6 min of exercise (2.588±0.424 vs. 2.686±0.438 L·min⁻¹, p<0.01) whereas no difference was observed at exhaustion (2.728±0.450 in BEET-IT and 2.763±0.467 L·min⁻¹ in PLA). Time to exhaustion during high-intensity exercise was significantly improved (9%) by dietary nitrate supplementation. Interestingly, two subjects with the higher aerobic fitness level were “non-responder”.

CONCLUSION: After prolonged exposure to hypobaric hypoxia, nitric oxide metabolism was modified at rest. Dietary nitrate supplementation enhanced exercise efficiency during moderate-intensity exercise and improved high-intensity exercise tolerance. These effects were not evident in two highly trained subjects, suggesting an apparent relationship between aerobic fitness and ergogenic potential of beetroot juice supplementation during prolonged exposure to hypobaric hypoxia.

916 Board #95 May 31 2:00 PM - 3:30 PM
Effects Of Normobaric Hypoxia And Exercise On Cold-induced Vasodilation, Body Temperature, And Oxygen Saturation

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PURPOSE: The purpose of the current study was to investigate the effects of normobaric hypoxia on the thermoregulatory and the cold-induced vasodilation (CIVD) response before and following submaximal exercise. **METHODS:** Ten apparently healthy men (23±3 years) volunteered for two experimental trials during which they were exposed to differing O₂ saturations (13% O₂ and 21% O₂) in an environmental chamber. Trials were counterbalanced and blinded from the participant. Following a 60-min acclimation the experimental trials consisted of two 15-min exposures to 5°C water of the non-dominant hand. The exposures were separated by a 30-min bout of submaximal exercise producing the equivalent of 400 watts (W) of metabolic heat. Mean body temperature (MBT), oxygen saturation (SaO₂), and thermal sensation (TS) were collected during the final 5 min of each stage. CIVD was measured pre- and post-exercise during each of the cold water exposures on the nailbed of the middle finger on the non-dominant hand. **RESULTS:** ANOVA revealed a significant time (baseline, acclimation, CIVDpre, exercise, and CIVDpost) by condition (13% O₂, 21% O₂) interaction for SaO₂ ($F = 38.4, p < 0.001$). Significant differences ($p < 0.001$) between conditions existed at all time-points with the exception of baseline ($p = 1.0$). A main effect of time was observed for amplitude temperature ($F = 20.034, p < 0.001$), which was significantly greater ($p < 0.001$) at CIVDpost compared to CIVDpre (CIVDpost: 1.13°C; CIVDpre: 0.28°C). No significant difference across time or condition exists for MBT or TS. In the 13% O₂ condition, the reduction in SaO₂ during exercise (81.5%) was positively associated ($r = 0.656, p = 0.039$) with amplitude temperature at CIVDpost (0.69°C), which was significantly greater ($p < 0.05$) compared to CIVDpre (0.14°C). **CONCLUSION:** It appears that during rest in normobaric hypoxia, a cold stress test has minimal effect on the CIVD response. During exercise, reduced CIVD amplitude is associated with reduced SaO₂. It appears that a submaximal bout of cycling exercise is not the proper stimulus to acutely induce a CIVD response to the magnitude at which physiological changes ensue.

917 Board #96 May 31 2:00 PM - 3:30 PM
The Effects Of Cold-Water Hand Immersion On Executive Function, Mood, And Memory In Normobaric Hypoxia

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PURPOSE: The purpose of the present study was to investigate the effects of cold-water hand immersion (CWI) on changes in executive function, mood, and memory during normobaric hypoxia and normoxia. **METHODS:** Ten apparently healthy men (23±3 years) volunteered for this study. The two experimental trials (13% O₂, 21%

O₂) were counterbalanced and blinded from the participant. The non-dominant limb was exposed to 5°C water for 15-min after a passive acclimation to the randomized experimental condition. Executive function (Stroop), total mood disturbance (TMD), and memory (RMCPT) were recorded during the final 8 min. of the following time points: baseline, acclimation, and CWI. **RESULTS:** Condition (13% O₂, 21% O₂) by time (baseline, acclimation, CWI) ANOVA's revealed no significant interaction or main effects of time or condition for any score of executive function ($F \leq 3.12, p \geq 0.069$) or mood ($F \leq 0.773, p \geq 0.477$). A significant time by condition interaction exists for throughput score ($F = 3.19, p = 0.039$), a measure of RMCPT. The score during CWI in the 13% O₂ condition was significantly lower compared to the 21% O₂ condition ($p = 0.05$), as well as when compared to acclimation of the 13% O₂ condition ($p = 0.02$). The worsening TMD trend led to positive associations between skin temperature during CWI and TMD scores at baseline ($r = 0.753, p = 0.012$), acclimation ($r = 0.653, p = 0.041$), and CWI ($r = 0.657, p = 0.039$) in the 13% O₂ condition. In the 21% O₂ condition, TMD at acclimation was significantly associated with skin temperature during CWI ($r = 0.716, p = 0.02$). **CONCLUSION:** Despite no effect on executive function in both normoxia and normobaric hypoxia, it appears CWI impairs measures of memory. Decreased skin temperature observed during CWI correlates to reduced mood throughout all time points in a hypoxic state. Further research is necessary to elucidate mechanisms to improve mood and memory in normobaric hypoxia.

918 Board #97 May 31 2:00 PM - 3:30 PM
Human Cognitive Function During Acute Hypoxic Exposure

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The execution or inhibition of decision making is critical for survival in a severe environment. Although cognitive performance (behavioral executive response such as reaction times) appears to be impaired at a given level of high altitude, the effect of hypoxia on cognitive processing including executive and inhibitory responses remains unclear. **PURPOSE:** The aim of present study was to test our hypothesis that not only executive processing but also inhibitory processing may be impaired during acute hypoxic exposure.

METHODS: We investigated two neural activities in motor execution and inhibition processing evaluated by the Go/No-go task with electroencephalographic event-related potentials before and during acute (~30 min) hypoxic condition. As a time control, subjects performed the same sessions in normoxia.

RESULTS: The amplitudes of the Go-P300 (i.e. execution) and No-go-P300 (i.e. inhibition) components were unchanged during normoxic trial. However the amplitudes of the Go- and No-go-P300 components were significantly reduced during acute hypoxic trial ($p < 0.05$), whereas reaction times and error rates were not changed. **CONCLUSIONS:** These results suggest that acute hypoxia impaired human cognitive processing including response execution and inhibition.

919 Board #98 May 31 2:00 PM - 3:30 PM
Inspiratory Muscle Training and Endurance Performance in Hypoxia

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Ventilation is higher at any submaximal workload in hypoxia as compared to normoxia. Whether or not training the respiratory muscles helps to improve exercise performance in hypoxia is unclear. **Purpose:** To determine if improvements in ventilatory strength with chronic inspiratory muscle training (IMT) improves 20km cycling time trial (TT) performance in hypoxia (FIO₂ = 16.1%). **Methods:** Ten highly-trained men were pair-matched based on pre-exercise values of maximal inspiratory pressure (MIP) and randomly placed into either a sham (n = 5, VO₂max = 61.7 ± 4.1 ml·kg⁻¹·min⁻¹) or an IMT (n = 5, VO₂max = 61.5 ± 6.8 ml·kg⁻¹·min⁻¹) group. Subjects completed 6 weeks of flow resistive IMT (80% of MIP) or a sham protocol (30% of MIP), with each session consisting of up to 6 sets of 8 MIP maneuvers performed to failure with descending rest intervals 3 times per week. Pre- and post-training, subjects performed tests of pulmonary function, lung volume, MIP, maximal expiratory pressure (MEP), lung diffusion capacity (DLCO), and a 20km cycling TT in hypoxia (FIO₂ = 16.1%). **Results:** After 6 weeks of IMT or sham, the IMT group significantly improved MIP (145.3 ± 27.9 cmH₂O vs 171.7 ± 38.7 cmH₂O, p < 0.05), while MIP in the sham group remained unchanged. MEP, DLCO, lung volumes, and pulmonary function values remained unchanged in both groups post-training. 20km TT mean

ventilation was higher post-IMT (98.9 ± 15.9 l·min⁻¹ vs 109.3 ± 22.4 l·min⁻¹, $p = 0.055$) and unchanged in sham ($p = 0.65$). 20km TT mean breathing frequency was also higher post-IMT (43.5 ± 6.4 b·min⁻¹ vs 47.8 ± 8.0 b·min⁻¹, $p < 0.01$) and unchanged in sham ($p = 0.46$). 20km TT mean \dot{V}_O_2 was higher post-IMT (45.5 ± 6.4 ml·kg⁻¹·min⁻¹ vs 47.5 ± 7.1 ml·kg⁻¹·min⁻¹, $p = 0.05$) and unchanged in sham ($p = 0.65$). In the IMT group, 20km TT performance time pre-training was $37:46 \pm 4:39$ min:sec and post-training was $37:16 \pm 4:02$ min:sec ($-1.2 \pm 2.2\%$, $p = 0.14$). 20km TT performance time was unchanged in the sham group ($+0.2 \pm 2.1\%$, $p = 0.90$). 20km TT heart rate and SpO_2 were unchanged in both groups post-training. **Conclusion:** In a small cohort, IMT-induced improvements respiratory muscle strength resulted in greater ventilation and oxygen uptake during a 20km time trial in hypoxia. IMT should be explored as a useful strategy for improving the quality of cycle exercise training and/or endurance exercise performance at altitude.

920 Board #99 May 31 2:00 PM - 3:30 PM

The Effect of Inspiratory Resistance on Exercise Performance in Moderate Normobaric hypoxia

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(No relationships reported)

Various respirators are used to protect workers against toxic airborne substances and pathogens. However, the use of respirators increases inspiratory resistance known to adversely affect physiological and psychological performance in some workers. **PURPOSE:** To evaluate the effect of inspiratory resistances on physical performance and subjective comfort during exercise in normobaric hypoxia. **METHODS:** Nine healthy men (Age: 25 ± 2 years, Height: 181.4 ± 6.1 , Weight: 92.5 ± 2.6 kg) participated in this study. Subjects breathed through a respiratory mask outfitted with one of four different inspiratory resistors (R) (0, 1.5, 4.5, 7.5 cm H₂O·L⁻¹·sec⁻¹) while exercising in normobaric hypoxia (17% O₂) for 10 minutes each at 50, 100, and 150 Watts followed by incremental exercise to maximal exertion (\dot{V}_{O_2max}). **RESULTS:** At exhaustion, added inspiratory resistance in hypoxia significantly decreased the maximal power output ($0R=272.2 \pm 44.1$, $1.5R=263.9 \pm 41.7$, $4.5R=255.6 \pm 34.9$, and $7.5R=241.7 \pm 50.0$ W, respectively, $p=0.009$), respiration rate ($0R=41.9 \pm 6.5$, $1.5R=39.6 \pm 7.6$, $4.5R=37.2 \pm 6.2$, and $7.5R=35.8 \pm 6.7$ bpm, respectively, $p < 0.009$), and minute ventilation ($0R=106.7 \pm 18.5$, $1.5R=98.4 \pm 13.2$, $4.5R=93.2 \pm 13.2$, and $7.5R=86.7 \pm 12.2$ L/min, respectively, $p=0.002$) while oxygen consumption ($0R=31.8 \pm 4.1$, $1.5R=31.7 \pm 3.4$, $4.5R=30.4 \pm 3.4$, and $7.5R=31.4 \pm 6.4$ ml/kg/min, respectively, $p=0.750$) and heart rate ($0R=174.3 \pm 10.9$, $1.5R=173.9 \pm 11.9$, $4.5R=177.4 \pm 10.1$, and $7.5R=171.9 \pm 14.3$ bpm, respectively, $p=0.265$) were not significantly changed. Breathing comfort ($0R=3.0 \pm 1.8$, $1.5R=2.7 \pm 1.3$, $4.5R=4.2 \pm 1.9$, and $7.5R=4.1 \pm 2.0$, respectively, $p=0.014$) and breathing effort ($0R=3.7 \pm 1.6$, $1.5R=3.9 \pm 1.5$, $4.5R=5.4 \pm 1.2$, and $7.5R=5.1 \pm 1.4$, respectively, $p=0.001$) were significantly increased with additional inspiratory resistance, but rating of perceived exertion (RPE) was not significantly increased ($0R=17.8 \pm 1.7$, $1.5R=18.1 \pm 1.6$, $4.5R=18.2 \pm 0.8$, and $7.5R=18.1 \pm 1.6$, respectively, $p=0.664$). **CONCLUSIONS:** Low-to-moderate inspiratory resistance in normobaric hypoxia did not have a detrimental effect on oxygen consumption and RPE at maximal work rates. However, added inspiratory resistance significantly decreased maximal power output and increased perception of breathing discomfort and breathing effort.

921 Board #100 May 31 2:00 PM - 3:30 PM

Impact of Inspiratory Resistance on Cognitive Function in Normobaric Hypoxia After Exercise

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(No relationships reported)

PURPOSE: To determine the effects of added inspiratory resistance on cycling in normobaric hypoxia on cognitive function. **METHODS:** Nine healthy adult males (mean \pm SD: age = 25 ± 2 yr, height = 1.81 ± 0.06 m, mass = 92.5 ± 2.1 kg, BMI = 28.0 ± 5.3 kg·m⁻², $\dot{V}_O_2 = 46.32 \pm 9.01$ ml·kg⁻¹·min⁻¹) data were analyzed. The protocol consisted of a counterbalanced design involving four visits involving a normoxic (21% O₂) condition with zero added inspiratory resistance (NORM0) and three hypoxic (17% O₂) conditions with 3 levels of added inspiratory resistance (HYPOX0, HYPOX1.5 and HYPOX4.5 cmH₂O) attached to a two-way valve facemask. Data were collected at baseline and during 30 min seated rest in the hypoxia chamber with resistor added. This was followed by three submaximal stages on the cycle ergometer (50, 100, and 150 W) which was then immediately followed by a \dot{V}_O_2max test. After completion of the \dot{V}_O_2max test the participants recovered in the hypoxia chamber for an additional 30 min. Cognitive function was assessed via a computerized cognitive test battery with the participants performing the running memory continuous performance task (RMCPT) and Stroop Color Word Test (SCWT). A 2 factor repeated measures ANOVA were used to evaluate condition (NORM0, HYPOX0, HYPOX1.5,

HYPOX4.5) by time (baseline in normoxia, 30 min of rest, after \dot{V}_O_2max test, and after 30 min recovery in hypoxia) were performed on RMCPT and SCWT with post-hoc significance ($p < 0.05$). **RESULTS:** A main effect of condition ($p = 0.001$): NORM0 = 126 ± 20 ; HYPOX1.5 = 116 ± 23 ; HYPOX4.5 = 115 ± 19) and a main effect of time ($p = 0.031$: base = 117 ± 21 ; rest = 120 ± 19 ; max = 123 ± 16 ; recovery = 124 ± 18) existed on throughput of RMCPT. A main effect of time ($p = 0.001$: base = 62 ± 11 ; rest = 67 ± 11 ; max = 69 ± 9 ; recovery = 70 ± 11) existed on word-color association for SCWT. **CONCLUSION:** No significant interactions between time or condition was demonstrated on cognitive function with added inspiratory resistance in hypoxia after cycling performance. It appears from these data that the respirators do not impair cognitive function during work at the selected levels of resistance in normobaric hypoxia. Further research may be performed on this device to elucidate other markers of cognitive function in more extreme environmental conditions.

922 Board #101 May 31 2:00 PM - 3:30 PM

The Effects of Added Inspiratory Resistance during Exercise in Hypoxia on Lactate and Hemoglobin

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(No relationships reported)

PURPOSE: To determine the effects of adding different levels of inspiratory resistance to submaximal and maximal exercise performance in normobaric hypoxia on blood lactate (Lac) and hemoglobin (Hb) values. **METHODS:** Nine apparently healthy, male adults (mean \pm SD; age = 25 ± 2 yr, height = 1.81 ± 0.06 m, mass = 92.5 ± 2.1 kg, BMI = 28.0 ± 5.3 kg·m⁻², $\dot{V}_O_2 = 46.32 \pm 9.01$ ml/kg·min⁻²) were analyzed. The participants visited the laboratory on four separate visits in a counterbalanced design. The four conditions consisted of a normoxic (21% O₂) condition with zero added inspiratory resistance (Normox0) and 3 hypoxic (17% O₂) conditions with 3 levels of added resistance (Hypox0, Hypox1.5, and Hypox7.5 cm H₂O) attached to a two-way non re-breathing face-mask. The exercise protocol consisted of data collection at baseline and after 30 min rest in the hypoxia chamber. Three submaximal stages followed on the cycle ergometer with increasing levels of intensity (50, 100, and 150 W) which were then immediately followed by a \dot{V}_O_2max test. After completion of the \dot{V}_O_2max test the participants recovered in the hypoxia chamber for an additional 30 min. Lac and Hb data were collected by a finger prick and analyzed. A 2 factor repeated measures ANOVA was used to evaluate condition (Normox0, Hypox0, Hypox1.5 and Hypox7.5) by time (baseline, 30 min of rest in hypoxia chamber, immediately after the \dot{V}_O_2max test, and during 30 min recovery period) on Lac and Hb. Paired-samples t-test were performed as the post-hoc test ($p < 0.05$) level of significance set a priori. **RESULTS:** A significant interaction was found between condition and time for Lac ($p = 0.014$) and was attenuated during Hypox7.5 condition at recovery compared to the other conditions (Normox0: 6.3 ± 3 mmol; Hypox0: 6.5 ± 3.2 mmol; Hypox1.5: 6.3 ± 3.4 mmol; Hypox7.5: 4.5 ± 3 mmol). Also, a main effect of time for Hb ($p < 0.001$) such that there was a 6.7% increase in Hb at max compared to base and rest, and 5.6% higher Hb at recovery compared to base and rest. **CONCLUSION:** Individuals who wear respirator masks with 7.5 cmH₂O in a hypoxic condition may clear Lac faster (turnover) which might improve recovery time. Future research may focus on Lac, Hb and other hemodynamic variables and the mechanism underlying lactate clearance in varying hypoxic conditions.

923 Board #102 May 31 2:00 PM - 3:30 PM

The Effect of Acute Simulated Altitude on the Lactate Thresholds of Well-Trained Cyclists

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(No relationships reported)

PURPOSE: Endurance cyclists often race or train at altitudes ranging from 1,000-3,000 m above sea level. It is well known that peak oxygen consumption ($\dot{V}_{O_{2peak}}$) and mean power output (PO) decrease with increasing altitude. However, factors such as lactate thresholds are also important for endurance performance. Research investigating the response of the lactate thresholds to acute hypoxia is however scarce. The aim of this study was to quantify and titrate the acute effect of simulated altitude on the lactate thresholds of well-trained cyclists. **METHODS:** Ten well-trained, non-altitude acclimatized male cyclists and triathletes completed a graded cycling exercise test in a hypobaric chamber at each of four simulated altitudes (200, 1,200, 2,200, 3,200 m). The test protocol comprised 5 x 5-min submaximal efforts (50, 100, 150, 200 and 250 W), to determine \dot{V}_O_2 , heart rate (HR) and blood lactate concentration ([La]) responses. Following a 10 min

passive rest, a 5-min maximal time-trial (5-minTT) was performed to determine peak physiological and performance responses. Combining these measures allowed a modified 2-in-1 protocol to be applied to calculate the lactate thresholds (LT1, LT2) using customized software (ADAPT).

RESULTS: VO_2 decreased by $5.5 \pm 1.1\%$, $15.9 \pm 1.5\%$ and $26.3 \pm 1.4\%$ at LT1 and by $6.5 \pm 1.2\%$, $13.4 \pm 1.3\%$ and $23.2 \pm 1.8\%$ at LT2 at 1,200, 2,200 and 3,200 m compared with 200 m respectively, $P < 0.05$. Mean PO declined by $5.4 \pm 1.1\%$, $17.7 \pm 1.7\%$ and $30.3 \pm 1.9\%$ for LT1 and by $5.2 \pm 1.3\%$, $13.9 \pm 1.4\%$ and $25.7 \pm 1.8\%$ at LT2 at 1,200, 2,200 and 3,200 m compared with 200 m respectively, $P < 0.05$. HR and $[\text{La}^-]$ at these thresholds remained unchanged. 5-minTT $\text{VO}_{2\text{peak}}$ and PO both followed the same pattern of decline with increasing altitude, $P < 0.05$.

CONCLUSIONS: A dose response effect of acute hypobaric hypoxia on VO_2 and PO was found at both submaximal (LT1 and LT2) and maximal (5-minTT) intensities. No such effects were seen for HR or $[\text{La}^-]$ at any intensity.

924 Board #103 May 31 2:00 PM - 3:30 PM
Resistance Exercise In Hypoxia Combined With Blood Flow Restriction

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The use of blood flow restriction (BFR) or systemic normobaric hypoxia (NH) during resistance exercise to increase metabolic stress and the subsequent muscular development is increasingly popular. However, the extent to which local and systemic hypoxic conditions in combination influence resistance exercise and accompanying physiological responses remains undetermined.

Purpose: To determine separate and combined effects of BFR and NH during resistance exercise on performance, perceptual cues, as well as muscle activation and oxygenation.

Methods: 14 physical education students were tested for 1 repetition maximum (1-RM) in the *barbell biceps curl* (biceps) and *dumbbell pull over* (triceps). On separate visits, they performed 6 separate randomized trials of 4 sets at 70% 1-RM to failure of each exercise (90-s and 10-min rest between sets and exercises, respectively) in normoxia (FiO_2 20.9%) or NH (FiO_2 12.9%) combined with 3 different levels of vascular occlusion (0%, 45% or 60% of maximal occlusion). Arterial oxygen saturation, heart rate, and perceptual responses were assessed following each set. Muscle activation and oxygenation were monitored *via* surface electromyography (EMG) and near-infrared spectroscopy, respectively.

Results: Compared to set 1, the number of repetitions before muscular failure decreased in sets 2, 3, and 4 for both the *biceps* ($-44 \pm 6\%$, $-59 \pm 7\%$ and $-63 \pm 6\%$, respectively; all $P < 0.001$) and *triceps* ($-39 \pm 10\%$, $-56 \pm 7\%$ and $-62 \pm 7\%$, respectively; all $P < 0.001$), independently of the condition ($P > 0.065$). Arterial oxygen saturation was lower with NH ($P < 0.001$), but not BFR, while heart rate ($P > 0.341$) did not differ between conditions. A significant main effect of time was observed for overall perceived discomfort, difficulty breathing and limb discomfort (all $P < 0.001$), but no difference between conditions (all $P > 0.235$). Overall, markers of metabolic stress (tissue saturation index during exercise and subsequent recovery; all $P > 0.206$) and muscle activation (Root Mean Square value; all $P > 0.626$) remained unaffected by environmental conditions.

Conclusion: Local and systemic hypoxic stimuli, or a combination of both, during resistance exercise to failure did not alter performance, perception of strenuous exercise, nor trends of muscle activation or oxygenation.

925 Board #104 May 31 2:00 PM - 3:30 PM
Effects of Hypobaric and Normobaric Hypoxia on Mitochondrial Related Gene Expression

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(No relationships reported)

Environmental stimuli such as temperature and hypoxia can influence cellular signaling in the skeletal muscle. Previously we have reported no changes in gene expression related to mitochondrial development with acute exposure to normobaric hypoxia. However, exposure to hypobaric hypoxia may elicit different physiological responses. **Purpose:** To determine the response of skeletal muscle mitochondrial related gene expression after 4-h exposure to normobaric hypoxia (NH), hypobaric hypoxia (HH) and normobaric normoxia (NN) after exercise. **Methods:** Recreationally trained participants ($n = 15$, age: 24 ± 4 y, height: 178 ± 12 cm, weight: 72.47 ± 13.84 kg, body fat: $14 \pm 7\%$, $\text{VO}_{2\text{max}}$: 3.60 ± 0.83 L \cdot min⁻¹, W_{max} : 274 ± 72 W) each completed three trials of 1-h cycling at 70% of W_{max} . Following exercise, participants sat in an environmentally controlled chamber for a 4-h recovery period in NH (4,420

m), HH (4,420 m), or NN (975 m) environmental conditions. Blood oxygen saturation was measured using pulse oximetry at baseline, 30 min into exercise, immediately after exercise, and 30 min into each hour of recovery. Muscle biopsies were taken from the *vastus lateralis* pre-exercise and after a 4-h exposure period. Samples were analyzed using qRT-PCR to assess gene expression related to mitochondrial development.

Results: Arterial oxygen saturation was lower in HH and NH trials compared to the NN trial ($p < 0.001$) and lower in the HH compared to NH ($p = 0.001$). PGC-1 α , GABPA, ERR α , and NRF1 mRNA were not different between the three conditions or from pre-exercise ($p = 0.804$, 0.650 , 0.956 , 0.563 , respectively). TFAM mRNA increased in NH from pre-exercise to post-exercise ($p = 0.036$) and was higher than NN ($p = 0.011$). **Conclusion:** These data indicate that gene expression related to mitochondrial development is only marginally affected (TFAM) by the type of hypoxic environment after a 4-h treatment despite differences in arterial oxygen saturation. Funding provided by the Department of Defense United States Army Medical Research and Materiel Command (DOD USAMRMC: W81XWH-15-2-0075).

926 Board #105 May 31 2:00 PM - 3:30 PM
Effects of Hypobaric and Normobaric Hypoxia on Myogenic and Proteolytic Gene Expression in Humans

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(No relationships reported)

Muscle mass is reduced during extended exposure to a hypoxic environment. Current research suggests that the physiological response to normobaric and hypobaric hypoxia may be different. It is currently unknown if these previously described differences extend to the skeletal muscle and transcriptional response regulating muscle mass.

PURPOSE: To determine the effects of normobaric and hypobaric hypoxia on myogenic and proteolytic gene expression. **METHODS:** Recreationally trained subjects ($n = 15$; age = 24 ± 4 y; $\text{VO}_{2\text{max}}$ = 3.60 ± 0.83 L \cdot min⁻¹) completed three trials of 60-min cycling at 70% of W_{max} followed by 4-h of recovery at ambient control conditions (975 m), normobaric hypoxia (4,420 m), and hypobaric hypoxia (4,420 m). For each trial, a muscle biopsy was taken from the *vastus lateralis* before exercise and at the end of the 4-h recovery period for analysis of gene expression (RT-qPCR).

RESULTS: There were no differences in the myogenic gene expression of MYOD ($p = 0.713$), MYF-5 (0.053), or MYOG (0.832) between trials. MYF-6 was higher after exercise ($p = 0.002$) regardless of trial. MSTN decreased from pre- to post-exercise ($p < 0.001$) in all conditions and was lower in hypobaric hypoxia compared to control condition ($p = 0.02$) and normobaric condition ($p = 0.037$). There were no differences in the proteolytic gene expression of atrogen-1 with exercise ($p = 0.811$) or between trials ($p = 0.419$). However, FOXO3 ($p = 0.009$) and MuRF-1 ($p < 0.001$) gene expression increased with exercise but were not different between conditions ($p = 0.543$, $p = 0.327$, respectively). **CONCLUSION:** These data indicate that hypoxic recovery from exercise, regardless of whether normobaric or hypobaric, does not affect the expression of genes related to myogenesis and proteolysis with the exception of a modest attenuation of myostatin in hypobaric hypoxia.

Funding provided by the Department of Defense United States Army Medical Research and Materiel Command (DOD USAMRMC: W81XWH-15-2-0075).

927 Board #106 May 31 2:00 PM - 3:30 PM
Prior Heat or Hypoxic Acclimation Does Not Attenuate the Cytokine Response to Hypoxic Exercise

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BACKGROUND: Heat acclimation activates the cellular heat shock response (HSR), inhibiting NF- κ B and reducing heat stress-mediated cytokine production and limiting stress-induced inflammation. Hypoxia-mediated intestinal ischemia activates the NF- κ B pathway and stimulates pro-inflammatory responses linked to acute mountain sickness and pulmonary and cerebral oedema. The upregulation of the HSR via heat acclimation may therefore reduce inflammatory responses following subsequent hypoxic exercise.

PURPOSE: To determine whether prior heat acclimation attenuates the cytokine response following hypoxic exercise. **METHODS:** Plasma TNF- α , IL-6, IL-10 and IL-1ra were determined at rest and following a 60 minute cycling normoxic stress test (NST) and hypoxic stress test (HST1; $\text{F}_2\text{O} = 0.14$, 50% $\text{VO}_{2\text{peak}}$) in 21 men (age 22 ± 5 years; stature 1.76 ± 0.07 m; mass 71.8 ± 7.9 kg; VO_2 peak 51 ± 7 mL \cdot kg⁻¹ \cdot min⁻¹). Participants formed 3 groups and completed 10 x 60 minute acclimation sessions (50% $\text{VO}_{2\text{peak}}$) in control ($n = 7$; 18°C, 35% RH), hypoxic ($n = 7$; $\text{F}_2\text{O} = 0.14$, 18°C, 35% RH), or hot ($n = 7$; 40°C, 25% RH) conditions. A second HST (HST2) was completed 48 hours after the final acclimation session. Cytokine data are presented as mean change in ng \cdot mL⁻¹ with 95% confidence intervals and comparisons made

using mixed ANOVA. **RESULTS:** Following the NST plasma IL-6 (+0.6, 95% CI 0.3 - 0.9 ngmL⁻¹), IL-10 (+1.1, 95% CI -2.8 - 5.0 ngmL⁻¹) and IL-1ra (-16.6, 95% CI -60.5 - 27.2 ngmL⁻¹) exhibited minimal change ($p > 0.05$). TNF- α was unaltered throughout the study. IL-6 (+3.9, 95% CI 2.8 - 4.9 ngmL⁻¹), IL-10 (+26.2, 95% CI 15.0 - 37.3 ngmL⁻¹) and IL-1ra (+1506, 95% CI 746 - 2266 ngmL⁻¹) were elevated following HST1 ($p < 0.01$), with no main effect for acclimation group ($p > 0.05$). A similar trend was observed after acclimation (HST2), with IL-6 (+3.1, 95% CI 2.5 - 3.7 ngmL⁻¹), IL-10 (+23.2, 95% CI 14.0 - 32.5 ngmL⁻¹) and IL-1ra (+1237, 95% CI 721 - 1753 ngmL⁻¹) increased ($p < 0.01$), and no main effect for trial or acclimation group observed ($p > 0.05$). **CONCLUSIONS:** Neither prior heat nor hypoxic acclimation attenuated the systemic cytokine response following acute exercise in hypoxia. Future work investigating the effectiveness of different acclimation modalities on improving inflammatory outcomes to hypoxic stress is recommended.

928 Board #107 May 31 2:00 PM - 3:30 PM
Validity of the Load Velocity for Power Resistance Training Adjustment at Real Moderate Altitude

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The relationship between muscle power and hypoxia represents a new way to improve the potential benefits of altitude training, especially in sports involving explosive movements. Monitoring workload through velocity (mean propulsive velocity, MPV), seems appropriate since both the neuromuscular demands and the training effect itself largely depend on the velocity at which loads are lifted. **PURPOSE:** To study whether the MPV could be used to adjust the workload during an oriented resistance training program (RT) at moderate real altitude. **METHODS:** 23 collegiate-men volunteers (23±3 yr) followed 4 weeks RT oriented to optimize muscle power development in either normoxia (N) or intermittent hypoxia (IH, 2320 m living at sea level). The RT (2 sessions/wk, 8 in total) was the same for both groups and the training load (TL) was weekly adjusted to elicit 1m·s⁻¹ of MPV. The TL was controlled by a linear velocity transducer, and the session loss-velocity in % (L) was estimated. Maximal isometric handgrip (Din) and SaO₂ were monitored before and after each session (s). The peak relative power at 1 ms⁻¹ of MPV (P), was determined before and after the RT. Intra (s) and inter (N vs. IH) comparisons were made by using mean comparison tests. **RESULTS:** Similar increases in TL were found between N and IH (P=0.716), with both groups showing significant increases when comparing s1 vs. s8 values (N: 9.84%, P=0.03; IH: 8.18%, P=0.007). Interestingly no significant changes in L were found between groups (N: 5.0 vs. IH: 5.9%, P=0.360). Pr increased significantly only in IH (s1: 50.66±5 vs. s8: 54.12±4.9 W·Kg⁻¹, P=0.002). As expected, lower values of SaO₂ were found in IH when compared with N (P<0.05) with no differences among s (P=0.571). No significant changes were found for Din between groups (N: 50.7 vs. IH: 56.3 Kg, P=0.137) or s (P=0.216). **CONCLUSIONS:** Monitoring the MPV allows to adjust the workload during RT. The lack of differences in L between groups, mobilizing similar TL, with an increase of Pr only in IH, supports the idea that intermittent exposure to moderate real altitude would have a positive effect on strength responses. A possible explanation could be the combination of the reduced air density and the stimulation of physiological factors. Supported by the Ministry of Education, Culture and Sport of Spain. Ref. DEP2015-64350-P, MINECO/FEDER

929 Board #108 May 31 2:00 PM - 3:30 PM
Effects Of Supplemental Oxygen On Submaximal And Maximal Cycling Performance At Altitude

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Purpose: Reduced partial pressure of oxygen (PO₂) at altitude reduces maximal oxygen consumption (VO₂). When O₂ is supplemented, maximal exercise performance at altitude has been shown to improve. We questioned whether supplemental O₂ would also increase performance during self-regulated, moderate-intensity exercise performed at 1890m. **Methods:** Twelve (7 male) 26.6±6.7 year-old healthy participants (height, 174.8±9.7cm; weight, 71.4±8.4kg) performed one familiarization trial and two experimental trials (double blind, cross over) while breathing either room air or supplemental O₂ to simulate sea level (FIO₂=0.265). To evaluate submaximal exercise performance, participants cycled an electrically braked ergometer (Velotron Elite) at a self-selected cadence and work rate corresponding to an RPE of 9 (very light) for 5 min and RPE of 13 (somewhat hard) for 10 min. Following a 2 min rest, participants performed an incremental test (25W + 25W/min) to maximal exertion. Watts, VO₂, VE, RER, HR, SpO₂, and RPE were recorded each

min. Differences between trials were evaluated by paired t-tests. Chi-square was used to determine subjects' ability to correctly identify the FIO₂ after each phase of the protocol. **Results:** Supplemental O₂ at 1890m increased SpO₂ during submaximal exercise at RPE 9 and 13 (3±3 and 4±2%, respectively P<0.01); Watts, VO₂, VE, RER, and HR were unaffected. Supplemental O₂ at 1890m increased SpO₂ (5±3%), power output (16±8 Watts), and VO₂ (0.28±0.16 L/min) at maximal intensity (all P<0.02). Subjects were not able to correctly identify the FIO₂ (P range: 0.25 to 1.00). **Conclusion:** Although supplemental O₂ improves maximal exercise performance at 1890m, it had little effect on short-duration, moderate-intensity exercise, such as might be performed during a warm-up for a competitive event.

930 Board #109 May 31 2:00 PM - 3:30 PM
Cerebral and Skeletal Muscle Oxygen Response During Exercise With and Without an Altitude Simulation Mask

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Altitude as well as hypoxic chambers cause a greater exercise-induced decrease in both cerebral oxygen response (COR) and skeletal muscle oxygen response (SMOR) when compared to exercise in normoxic conditions. Altitude simulating masks (ASM) such as restrictive breathing devices have promoted their products as respiratory muscle trainers that also expose the body to hypoxic conditions.

PURPOSE: To determine if a significant difference in COR and SMOR measured by near-infrared spectroscopy (NIRS) exists during maximal exercise under normoxic conditions with and without an ASM. **METHODS:** Thirteen healthy individuals (F=3, M=10, 24.2 ± 2.7 yr) completed three separate bicycle ergometer maximal exercise tests. Test 1 consisted of respiratory gas analysis to identify $\dot{V}O_{2max}$ ventilatory threshold 1 (VT1), and the respiratory compensation point (RCP). Tests 2 and 3 were with and without the ASM in a counterbalanced crossover design. Heart rate (HR), blood pressure (BP), pulse oximetry (S_pO₂), and blood lactate (BL) were assessed for all tests. COR was calculated by taking the peak 5-second average of oxygenated hemoglobin (O₂Hb) and subtracting it from the O₂Hb at the end of exercise. SMOR was measured by calculating the difference in tissue saturation index (TSI) at the onset and end of exercise. Dependent t-tests were used to assess differences between ASM and non ASM. Significance was set at $p < 0.05$. **RESULTS:** There were no significant differences in COR (non ASM 6.01 ± 3.54 vs. ASM 3.75 ± 1.92 $\mu\text{M} \cdot \text{L}^{-1} \text{O}_2\text{Hb}$; $p=0.078$) or SMOR (non ASM 17.97 ± 8.08 vs. ASM 19.61 ± 10.92%, TSI; $p=0.462$) during maximal exercise. There was, however, a reduced S_pO₂ during exercise in the ASM condition (ASM 3.1 ± 3.3 vs. non ASM 1.0 ± 2.2%; $p < 0.001$). A significantly higher exercise capacity (non ASM 284.2 ± 74.6 vs. ASM 271.6 ± 65.8 watts, $p=0.007$) and BL (non ASM 11.5 ± 3.7 vs. ASM 9.5 ± 2.3 mM · L⁻¹; $p=0.008$) was observed in the non ASM exercise trial compared to ASM. **CONCLUSIONS:** These results suggest that the use of the ASM during exercise in normoxic conditions did not show a significant difference in COR or SMOR when compared to exercise without the ASM. Although this study did not analyze the respiratory muscle training effect of the ASM, there was no evidence of a cerebral or muscle hypoxic effect during the acute bout of exercise.

931 Board #110 May 31 2:00 PM - 3:30 PM
Influence of Exercise Modality on Hypoxia-Mediated Decrements in Endurance Exercise Performance

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Low oxygen environments, such as high altitude, impair endurance exercise performance. The magnitude of performance decrements are highly variable and may in part be explained by the exercise modality and volume of active muscle mass. For example, it is unclear if an exercise modality engaging both the upper and lower body, such as rowing, would be more impaired than a predominantly lower body exercise, such as cycling. **PURPOSE:** To determine the influence of exercise modality on hypoxia-mediated decrements in endurance exercise performance.

METHODS: Endurance trained men and women (n=8; 4 female; age: 30±11 years; maximal oxygen uptake: 3.51±1.01 L/min or 48.1±8.2 ml/kg/min (mean±SE)), participated in a Latin Square experimental design. Four time trials were completed: two on a stationary cycle (4km) and two on a rowing (2km) ergometer, in normoxia (FiO₂=0.210) and simulated high-altitude (hypoxia; FiO₂=0.150). Potential differences were analyzed using two-way analysis of variance with repeated measures.

RESULTS: Hypoxia slowed time trial performance (P>0.001) in both exercise modalities (Cycling: 6.7±0.7 vs. 7.3±1.0; Rowing: 8.0±0.9 vs. 8.5±1.0 min); the proportional magnitude of hypoxia-mediated decrements were not different (P=0.45) between cycling (9.5±4.6%) and rowing (6.3±3.7%).

CONCLUSIONS: Endurance exercise performance is attenuated in hypoxia. Our preliminary data suggest the magnitude of decrements may not be appreciably different between exercise modalities engaging upper and lower body, such as rowing, compared with modalities relying predominantly on lower body, such as cycling.

932 Board #111 May 31 2:00 PM - 3:30 PM
Effect of Acute Simulated Altitude Exposure on Excess Postexercise Oxygen Consumption

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Oxygen consumption (VO_2) that remains elevated above the baseline after exercise termination is known as excess post-exercise oxygen consumption (EPOC). Arrival at altitude decreases maximal oxygen uptake, however studies are mixed with respect to the effect of altitude on resting metabolic rate (RMR). To our knowledge, the EPOC response has not been studied with altitude as an independent variable. **PURPOSE:** To observe the EPOC to constant-load cycle exercise performed under acute simulated altitudes of 3353 m and 6401 m.

METHODS: Subjects ($N = 7$ female, 7 male) reported to the laboratory between 0600 and 0830 hours and RMR was obtained. Constant workload cycle exercise was then performed (10-min at 100 W) while breathing air from an altitude simulator under one of the following conditions: control (CON), 3353 m (MID), 6401 m (HI). Subjects returned to complete the remaining conditions in a counterbalanced order. Upon completion of the exercise bout, participants were reconnected to the metabolic system and rested until a running 5-min average of VO_2 values returned to or below baseline (EPOC duration). Magnitude was determined by summing the net oxygen consumption for each minute during the EPOC period. Data were analyzed using 2 x 3 repeated measures ANOVA.

RESULTS: Since no sex differences were detected, data were collapsed and analyzed using one-way repeated measures ANOVA. There was no difference between condition for RMR (CON=3.9±0.5, MID=3.9±0.3, HI=3.9±0.4 ml/kg/min), or cycle performance variables including average power (CON=98±4, MID=100±4, HI=95±9 W). EPOC duration was significant at each altitude increase (CON=15.2±1.9 vs MID=20.7±1.7 min, $p=0.002$) (MID vs HI=28.1±2.6 min, $p=0.006$). Likewise, EPOC magnitude was significant at each altitude (CON=73.5±9.9 vs MID=99.1±9.3 ml O₂, $p=0.002$) (MID vs HI=139.7±14.3 ml O₂, $p=0.001$).

CONCLUSIONS: Determining the EPOC response to altitude is important because it represents a source of elevated caloric expenditure that must be accounted for given that carbohydrates are preferentially utilized with altitude exposure. This has an influence on recovery from exercise as well as future bouts of work. Thus, individuals who are active at altitude must account for this increased caloric deficit despite a loss of appetite that is common with altitude exposure.

933 Board #112 May 31 2:00 PM - 3:30 PM
Efficacy of Normobaric Intermittent Hypoxic Training to Improve VO₂peak During Acute Hypobaric Hypoxia Exposure

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Environmental conditions pose additional threats to the health of soldiers during military operations. Missions conducted at high altitude increase the relative workload for military personnel and unacclimatized warfighters may endure performance decrements.

PURPOSE: To examine the effects of normobaric intermittent hypoxic training (NIHT), when compared to normobaric normoxia (NN) training, on peak aerobic capacity ($\text{VO}_{2\text{peak}}$) in hypobaric hypoxia (HH). **METHODS:** Eleven male Reserve Officers' Training Corps (ROTC) cadets (age 19.55±1.44 y, mass 75.80±8.82 kg, stature 177.45±6.67 cm) completed the 6 week training intervention in either the NIHT (EXP, $n=6$) or NN (CON, $n=5$) conditions. Pre- and post-assessment of $\text{VO}_{2\text{peak}}$ was conducted in an HH setting equivalent to 3033 m. The EXP group also completed a follow-up $\text{VO}_{2\text{peak}}$ assessment after a 1 week detraining period. Mixed ANOVA was performed to analyze differences between the within-subjects factor (time) and between-subjects factor (group). Repeated measures ANOVA were also performed to analyze differences between the pre-, post-, and follow-up results of the EXP group. **RESULTS:** There was no significant interaction of time x group, $F(1,9)=1.17$, $P=0.31$, partial $\eta^2=0.12$, nor significant main effect of group, $F(1,9)=0.03$, $P=0.86$, nor was there a significant main effect of time $F(1,9)=3.35$, $P=0.10$, on time-to-exhaustion (TE) measured in HH. Neither was there a significant interaction of time x group for relative $\text{VO}_{2\text{peak}}$ ($\text{RVO}_{2\text{peak}}$). $F(1,9)=1.64$, $P=0.23$, partial $\eta^2=0.15$. Further, there was no

significant main effect of group for $\text{RVO}_{2\text{peak}}$, $F(1,9)=0.61$, $P=0.45$. However, there was a significant main effect of time for $\text{RVO}_{2\text{peak}}$, $F(1,9)=6.88$, $P=0.03$. Finally, there was no significant difference of $\text{RVO}_{2\text{peak}}$ in the EXP group between pre-, post-, and follow-up assessments in the HH chamber, $F(2,3)=6.53$, $P=0.06$. **CONCLUSION:** NIHT, compared to NN, failed to elicit significantly greater aerobic endurance enhancements in acute HH. However, while statistical significance for TE, $\text{VO}_{2\text{peak}}$, and $\text{RVO}_{2\text{peak}}$ may not have been attained, moderate effect sizes for the aforementioned variables reveal a potential practical significance was achieved via increases of 7.37%, 15.99%, and 14.71% for the EXP group, respectively.
 Supported by NSCA Foundation Doctoral Research Grant

934 Board #113 May 31 2:00 PM - 3:30 PM
Maximum Oxygen Consumption Returns to Sea Level Values after Two Weeks of Altitude Acclimatization in a Large Multi-Year Study

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While it is generally agreed that maximum oxygen consumption ($\text{VO}_{2\text{max}}$) declines upon acute ascent to altitude, there has been some disagreement about the effects of acclimatization on $\text{VO}_{2\text{max}}$. Some of the disagreement reflects a small sample size and lack of control of physical activity during the stay at altitude. To our knowledge, no studies with a large subject pool that controls for physical activity have looked at $\text{VO}_{2\text{max}}$ after acute exposure, acclimatization and upon return to sea level in the same study. **Purpose:** Therefore, the purpose of this study was to determine the effect of moderate altitude exposure on maximum oxygen consumption acutely, after acclimatization, and upon return to sea level. **Methods:** Over the course of a 6-year period, eighty-eight active subjects (age = 23.3 + 3.5 yrs, weight = 78.5 + 17.5 kg, $\text{VO}_{2\text{max}} = 42.4 + 5.7$ ml/kg/min) completed a graded-exercise test on a cycle ergometer at sea level (SL1), upon acute exposure to 3417 m (ALT1), two weeks following acclimatization at 3417 m (ALT2), and upon return to sea level (SL2). Workloads were increased every two minutes following a two-minute warmup until volitional fatigue. Maximum oxygen consumption was measured using a Parvo TruOne 2400 Metabolic cart. Subject's activity levels were assessed during the 2-week period and were unchanged relative to sea level. **Results:** Maximum oxygen consumption significantly declined ($P<0.05$) from SL1 to ALT 1 (3.48 + .39 l/min vs. 3.04 + .32 l/min). However, by ALT2 $\text{VO}_{2\text{max}}$ was not different from SL1 (3.48 + .39 l/min vs. 3.31 + .51 l/min). Maximum oxygen consumption was slightly, but not significantly higher upon return to sea level (SL2 = 3.65 + .66 l/min). While body weight changes occurred in some subjects, overall there was no difference in average body weight between any of the testing points. **Conclusions:** These data suggest that exposure to acute altitude results in a reduction in maximum oxygen consumption. However, after two weeks of acclimatization maximum oxygen consumption returns to pre-sea level values in a large multi-year study.

935 Board #114 May 31 2:00 PM - 3:30 PM
Does Arterial Oxyhemoglobin Saturation Influence the Hemoglobin Mass-VO₂Peak Relationship in Endurance Athletes at Moderate Altitude?

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Total hemoglobin mass (tHb) is a well-established, key predictor of maximal oxygen uptake ($\text{VO}_{2\text{peak}}$) across aerobic fitness levels. Arterial oxyhemoglobin saturation ($\text{S}_{\text{a}}\text{O}_2$) has the potential to modify this relationship, especially in populations that experience exercise-induced arterial desaturation. **PURPOSE:** To examine how variability in $\text{S}_{\text{a}}\text{O}_2$ at $\text{VO}_{2\text{peak}}$ modifies the relationship between tHb and $\text{VO}_{2\text{peak}}$ at moderate altitude (1625m) in highly trained athletes.

METHODS: 16 male and 17 female competitive, highly trained (>10 hr training per week) cyclists/triathletes took part. On visits one and four tHb was assessed via the optimized carbon monoxide rebreathing method. Visits two and three were identical graded exercise tests (GXT) on a cycle ergometer to determine $\text{VO}_{2\text{peak}}$ and $\text{S}_{\text{a}}\text{O}_2$ at $\text{VO}_{2\text{peak}}$; the workload began at 4 and 3 W kg^{-1} for men and women respectively, rounded down to the nearest 20 W increment, and power increased 20 W every minute until volitional exhaustion. VO_2 was measured using indirect calorimetry and $\text{VO}_{2\text{peak}}$ was calculated as the highest average 30 sec VO_2 . $\text{S}_{\text{a}}\text{O}_2$ was measured at rest and during exercise using forehead pulse oximetry; $\text{S}_{\text{a}}\text{O}_2$ at $\text{VO}_{2\text{peak}}$ was calculated as the average $\text{S}_{\text{a}}\text{O}_2$ during the same 30 sec used to determine $\text{VO}_{2\text{peak}}$. Duplicate measures of tHb were averaged in order to reduce measurement error. In order to control for the effect of body mass on $\text{VO}_{2\text{peak}}$ and tHb, both variables were normalized by body mass prior to analysis.

RESULTS: $\text{VO}_{2\text{peak}}$ was significantly higher for the second GXT (+0.06 ± 0.17 L O₂ min⁻¹, $p = 0.05$) and the difference in $\text{VO}_{2\text{peak}}$ was related to the difference in $\text{S}_{\text{a}}\text{O}_2$ ($r = -0.42$, $p = 0.02$), so results from the second GXT were used. $\text{VO}_{2\text{peak}}$ ranged from

62.5 – 83.0 and 44.5 – 67.3 ml kg⁻¹ min⁻¹ in men and women respectively; tHb ranged from 12.1 – 17.5 and 9.1 – 13.0 g kg⁻¹ and S_aO₂ at VO_{2peak} ranged from 81.7 – 94.0 and 85.7 – 95.0%. tHb explained 32% of the variability in VO_{2peak} (p = 0.02) in men and 42% in women (p = 0.01), but correcting by end exercise S_aO₂ did not improve either relationship.

CONCLUSION: Across a range of highly trained athletes at moderate altitude, correcting tHb by S_aO₂ at VO_{2peak} does not appear to explain additional variability in VO_{2peak}, despite large variability in the levels of observed desaturation.

936 Board #115 May 31 2:00 PM - 3:30 PM
Cardiopulmonary Responses, Brain And Muscle Oxygenation During Incremental Exercise On Acute Hypoxia And Hyperoxia

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Changes in inspired oxygen concentration will affect the peak oxygen uptake compared with normoxia. These underlying mechanisms are not fully understood, but peripheral and central mechanisms have been proposed. **PURPOSE:** Our study focuses on the effect of acute moderate hypoxia and hyperoxia on cardiopulmonary responses, brain and muscle oxygenation during exercise. **METHODS:** Seven healthy male subjects performed on incremental maximal exercise test under normoxia (Norm: 20.9 FIO₂), hypoxia (Hypo: 14.5% FIO₂) and hyperoxia (Hyper: 28.5% FIO₂) conditions. We measured cardiopulmonary measurements (VE, VO₂, HR and Q) and blood gas (PO₂ and PCO₂) on incremental exercise. Near-infrared spectroscopy (NIRS) was also used to monitor concentration (μM) changes of oxy- and deoxyhemoglobin (Δ[O₂Hb], Δ[HbHb]) in left frontal cortex region of the forehead and ipsilateral vastus lateralis muscle. Changes in total Hb and StO₂ were calculated and used as index of change in regional blood volume. Repeated-measures ANOVA were performed across treatments. **RESULTS:** VO_{2peak} decreased in Hypo (38.5±3.1 ml/kg/min, p<0.05) and no difference in Hyper (42.6±3.4 ml/kg/min) compared with Norm (42.2±3.9 ml/kg/min). But blood PO₂ at rest and moderate exercise was low in Hypo (57.7±3.1 and 52.2±5.4 mmHg, p<0.05) and high in Hyper (98.6±8.8 and 105.3±9.3 mmHg, p<0.05) compared with Norm (79.3±12.6 and 84.3±4.7 mmHg). Muscle oxygenation dropped progressively during Hypo, and also changes in muscle oxygenation during Hyper were similar to Norm. Interestingly, Brain oxygenation (Δ[O₂Hb]) was slightly increased and deoxygenation (Δ[HbHb]) was increased during exercise under each three conditions, respectively. Furthermore, changes brain and muscle oxygenation was also greater in Hypo compared with Norm and Hyper (p>0.05). **CONCLUSIONS:** Acute hypoxia decrease oxygen uptake with decreased muscle oxygenation and slightly increased brain oxygenation. But it is unlikely that changes in brain and muscle oxygenation was related with oxygen uptake in hyperoxia, despite a similar difference absolute PO₂ in inspired oxygen and blood from hypoxia and/or hyperoxia to normoxia.

937 Board #116 May 31 2:00 PM - 3:30 PM
Passive And Active Intermittent Hypoxic Exposure Pre-acclimatization Does Not Alter Heart Rate Variability At Altitude.

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PURPOSE: This study evaluated the impact of passive and active intermittent hypoxic (IH) exposure pre-acclimatization strategies on temporal and spectral power measures of heart rate variability (HRV) in normobaric hypoxia (NH), and natural altitude.

METHODS: Thirty participants (17 male and 13 female, aged 20-62 years), matched by sex, age and maximal aerobic capacity (VO_{2peak}), were randomly allocated to either a control, passive IH or active IH group. Experimental groups completed 10 x 2-h, passive (PIH) or active (AIH), normobaric IH exposures (FIO₂ = 0.124, ~4,011 m) over the 14-day intervention period (weekends excluded). The control group received no IH exposure. During the intervention period, participants completed 20 minutes daily running training, at an individualised intensity equivalent to 80% heart rate reserve (HRR). Training workload was determined by regressing HR and running speed data from individual VO_{2peak} tests in normal ambient conditions (control and PIH groups) or NH (AIH group, FIO₂ = 0.124). AIH participants completed the exercise training sessions under supervision, during scheduled IH exposure sessions, while control and PIH groups completed training unsupervised in normal ambient conditions. Within 48 hours of completing pre-acclimatization, participants travelled by air from the

UK to Nepal, a journey time of approximately 36 hours. Participants then trekked from 2800 m to 5300 m over 14 days. Temporal (RR, SDNN, RMSSD) and spectral power measures (LFnu, HFnu and LFHF ratio) of HRV were recorded, at rest with spontaneous breathing, in normal ambient conditions (FIO₂ = 0.209), NH (FIO₂ = 0.124, ~4011 m) and in hypobaric hypoxia (HH) at 4356 m and 5350 m, during ascent. **RESULTS:** Two-way ANOVA (group x condition) with repeated measures revealed neither significant interactions (P>0.05), nor between-group (P>0.05) nor within-group (P>0.05) differences for temporal or power spectral HRV measures between baseline, pre-IH and post-IH. No significant interactions, between-group or within-group changes were noted between post-IH, 4300 m and 5300 m (P>0.05) natural altitude. **CONCLUSION:** Pre-acclimatization using active and passive intermittent hypoxic exposure did not significantly alter heart rate variability responses during ascent to very high altitude.

938 Board #117 May 31 2:00 PM - 3:30 PM
Hematological Response to Uncontrolled Use of Altitude Training by Elite Distance Runners

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Elite endurance athletes typically use “live high - train low” altitude training to enhance sea level performance. Perhaps the most commonly utilized and expected experimental control in altitude training research concerns iron stores and supplementation. Whether elite athletes and coaches independently follow evidence-based best-practice principles regarding iron status and training at altitude, outside of a controlled research setting, is unknown. **PURPOSE:** To examine logistical decisions elite U.S. distance runners make regarding altitude training and the hematological outcomes that result from those decisions. **METHODS:** Elite U.S. distance runners (n = 58) completed altitude training (living elevation = 2,000 - 2,600m) at their own cost and volition. Total hemoglobin (tHb) mass was measured using CO rebreathing upon arrival and departure from altitude. Questionnaires asked athletes to self-report pre-altitude serum ferritin values, if iron was taken (pill or liquid) at altitude, and workout specifics. **RESULTS:** Of the 40 athletes who knew their serum ferritin level at the start of the camp, those with ferritin < 50 ng·ml⁻¹ (n = 11) demonstrated a ΔtHb of 0.6 ± 2.0% (ns) and those with ferritin > 50 ng·ml⁻¹ (n = 29) significantly increased tHb by 3.7 ± 3.0%. Of those with ferritin levels > 50 ng·ml⁻¹, athletes who lived at altitude < 23 days (n = 9) showed a ΔtHb mass of 1.3 ± 1.7% (ns) and those who lived at altitude for > 27 days (n = 20) significantly increased tHb mass by 3.8 ± 2.6%. Of the total cohort, 49 athletes answered questions regarding iron supplementation. Those who supplemented iron in liquid form (n = 27) significantly increased tHb mass by 4.2 ± 3.4%. Those who did not supplement iron (n = 3) or supplemented in pill form (n = 19) showed a ΔtHb mass of 1.5 ± 0.5% (ns) and 1.4 ± 2.7% (ns). Athletes who answered questions regarding training (n = 47) reported completing 8.5 ± 2.5 “higher intensity workouts,” and 3.6 ± 1.1 of those workouts were done at <1,500m. Only 4 of the 47 athletes completed all higher intensity sessions at <1,500m. **CONCLUSION:** A substantial number of elite U.S. distance runners do not follow what would be considered evidence-based best-practice principles regarding altitude training. Coaches, sport scientists, and clinicians would be prudent to strongly advocate for athletes to follow these principles.

939 Board #118 May 31 2:00 PM - 3:30 PM
No Sex Differences in the Cardiac Response to Acute Normobaric Hypoxia

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Acute hypoxia reduces arterial oxygen content, thereby increasing cardiac work to maintain oxygen delivery. Hypoxia may be accompanied by impairments in cardiac function which may be subject to sex differences, although this remains inadequately described. **PURPOSE:** Explore sex differences in the cardiac response to acute hypoxia. **METHODS:** Thirty healthy participants (15 men, 22±4 yrs, BMI 25.3±3.0 kg/m²; 15 women, 20±3 yrs, BMI 22.6±1.2 kg/m²) underwent echocardiographic measures with simultaneous 1-Lead electrocardiogram-gating following ~1.5 hour sham condition (20.0% O₂) and normobaric hypoxic (12.5% O₂) exposure on two separate days, in a randomized order. Systolic function (M-mode, tissue Doppler imaging [TDI]) and diastolic function (mitral filling velocities, TDI) were assessed in triplicate. Systolic function was assessed using fractional shortening (FS), ejection fraction (EF) from 2D Teicholz M-mode (parasternal short-axis), and S-wave velocity from tissue Doppler Imaging (TDI, apical 4-chamber). Diastolic function was assessed

using ratios between early (E) and late (A) filling waves assessed from Doppler (E, A) and TDI (E', A'). **RESULTS:** EF, FS, S-velocity (septal) were greater in hypoxia vs sham (p<0.05). Markers of diastolic function (E:A, E':A') were lower in hypoxia vs sham (p<0.05). Men had higher EF vs women across conditions (p<0.05). No significant condition by sex interactions were noted. **CONCLUSION:** Hypoxia resulted in greater systolic function but impaired diastolic function compared to the sham condition. Although men tended to have greater cardiac systolic function vs women there were no sex differences in the cardiac systolic or diastolic response to acute hypoxic exposure. Supported by a Foundation Research Grant from ACSM

Table 1: Myocardial function in sham condition and acute hypoxia in males and females (mean± SD)

	Sham		Hypoxia		P value			df
	Men	Women	Men	Women	Condition	Sex	CxS	
Systolic Function								
EF (%)	57± 7	63± 5	63± 8	66± 6	0.01	0.02	0.25	26
FS (%)	30± 5	34± 4	35± 6	36± 5	0.01	0.06	0.33	26
Tissue Doppler velocities								
Lateral S (cm/s)	11.3± 1.9	11.8± 1.4	12.6± 2.6	11.8± 2.5	0.12	0.85	0.14	23
Septal S (cm/s)	8.4± 1.1	8.5± 1.1	9.0± 1.2	9.2± 1.1	0.01	0.68	0.86	22
Diastolic Function								
Mitral E:A	2.0± 0.4	2.0± 0.5	1.6± 0.3	1.7± 0.4	<0.01	0.60	0.93	24
Tissue Doppler velocities								
Lateral E':A''	2.92± 0.75	2.71± 0.91	2.38± 0.60	2.19± 0.38	<0.01	0.42	0.91	23
Lateral E:E''	3.50± 0.63	3.77± 0.68	3.32± 0.58	3.76± 1.00	0.55	0.16	0.62	23
Septal E':A''	2.92± 0.75	2.71± 0.91	2.38± 0.60	2.19± 0.38	<0.01	0.42	0.91	22
Septal E:E''	5.03± 0.86	5.06± 0.87	4.79± 0.71	4.86± 1.15	0.39	0.86	0.92	22
CxS, condition x sex interaction; EF, ejection fraction; FS, fractional shortening								

940 Board #119 May 31 2:00 PM - 3:30 PM
Effect Of Additional Overnight Hypoxic Exposure In Combination With Intermittent Hypoxic Training On MART

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We previously demonstrated that 7 days of intermittent hypoxic training (IHT) improved performance in the maximal anaerobic running test (MART) (ACSM 2015). However, it is unclear whether additional overnight hypoxic exposure in combination with IHT can further enhance MART. **PURPOSE:** The purpose of the present study was to compare the physiological adaptations in well-trained 400m or 800m runners following either 7 days of intermittent hypoxic overnight exposure (IHE), IHT, or a combination of IHE and IHT (IHE+IHT).

METHODS: Thirty-two well-trained university female 400m or 800m runners were assigned to either IHE (n=9), IHT (n=9), IHE+IHT (n=6) or Control (n=8) groups. IHE and IHE+IHT slept in a normobaric hypoxic room (FIO₂=16.4%; 2000m; 10 h/d). IHT and IHE+IHT trained in a normobaric hypoxic room (FIO₂=14.4%; 3000m; 4 h/d). Control, non-IHE hours, and non-IHT hours were spent in ambient normobaric normoxia (60m). Subjects trained for 7 days and performed MART and an incremental maximal running test before and after the 7 days training period. Training consisted of high intensity interval training (5 x 30s maximal effort pedaling) and endurance training (30min incremental running and 30min steady pedaling). VO₂max and the velocity equivalent to 4mmol lactate (V4mM) were measured in the incremental running test.

RESULTS: Maximal power in the MART increased significantly (P<0.05) in IHT (109.5±1.4 vs. 111.7±2.8 ml/kg/min). However, there were no significant changes in IHE, IHE+IHT or Control (IHE: 111.0±4.2 vs. 111.6±4.0, IHE+IHT: 109.4±3.3 vs. 110.2±3.6, Control: 112.1±3.0 vs. 111.5±3.9 ml/kg/min). No significant change in VO₂max in any groups was found. V4mM increased significantly (P<0.05) in IHT and

IHE+IHT (IHT: 248.4±13.7 vs. 255.3±15.6, IHE+IHT: 221.8±16.1 vs. 237.8±9.9 ml/min), whereas there were no significant changes in IHE or Control (IHE: 253.1±24.2 vs. 251.6±22.8, Control: 246.7±16.8 vs. 250.6±21.0 ml/min).

CONCLUSIONS: These results suggest that 7 days of IHT (3000m) enhances maximal anaerobic capacity (MART) in well-trained female middle distance runners, which supports our earlier findings (ACSM 2015). However, there does not appear to be further enhancement of anaerobic running performance with the addition of overnight hypoxic exposure to IHT.

941 Board #120 May 31 2:00 PM - 3:30 PM
Influence Of Altitude Difference On Residents' Physical Function

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Purpose: To compare the physical characteristics and function between the residents in different altitude. **Methods:** 441 Tujia-Nationality men (24.6±3.2 yr) from high (H = 1500 M, N = 196) and low (L = 800 M, N = 215) mountain areas in Enshi Tujia and Miao Autonomous Prefecture, Hubei province of China who had the same social-economic status were compared with the physical characteristics and physiological functions. **Results:** Compared with the H group, the L group were taller (167.5 ±5.3 vs 165.0 ±5.2cm, P < 0.001) and had lower waist-to-height ratio (0.51 ±0.04 vs 0.52 ±0.04, P < 0.001), but no significant difference in body weight and circumferences. The L group had higher heart rate (79.5 ±10.8 vs 76.7 ±9.4 bpm, P = 0.034), greater vital capacity (3225 ±677 vs 2839 ±731 ml, P < 0.001), lower systolic pressure (112.0 ±10.4 vs 115.7 ±12.4 mmHg, P = 0.007), and lower diastolic pressure (74.5 ±8.0 vs 79.8 ±11.7 mmHg, P < 0.001). The L group had lower sit-and-reach (6.6 ±7.9 vs 8.5 ±5.3 cm, P = 0.015), but had greater vertical jump (34.2 ±9.0 vs 30.4 ±8.4 cm, P < 0.001), longer time to stand on one foot with eyes closed (31.7 ±31.2 vs 20.5 ±21.4 sec, P < 0.001), more push-up (26±13 vs 23±12, P < 0.031) and shorter reaction time (0.46 ±0.08 vs 0.51 ±0.15 sec, P < 0.001). **Conclusion:** Residents in low mountain area are taller, have lower arterial pressure and better neuromuscular function as compared to their counterparts in high mountain area.

942 Board #121 May 31 2:00 PM - 3:30 PM
Losartan Does Not Affect Maximal Exercise Performance at High Altitude (5000 m)

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Exposure to high altitude induces hypertension that likely exacerbates arterial hypoxia via pulmonary vasoconstriction and ventilation-perfusion mismatching. Research has shown that inhibition of the renin-angiotensin-aldosterone system (RAAS) via an inhibitor provides an antihypertensive effect at rest during acute exposure to high altitude. Such effects may have benefits for exercise performance given the potential for improved arterial saturation, but has not been studied.

PURPOSE: To assess the effects of the RAAS inhibitor losartan on maximal exercise performance at 5000 m.

METHODS: Eighteen lowlanders were paired-matched for age, ACE gene status, previous altitude exposure and sex, with each of the pair randomly assigned to a group (men:women: losartan 6:3, placebo 6:3; age 40 ± 18 years; height 175 ± 9 cm; body mass 72.4 ± 12.4 kg; BMI 23.7 ± 2.2 kg/m²). A 100 mg once daily dose of either losartan or placebo (starch) was administered in a double-blind manner for 21 days, which included a slow 8-day ascent to 5000 m (Whymper Hut, Chimborazo, Ecuador). At sea-level and within 48 h of arrival at 5000 m, participants (pairs exercised within ~1 h of each other) completed a graded exercise test (GXT) to exhaustion on a supine cycle ergometer (Altcycle, BMRES). Ventilation (VE) and end-tidal gases were measured breath-by-breath (K4b2, Cosmed), and heart rate (HR, ECG), arterial oxygen saturation (SpO₂, pulse oximeter) and beat-to-beat blood pressure (finometer) were measured continuously at rest and during exercise. Data are mean ± SD and group differences at peak power output were analyzed using independent t-tests, with significance set at p<0.05.

RESULTS: At 5000 m, resting measures of SpO₂ between losartan and placebo groups were not significantly different (79 ± 5 vs. 76 ± 6%, p=0.40). Peak power was similarly

reduced relative to sea level ($p < 0.01$) in both groups (down 100 ± 29 vs. 91 ± 28 W, $p = 0.55$), while SaO_2 (70 ± 6 vs. $70 \pm 5\%$, $p = 0.96$), $\text{VO}_{2\text{peak}}$ (31.3 ± 4.6 vs. 34.0 ± 7.2 $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $p = 0.35$), VE (142 ± 38 vs. 146.2 ± 31.2 $\text{L} \cdot \text{min}^{-1}$, $p = 0.81$) and HR (146 ± 21 vs. 149 ± 24 $\text{b} \cdot \text{min}^{-1}$, $p = 0.78$) were similar between groups at peak power, as was the increase in BP from rest to peak power (increased by 31 ± 17 vs. 25 ± 16 mmHg , $p = 0.71$).

CONCLUSION: Losartan (100 mg) taken daily for 21 days had no observable effect on exercise performance at 5000 m.

943 Board #122 May 31 2:00 PM - 3:30 PM
Ischemic Preconditioning Attenuates Acute Mountain Sickness in Hypobaric Hypoxia during Recreational Mountaineering
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Purpose: Acute mountain sickness (AMS) is a syndrome commonly experienced in non-acclimatized mountaineers when ascent is too high and too rapid. Ischemic preconditioning (IPC) is a noninvasive experimental technique that has been shown to protect remote organs from ensuing hypoxic damage. In this study we sought to determine if IPC would 1) mitigate the effects of altitude on arterial O_2 saturation (SpO_2) and 2) attenuate the symptoms of AMS. **Methods:** Ten (6 men and 4 women) physically active individuals (Age: 26.7 ± 5.0 yrs, $\text{VO}_{2\text{max}}$: 45.0 ± 7.1 $\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) who were acclimated to 2350m were randomized to either a treatment (IPC) or control (CON) group. An IPC protocol consisting of 3x5 min bilateral leg occlusion/reperfusion bouts at 200 mmHg was administered to the IPC group. The CON group was administered a protocol identical in time and frequency, but with an inflation pressure of 40 mmHg. To examine the potential late phase protective effects of IPC on SpO_2 and symptoms of AMS, 36 hours post-IPC or CON, all participants hiked 9km at a standardized pace to an elevation of 3800m. Symptoms of AMS were evaluated by Lake Louise score (LLS). **Results:** It was found that SpO_2 was significantly higher ($p < 0.05$) in the IPC group when compared to the CON group (IPC $89.6 \pm 3.9\%$ vs. CON $86.9 \pm 4.2\%$). A LLQ score of less than 3 is considered mild AMS, whereas a score of 3 or more is considered severe AMS. Incidence of severe AMS was significantly lower ($p < 0.05$) in the IPC (0%) vs. CON (50%) group. Moreover, the IPC group (when compared to CON group) had significantly ($p < 0.05$) lower incidence of dizziness/lightheadedness (IPC=0% vs. CON=50%), fatigue/weakness (IPC=25% vs. CON=66.6%), change in mental status (IPC=0% vs. CON=33.3%) and ataxia (IPC=0% vs. CON=16.6%). **Conclusion:** Our findings suggest that IPC may be a strategy to increase SpO_2 and decrease AMS symptoms at high altitude.

944 Board #123 May 31 2:00 PM - 3:30 PM
Locomotor-Respiratory Coupling is Maintained in Hypoxia in Trained Distance Runners
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 (No relationships reported)

PURPOSE: To determine if acute exposure to normobaric hypoxia alters locomotor-respiratory coupling (LRC) patterns typically observed in trained runners, and to determine if any changes in LRC influence running economy (RE) and/or perceptions of ventilatory effort.

METHODS: Trained male distance runners ($n=13$) with $\text{VO}_{2\text{max}} = 66.8 \pm 1.1$ $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ completed two laboratory visits, each in a different inspired gas condition, either normoxia (NORM) or hypoxia (HYP) ($\text{FIO}_2 = 15.8\%$; $\sim 2500\text{m} / 8000\text{ft}$). During each visit, subjects ran for 5 min at each of three constant submaximal speeds of 12.9, 14.3, and 16.1 $\text{km} \cdot \text{hr}^{-1}$ with 4 min standing rest between speeds. Following the third stage, an incremental incline ramp protocol was used to determine $\text{VO}_{2\text{max}}$, RE and LRC measures were taken during the 4th min of each speed (3:00-4:00), while ratings of perceived exertion (RPE) and dyspnea (DYS) were taken during the first 30 seconds of the final minute at each speed (4:00-4:30), and again at the conclusion of the test. The degree of LRC was calculated as the highest number of inspirations or expirations beginning in the same decile of the step divided by the total number of breaths.

RESULTS: Compared with NORM, the degree of LRC was not significantly different at any of the three common submaximal speeds with exposure to HYP, however it was increased at $\text{VO}_{2\text{max}}$ ($43.8 \pm 3.4\%$ vs. $57.1 \pm 3.8\%$; $p < 0.05$). Breathing frequency (breaths min^{-1}) was significantly increased at each submaximal speed in HYP compared to NORM (30.3 ± 1.9 vs. 35.9 ± 2.2 , 34.8 ± 2.0 vs. 39.8 ± 2.2 , 40.4 ± 2.4 vs. 45.2 ± 1.9 ; $p < 0.05$), but was not significantly different at $\text{VO}_{2\text{max}}$. Stride frequency-to-breathing frequency quotients were significantly lower at each submaximal speed in HYP (2.91 ± 0.20 vs. 2.45 ± 0.17 , 2.53 ± 0.17 vs. 2.21 ± 0.14 , 2.22 ± 0.14 vs. 1.95 ± 0.09 ; $p < 0.05$)

due to increases in breathing frequency while maintaining stride frequency. RE and RPE were not significantly different at any speed. DYS was only significantly different between NORM and HYP at 16.1 $\text{km} \cdot \text{hr}^{-1}$ ($p < 0.05$).

CONCLUSIONS: Trained distance runners are able to maintain LRC in hypoxia, even when breathing frequency is increased at any submaximal pace. It is possible that within this unique population, years of training enhance and optimize the ability to make adjustments to LRC in order to minimize metabolic costs.

945 Board #124 May 31 2:00 PM - 3:30 PM
Acute Hypoxia Exacerbates Central Fatigue but not the Fatigue-related Reduction in Motor Neuron Responsiveness
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It has been shown recently that acute hypoxia (AH) exacerbates fatigue through both muscular and neural mechanisms. At a supraspinal level, the voluntary drive from the motor cortex during fatiguing efforts was impaired compared to normoxia (NM). However, it is currently unknown whether hypoxia acutely affects motor neuron properties and their contribution to fatigue. **PURPOSE:** To examine motor neuron responsiveness and voluntary activation (VA) during fatiguing contractions in AH and NM. **METHODS:** On separate days, 11 males (31 ± 8 years) completed a 16-minute fatigue protocol composed of submaximal (25% maximal torque; MVC) intermittent (10s contraction, 5s rest) isometric elbow flexions in NM ($\text{F}_{\text{O}_2} = 21\%$) and AH ($\text{F}_{\text{O}_2} = 11\%$). For the last contraction of each minute, participants matched the integrated electromyographic activity (EMG) to that recorded during brief contractions at 25% MVC prior to fatigue; motor neuron responsiveness was measured by delivering cervicomedullary stimulation in the silent period evoked by transcranial magnetic stimulation (TMS) of the motor cortex (100ms inter-stimulus interval). Every 2 minutes, VA was measured by delivery of TMS during contractions at 100, 75 and 50% MVC, separated by 3s. **RESULTS:** Prior to fatigue, arterial saturation and cerebral tissue oxygenation index were significantly lower in AH compared to NM (98 ± 1 vs. $76 \pm 3\%$ and 65 ± 7 vs. $48 \pm 12\%$, respectively; $p < 0.01$). MVC torque was equivalent (76.2 ± 9.5 vs. $80.6 \pm 13.0\text{Nm}$, respectively; $p > 0.05$) but VA was significantly lower in AH compared to NM (90.4 ± 5.0 vs. $93.5 \pm 5.4\%$, respectively; $p < 0.05$). At the end of the fatigue protocol, the reductions of MVC torque and VA (relative to control values) were greater in AH compared to NM (20.5 ± 8.2 vs. $11.6 \pm 9.8\%$ and 14.4 ± 12.3 vs. $4.0 \pm 7.1\%$, respectively; $p < 0.05$). Conversely, the reduction in motor neuron responsiveness (area of the cervicomedullary motor evoked potential normalized to the maximal compound muscle action potential) was not significantly greater during AH compared to NM (47.6 ± 30.8 vs. $31.2 \pm 37.2\%$, $p > 0.05$). **CONCLUSION:** While AH elicited a marked effect in the CNS, such impairment was only confined to the cortical compartment (a greater reduction in VA), without affecting the responsiveness of motor neurons to a fatiguing task.

Supported by NSERC, CFI and BCKDF

946 Board #125 May 31 2:00 PM - 3:30 PM
Training Periodisation During LHTH at Various Altitudes Improves Performance in Elite Runners
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Previous studies have reported improved sea level performance and increased haemoglobin mass (Hb_{mass}) following hypoxic doses of varying magnitude. Less research has focused on the periodisation of training during hypoxic exposure which may influence subsequent performance.

PURPOSE: To determine the effect of intensified training and tapering during different doses of Live High Train High (LHTH) altitude on sea level performance and Hb_{mass} in elite runners.

METHODS: Twenty one runners completed one of three LHTH altitude camps following 4 weeks of sea level training; 22 days at 1720 m (MOD22; $n = 7$; $\text{VO}_{2\text{max}} = 71 \pm 4$ $\text{mL} \cdot \text{min} \cdot \text{kg}^{-1}$), 22 days at 2100 m (HI22; $n = 4$; 67 ± 3 $\text{mL} \cdot \text{min} \cdot \text{kg}^{-1}$) or 30 days at 2100 m (HI30; $n = 10$; 70 ± 4 $\text{mL} \cdot \text{min} \cdot \text{kg}^{-1}$). Hb_{mass} was assessed via CO rebreathing immediately pre and post LHTH, and sea level performance was measured in competitive races completed pre and within 2 weeks post. For each training session, Training Load (TL) was calculated using the session RPE method. Training Stress Balance (TSB) was calculated as the ratio between 7 and 28 day exponentially weighted moving averages. Differences between groups were assessed using one-way ANOVA, with the Kruskal-Wallis test used when assumptions were violated (TSB).

RESULTS: Race performance improved by $0.6 \pm 1.5\%$ overall, with similar improvements in HI22 ($0.9 \pm 0.5\%$) and HI30 ($0.9 \pm 0.9\%$); however these were not significantly different to MOD22 ($0.1 \pm 2.3\%$). Performance improvements were achieved by all 4 participants in HI22, 9 of 10 in HI30 and 4 of 7 in MOD22 (4, 7 and 3 lifetime bests respectively). HB_{mass} was increased from baseline in all groups (MOD22 = $4.4 \pm 4.6\%$; HI22 = $6.0 \pm 2.1\%$; HI30 = $4.0 \pm 3.1\%$). Weekly TL during the first 2 weeks of LHTH was similarly increased in all groups compared to preceding sea level training (range $58 \pm 13\%$ to $72 \pm 27\%$). TSB at the start of LHTH in MOD22 (132 ± 21) was significantly higher ($p < 0.03$) than HI22 (94 ± 11) but not HI30 (95 ± 11 ; $p = 0.10$). TL for the final week of LHTH was reduced significantly less ($p \leq 0.03$) from weeks 1 and 2 in MOD22 ($23 \pm 13\%$) than in HI22 ($44 \pm 5\%$) or HI30 ($41 \pm 10\%$).

CONCLUSIONS: Lifetime best sea level performances were achieved following various doses of LHTH. Substantial increases in training load were observed within the first 2 weeks at altitude, and tapering concluding LHTH appeared beneficial for optimal performance.

947 Board #126 May 31 2:00 PM - 3:30 PM

Performance and Muscle Damage Responses during Repeated Sprint Exercise in Hypoxia among Athletes

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The influence of repeated sprint exercise in moderate hypoxia on muscle damage and inflammatory responses in athletes has not been fully elucidated. **PURPOSE:** The purpose of the present study was to determine the effects of repeated sprint exercise in moderate hypoxia on performance and muscle damage responses among competitive athletes. **METHODS:** Ten sprinters (height; 175.7 ± 1.9 cm, body weight; 67.3 ± 2.0 kg, BMI; 21.7 ± 0.2 kg/m²) participated in this study. They performed two trials under either hypoxic (HYP, F_{iO_2} : 14.5%, a simulated altitude of 3000m) or normoxic (NOR, F_{iO_2} : 20.9%) conditions. The exercise in each trial consisted of three sets of repeated maximal sprints (5×6 -s sprint) with a 30-s rest period between sprints. All subjects were exposed under hypoxic or normoxic conditions during exercise and 3h of post-exercise period. Time-course changes in percutaneous oxygen saturation (SpO₂), power output during exercise, blood lactate, glucose, serum myoglobin (Mb) and plasma interleukin-6 (IL-6) concentrations, and respiratory variables were evaluated. **RESULTS:** During exercise, a significant interaction was observed for mean power output (trial \times number of sprint, $P < 0.001$). However, no significant difference in total power output over all sprints was observed between the two trials. There were significant interaction (trial \times time, $P < 0.001$) and main effect for trial ($P < 0.001$) for blood lactate concentration. The post-hoc test revealed that blood lactate concentrations immediately after exercise was significantly higher in the HYP than in the NOR ($P < 0.05$). Serum Mb concentration increased significantly after exercise (main effect for time, $P < 0.001$), but no significant interaction ($P = 0.804$) or main effect for trial ($P = 0.268$) was observed. Accumulated VO₂ during exercise was significantly lower in the HYP ($P < 0.001$), whereas average RER values during exercise were significantly higher in the HYP than in the NOR ($P < 0.001$). There was no significant difference between trials for any respiratory variables during post-exercise period.

CONCLUSIONS: Repeated sprint exercise in hypoxia elicited blood lactate elevation compared with the same exercise in normoxia. However, magnitude of exercise-induced muscle damage response (elevation of serum Mb) was not affected.

948 Board #127 May 31 2:00 PM - 3:30 PM

Factors Predicting Performance during a High Altitude Hike

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Civilian and military personnel often endure heavy exercise loads at high altitude. To improve performance at high altitude, it is important to understand what factors predict human performance in that setting. **PURPOSE:** To assess whether a physical fitness test at sea-level can be used to predict exercise performance at high altitude. **METHODS:** Subjects were recruited from mid-Michigan (sea level) and were required to pass a medical screening and achieve a high score on the Army Physical Fitness Test (APFT) in order to participate. The APFT performance trial consisted of a pushup test (maximum number of pushups in 2 min), a sit-up test (maximum number of sit-ups in 2 min), and a timed two-mile run. Ninety-nine subjects completed APFT testing at sea-level before being transported to Breckenridge, Colorado (9,075

ft; 2766 m) to undergo APFT testing immediately upon arrival. On day two in Colorado, subjects wore a 35-pound rucksack during a timed, 3.7-mile uphill hike from 10,627 feet (3239 m) to 12,595 feet (3840 m). Multivariable regression analysis was performed to predict which variable(s) (height, weight, pushup score on APFT, sit-up score on APFT, 2 mile run time at the performance trial and at altitude) were most important in determining hike time. **RESULTS:** One multi-variable linear regression model indicated a significant correlation ($p < .05$) between subjects' weight and two-mile run time at the APFT performance trial at sea level relative to hike time ($r^2 = .33$). These findings indicate that as body weight increases hike time was slower, and that a faster 2-mile run time resulted in a faster hike time. A second multi-variable linear regression analysis indicated a significant relationship between the 2-mile run time, sit-ups, and push-ups at high altitude, and subjects' weight relative to hike time ($r^2 = .52$). **CONCLUSIONS:** Overall, the APFT high-altitude trial was a better predictor of hike performance given that the model accounted for 52% of the variance relative to hike performance. Furthermore, in both the sea level and high-altitude trials, subjects' weight and two-mile run time had the greatest influence on hike performance.

B-64 Free Communication/Poster - Blood Flow

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM

Room: Hall F

949 Board #128 May 31 3:30 PM - 5:00 PM

Prolonged Improvement In Hemodynamic Parameters At Rest And During Stress Testing After High-intensity Interval Training

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Purpose: As demonstrated earlier, one bout of aerobic exercise has been shown to result in a prolonged lowering of peripheral and central blood pressure (BP) and pulse wave velocity (PWV) in normotensive and hypertensive individuals. Therefore, a study was initiated to evaluate if faster and more intense forms of exercise, such as HIIT, can also bring about similar blood pressure and PWV reductions. Since cardiovascular hyper-reactivity to stress has a higher prognostic value than measurements conducted at rest, the responses during a following cold pressor test (CPT) were studied as well. **Methods:** In 39 healthy men (34±8 years, BMI 24±2 kg/m²) peripheral BP (pBP), central BP (cBP) and PWV were measured non-invasively at rest and at the end of a 2 minute CPT using 24 PWA monitor. Following a HIIT (6 x 1 min., 98% of previously determined maximum workload, 4 min. rest between intervals) pBP, cBP and PWV were measured throughout 60 minutes of rest and thereafter during a CPT. **Results:** Even 45 minutes after HIIT, there was a significant reduction in systolic pBP (127 ± 9 mmHg to 124 ± 10 mmHg; $p = 0.029$), systolic cBP (116 ± 8 mmHg to 112 ± 9 mmHg; $p = 0.003$) and PWV (5.92 ± 0.7 m/sec. to 5.84 ± 0.7 m/sec.; $p = 0.037$) compared with pre-exercise. Furthermore there were significant reductions in diastolic pBP (81 ± 8 mmHg to 79 ± 7 mmHg; $p = 0.031$) compared to pre-exercise as well. Moreover, pBP ($144 \pm 13/96 \pm 12$ mmHg to $137 \pm 12/93 \pm 11$ mmHg), cBP ($130 \pm 13/98 \pm 12$ mmHg to $125 \pm 12/94 \pm 11$ mmHg) and PWV (6.4 ± 0.7 m/sec to 6.2 ± 0.8 m/sec.) during CPT after HIIT were significantly ($p < 0.01$) lower when compared with pre-exercise measurements.

60 minutes after exercise, there were no more significant differences compared with pressures at rest before exercise. In contrast, 60 minutes after HIIT the increases in systolic pBP ($\Delta = 16.2 \pm 10$ mmHg vs. $\Delta = 11.8 \pm 11$ mmHg; $p = 0.019$), systolic cBP ($\Delta = 14.5 \pm 11$ mmHg vs. $\Delta = 9.8 \pm 11$ mmHg; $p = 0.017$) and PWV ($\Delta = 0.47 \pm 0.36$ m/sec. vs. $\Delta = 0.29 \pm 0.42$ m/sec; $p = 0.026$) due to CPT were still significantly lower when compared with measurements during CPT before exercise.

Conclusion: HIIT leads to a reduction in pBP, cBP and PWV, which was still established 45 minutes after completion of the training. Moreover, pressures and PWV during a CPT increased less after HIIT, indicating attenuated hemodynamic response to stress testing after a single HIIT-session.

950 Board #129 May 31 3:30 PM - 5:00 PM

Arterial Compliance Response To Aerobic Exercise With and Without Blood Flow Restriction In Pre-hypertensive MalesMurat Karabulut¹, Margarita Gonzalez¹, Brittany Esparza¹, Ulku Karabulut¹, Ryan Russell¹, Michael G. Bembem, FACSM².
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PURPOSE: The aim of the study was to assess the effects of acute aerobic exercise with and without blood flow restriction on arterial compliance in pre-hypertensive males.**METHODS:** Ten pre-hypertensive male subjects (age= 23.1±3.2) performed two randomized exercise sessions. Anthropometric measurements, questionnaires, and Bruce protocol were completed at screening. Baseline measurements were obtained each testing day following subjects reaching a normal hydration status. Subjects then ran at 65% VO₂ for a 60 min or 20 min at 40% VO₂ with blood flow restriction (BFR). Arterial elasticity was measured at 0, 10, 20, and 40 minutes and pulse wave velocity (PWV) was measured at 5, 15, 25, and 35 minutes post-exercise.**RESULTS:** There were no significant condition*time interactions or no main effects for condition and time for carotid to radial, carotid to femoral, femoral to distal PWV, small (SAE) or large arterial elasticity (LAE). Significant condition*time interaction (p<.03) and time main effect (p<.01) were found in systolic blood pressure (p<.03). There were also significant condition*time interaction (p<.03) and condition main effect (p<.03, BFR higher) in diastolic blood pressure (p<.03). Significant condition*time interaction (p<.01) and condition (p<.01, 60 min higher) and time main effects (p<.01) were found in heart rate (HR). Significant condition*time interaction (p<.01) and condition (p<.05, BFR higher) and time main effects (p<.01) were found in stroke volume (SV). Significant condition*time interaction (p<.01) and time main effects (p<.02) were found in cardiac output (CO). Significant condition*time interaction (p<.01) and condition (p<.01, 60 min lower) and time main effects (p<.02) were found in systemic vascular resistance (SVR). A significant condition main effect for total vascular impedance (TVI) was detected (p<.05, 60 min lower).**CONCLUSIONS:** Since subjects were in supine position for post-testing, significantly lower SV values could be due to lower venous return and/or sweat-related blood volume loss and lower SVR and TVI could be because of endothelium derived nitric oxide following the 60 min session. The findings also indicate that the 20 min with BFR session may not be intense and/or long enough to cause significant changes in variables tested.

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Central Cardiovascular Hemodynamics and Vascular Stiffness during Handgrip Exercise with and without Blood Flow RestrictionEdward T. Kelley¹, Jeffrey D. Miller¹, Lee Stoner², Daniel P. Credeur¹. ¹University of Southern Mississippi, Hattiesburg, MS.²University of North Carolina at Chapel Hill, Chapel Hill, NC.

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Walking, coupled with bilateral blood flow restriction (BFR) in legs, augments the central cardiovascular adjustment to activity (e.g., greater blood pressure, and aortic wave reflection) as compared to walking without BFR. Whether the same occurs in response to unilateral, upper-body exercise performed with BFR is unknown.

PURPOSE: To examine the central cardiovascular hemodynamics and vascular stiffness responses to low- and high-intensity, unilateral handgrip exercise performed with and without BFR. **METHODS:** Eight college-aged males (Age=24±5 yrs; BMI=30±7 kg/m², handgrip max voluntary contraction-MVC=52±8 kg) underwent three 5-minute bouts (counter-balanced, 10 mins rest between) of rhythmic handgrip dynamometry (1-2 sec duty cycle, 20 squeezes/min) performed at a low (40% MVC) and high-intensity (60% MVC) with and without proximal occlusion (80-100mmHg, 50-80% arterial occlusion assessed via radial artery Doppler-ultrasound). Brachial pulse wave analysis and carotid applanation tonometry (heart rate-HR, mean arterial pressure-MAP, augmentation index-AIx, aortic pulse wave velocity-PWV, wave reflection magnitude-RM%) were performed at baseline and at the end of each 5-min bout of handgrip. To provide an index of peripheral vasoconstriction, perfusion of the vastus lateralis (oxy-hemoglobin, via Near-Infrared Spectroscopy) was also examined during these time points. **RESULTS:** HR increased more during high-intensity handgrip, both with and without BFR, as compared to low-intensity with BFR (60% with BFR=+9±7, vs. 60% without BFR=+9±7, vs. 40% with BFR=+4±5 bpm, P<0.001). Central MAP increased during all handgrip bouts, with the greatest change during high-intensity with BFR (+17±4 mmHg, P<0.001), but comparable responses observed between low-intensity with BFR and high-intensity without (low-intensity with BFR=+9±4, P<0.001; vs. high-intensity without BFR=+13±3 mmHg, P<0.001).No change was observed for AIx, RM%, aortic PWV, or microvascular perfusion across all handgrip bouts (P>0.05). **CONCLUSIONS:** These preliminary findings indicate that unilateral, handgrip exercise performed with and without BFR produces an intensity-dependent increase in HR and central MAP, with no change occurring in aortic wave reflection, vascular stiffness or leg vasoconstriction.

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Acute Effects of Aerobic Exercise with Blood Flow Restriction on Pulse Wave Velocity

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(No relationships reported)

PURPOSE: To investigate the acute effects of a 20-minute walk/run at 40% VO₂ with and without blood flow restriction on pulse wave velocity (PWV). **METHODS:** Seventeen female subjects, between the ages of 18 and 40, signed informed consent and were familiarized with the study protocol, on the same day measurements were assessed: height, weight, body composition, and thigh circumference. Followed by each subject performing the Bruce Protocol on a treadmill. Subjects were asked to come back to the lab hydrated and 8 hours fasted on two different days (separated by at least 48 hours). After reaching hydration, participants were asked to lie down in the supine position for a minimum of 10 minutes and baseline hemodynamics and measurement of PWV using SphygmoCor® CPV Pulse Wave Analyzer. The sites tested were carotid to radial (C-R), carotid to femoral (C-F), and femoral to posterior tibial (F-PT). The randomized testing sessions consisted of two 20-minute walk/run sessions at 40% VO₂ intensity with BFR cuffs inflated (BFR), and the BFR cuffs uninflated (CON). Tightness of the cuffs was set at 55-60 mmHg for BFR, and the cuffs were placed snug enough that they don't move during exercise for the CON session. The final cuff pressures were achieved by starting at 120 mmHg and increasing progressively by 20 mmHg with 10 s rest in between increments. Upon completion of exercise, post exercise PWV was assessed at immediately, 15, 25, and 45 minutes. **RESULTS:** No condition*time interaction or condition and time main effects were observed for C-R and C-F sites (p>0.05). There were no significant condition*time interaction or time main effect for the F-PT site (p>0.05), but a significant condition main effect was detected at the 15 minute mark post exercise following the BFR session (p<.01). **CONCLUSION:** The results suggest that the BFR session resulted in an improved arterial compliance at the F-PT site. This may have been caused by the increased shear stress from blood pooling during the BFR session resulting in a greater release of nitric oxide therefore vasodilation in the lower body. There may be a practical application of using this combination of exercise and settings to help improve cardiovascular health. Since this was an acute study, future training studies should look at the chronic effects on pulse wave velocity using these settings.

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Exercise-Induced Blood Flow Patterns Changes Based on Lactate Levels

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Exercise improves cardiovascular health. However, only 45% of the mechanisms for its beneficial effects for cardiovascular diseases are known. Blood flow patterns and endothelial shear stress during exercise may explain part of the remaining unknown cardiovascular protective mechanisms.

PURPOSE: To identify blood flow patterns of the brachial artery at specific lactate levels of 0-2, 2-4, and 4+ mmol/L to help standardize exercise intensities in cardiac rehabilitation.**METHODS:** Fifteen young healthy subjects (Age 18-35) (9 males and 6 females) were recruited to perform two exercise tests on a cycle ergometer in fasting and exercise-free conditions for at least 10 hours prior the tests. The first test was a maximal, graded exercise test. The second one, performed 48-72 hours after the first exercise test, was a 3-workload steady state test at lactate levels of 0-2, 2-4, and 4+ mmol/L determined during the first exercise test. Oxygen consumption (VO₂), blood pressure, blood lactate levels, and ultrasound imaging of the brachial artery (assessing vessel diameter and blood flow direction and velocity) were continuously monitored during both tests. Repeated measurements ANOVA comparing all three intensities for all variables were performed at alpha=0.05.**RESULTS:** There were no significant changes in brachial artery diameter between exercise intensities and baseline conditions (3.70±0.21 mm vs. 3.76±0.20 mm vs. 3.68±0.21 mm vs. 3.75±0.21 mm, baseline vs. 0-2 mmol/L vs. 2-4 mmol/L vs. 4+ mmol/L, respectively). However, both antegrade and retrograde shear rates significantly increased with exercise in an intensity-dependent manner from baseline to 2-4

mmol/L (antegrade shear rate: $178 \pm 18 \text{ s}^{-1}$ vs. $260 \pm 22 \text{ s}^{-1}$ vs. $309 \pm 24 \text{ s}^{-1}$, baseline vs. 0-2 mmol/L vs. 2-4 mmol/L, respectively, $p < 0.01$; retrograde shear rate: $42 \pm 5 \text{ s}^{-1}$ vs. $84 \pm 9 \text{ s}^{-1}$ vs. $102 \pm 10 \text{ s}^{-1}$, baseline vs. 0-2 mmol/L vs. 2-4 mmol/L, respectively, $p < 0.05$). No significant difference was observed between the 2-4 and 4+ mmol/L intensities.

CONCLUSIONS:

The data shows that exercise-induced blood flow patterns are exercise intensity-dependent. However, high intensity exercise (lactate 4+ mmol/L) appears to offer little changes in blood flow patterns in comparison with moderate exercise (lactate 2-4 mmol/L).

954 Board #133 May 31 3:30 PM - 5:00 PM
Autonomic Modulation After an Acute Bout of Bench Press With and Without Blood Flow Restriction
 Olivia Gilmour, Alaina Glasgow, Erica Marshall, Yu Lun Tai, J. Derek Kingsley. *Kent State University, Kent, OH.* (Sponsor: Ellen L. Glickman, FACSM)
 (No relationships reported)

Traditional resistance exercise may decrease vagal tone up to 30 minutes, which may increase the risk of cardiovascular events. However, the effects of resistance exercise with blood flow restriction (BFR) on autonomic modulation are unclear. **PURPOSE:** To evaluate autonomic modulation after resistance exercise with and without BFR in active men. **METHODS:** Sixteen resistance-trained men volunteered for the study. Autonomic modulation was assessed at rest, 15 (Rec1), and 25 (Rec2) minutes after three different conditions. The low-intensity bench press with BFR (LI-BFR) consisted of 4 sets of 30, 15, 15, and 15 repetitions at 30% 1-repetition maximum (1RM) with 30 second rest between sets. The traditional high-intensity bench press (HI) consisted of 4 sets of 8 repetitions at 70% 1RM with 60 seconds rest between sets, and control (CON) consisted of supine rest. Autonomic modulation was expressed as natural logarithm (Ln), and included total power (LnTP), high-frequency power (LnHF), low-frequency power (LnLF), and sympathovagal balance (LnLF/LnHF ratio). A repeated measures ANOVA was used to evaluate conditions (LI-BFR, HI and CON) across time (Rest, Rec1, and Rec2) on autonomic modulation. **RESULTS:** There was a significant condition by time interaction for LnTP (LI-BFR: Rest: $8.6 \pm 0.9\%$, Rec1: $7.9 \pm 1.0\%$, Rec2: $7.9 \pm 1.2\%$; HI: Rest: $8.6 \pm 1.6\%$, Rec1: $7.7 \pm 0.9\%$, Rec2: $7.3 \pm 1.0\%$; CON: Rest: $8.7 \pm 0.8\%$, Rec1: $8.7 \pm 0.7\%$, Rec2: $8.5 \pm 0.8\%$, $p < 0.05$), LnHF (LI-BFR: Rest: $7.3 \pm 1.1\%$, Rec1: $5.5 \pm 1.2\%$, Rec2: $6.6 \pm 1.5\%$; HI: Rest: $7.4 \pm 1.2\%$, Rec1: $5.9 \pm 1.4\%$, Rec2: $6.5 \pm 1.5\%$; CON: Rest: $7.5 \pm 1.1\%$, Rec1: $7.5 \pm 1.8\%$, Rec2: $7.4 \pm 1.3\%$, $p < 0.05$), and LnLF (LI-BFR: Rest: $7.3 \pm 0.9\%$, Rec1: $5.9 \pm 0.9\%$, Rec2: $6.5 \pm 1.2\%$; HI: Rest: $7.3 \pm 1.1\%$, Rec1: $6.4 \pm 0.8\%$, Rec2: $6.6 \pm 1.2\%$; CON: Rest: $7.1 \pm 1.0\%$, Rec1: $7.1 \pm 1.8\%$, Rec2: $7.1 \pm 1.0\%$, $p < 0.05$) such that they were reduced at Rec1 and Rec2 after LI-BFR and HI compared to Rest and CON. There was a significant ($p < 0.05$) of time effect for LnLF/LnHF ratio (Rest: $1.0 \pm 0.1\%$; Rec1: $1.0 \pm 0.2\%$; Rec2: $1.0 \pm 0.1\%$) such that it was increased at Rec1 and Rec2 compared to Rest. **CONCLUSIONS:** These data suggest that LI-BFR and HI significantly alters autonomic modulation for at least 30 minutes, with no difference between LI-BFR and HI.

Funded by School of Health Sciences at Kent State University

955 Board #134 May 31 3:30 PM - 5:00 PM
Pressor Responses To High And Low-intensity Continuous Or Interval Cycling With/without Blood Flow Restriction.

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A single bout of continuous or high-intensity interval cycling has been able to induce post-exercise hypotension (PEH). However, it is not clear if low-intensity continuous cycling with blood flow restriction (CLI-BFR) induces PEH. **PURPOSE:** To compare post-exercise pressure responses between high-intensity interval cycling (HII), continuous low-intensity cycling (CLI), and continuous low-intensity cycling with blood flow restriction (CLI-BFR). **METHODS:** Eleven young obese adults (age=24.63 \pm 5.7 yrs, body mass index=33.42 \pm 2.04 kg/m², body fat percentage=27.7 \pm 3.0 %, and peak oxygen consumption [VO_{2peak}]=26.26 \pm 3.54 mL·kg⁻¹·min⁻¹) participated in a crossover randomized counterbalanced study design. Subjects completed four separate visits, each separate by 4-9 days. Following the first visit, assessing VO_{2peak}, subjects completed three different cycling sessions which included: CLI – continuous cycling at 45% VO_{2peak} for 15 min; HII – high-intensity interval cycling at 90% of VO_{2peak} consisting of 5 sets of 90 second exercise intervals with 90 second active rest periods at 45% VO_{2peak}; and CLI-BFR – continuous low-intensity cycling with BFR at 45% of VO_{2peak} for 15 min. BFR was applied at the proximal portion of the thigh using a

76 mm wide elastic knee wraps based upon the thigh circumference. Systolic (SBP) and diastolic blood pressures (DBP) were assessed at rest, immediately post-exercise, 10 min, 20 min, 30 min, 40 min, 50 min, and 60 min post-exercise. To compare SBP, DBP, and mean arterial pressure (MAP) measurements, a two-way ANOVA with Newman-Keuls post hoc was used. **RESULTS:** The main effect of condition was not significant for any of the pressor responses ($p > 0.05$), however there was a significant main effect for time. When compared to rest there were significant increases immediately post-exercise for SBP, DBP, and MAP ($p < 0.05$), and a significant increase in DBP at 60 min post-exercise ($p < 0.05$). **CONCLUSION:** CLI-BFR, HII, CLI were not capable of inducing PEH in young obese adults up to 60 min post-exercise.

956 Board #135 May 31 3:30 PM - 5:00 PM
Hemodynamic Response to Resistance Blood Flow Restriction Exercise at Different Degrees of Arterial Occlusion Pressure

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Although resistance exercise involving the application of an external arterial occlusion pressure (AOP) have been widely discussed in the literature, the hemodynamic response to this type of exercise when performed at different degrees of AOP remains unclear. **PURPOSE:** To investigate the hemodynamic response to resistance exercise performed at different degrees of AOP. **METHODS:** Twelve healthy trained males (2.67 yrs, 73.46 \pm 7.89 kg, 1.81 \pm 0.07 m, and 22.50 \pm 1.66 kg/m²) were randomly assigned to four exercise conditions: CON (no occlusion), AOP-50 (50% of AOP), AOP-75 (75% of AOP), and AOP-100 (100% of AOP) in a within subjects cross-over design. A standard 15 cm wide cuff was placed on the thigh, inflated to the target pressure, and four sets of 10 repetitions of unilateral knee extension at 20% of 1RM were executed with 30 s between sets. Subjects performed the same protocol for the CON condition but without occlusion. There was an interval of 7 days between each trial. Total AOP was set as the amount of pressure needed to fully occlude the auscultatory pulse in the lower limbs. Systolic (SBP) and diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), and cardiac product (DP) were assessed at rest, between the second and the third set (during), immediately post-exercise, and every 15 minutes until 60 minutes post-exercise. **RESULTS:** SBP and DP significantly ($p < 0.05$) increased from rest, during and immediately post-exercise for each condition. Significant ($p < 0.05$) elevations from rest were observed in DBP for all experimental conditions during exercise. MAP significantly ($p < 0.05$) increased during exercise from rest for all experimental conditions and for AOP-50, and AOP-100 immediately post-exercise. HR was significantly ($p < 0.05$) increased during exercise only for CON and for all conditions immediately post-exercise. All these parameters returned to baseline 15 minutes post, and remained unchanged up to 1 h post-exercise. **CONCLUSION:** Similar hemodynamic responses were observed for the AOP conditions during, immediately post-exercise, and until 60 minutes post-exercise, regardless of the amount of pressure applied.

957 Board #136 May 31 3:30 PM - 5:00 PM
Importance of Venous Return for Muscle Metaboreflex-mediated Stroke Volume and Cardiac Output Responses

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 (No relationships reported)

It has been shown in animals that activation of the muscle metaboreflex during dynamic exercise increases cardiac output (CO) via rises in heart rate (HR) with sustained stroke volume (SV). In addition, to maintain CO at higher level, venous return also needs to increase. Indeed, decrease in venous return abolishes the muscle metaboreflex-induced rise in CO. However, importance of venous return for the muscle metaboreflex-mediated SV and CO responses has never been examined in humans. **PURPOSE:** We aimed to investigate the influences of decreases in venous return from exercising limbs on the muscle metaboreflex-mediated SV and CO responses in humans. **METHODS:** We studied 9 healthy male volunteers. After resting measurements, the subjects performed cycling exercise for 8-min at 30% and 60% of VO_{2peak} (EX30 and EX60), respectively. Beginning 3 min after the start of the exercise, inner pressure of the occlusion cuffs placed on the both thighs were increased by 80, 100, 120, 140 and then 160 mmHg in stepwise fashion with 1-min step durations. The purpose of the progressive application of thigh cuff pressure was to reduce venous return from exercising limbs as well as to decrease arterial blood flow (i.e., oxygen supply) to exercising skeletal muscles to activate the

muscle metaboreflex. The thigh cuff pressure was not applied in control conditions. **RESULTS:** During exercise at both intensities, the application of thigh cuff pressure progressively increased HR and mean arterial pressure (at last 1-min during exercise in control vs. thigh cuff pressure conditions in EX30: 97 ± 3 vs. 108 ± 3 , 82 ± 3 vs. 104 ± 2 , EX60: 140 ± 3 vs. 155 ± 3 beats/min, 95 ± 2 vs. 116 ± 2 mmHg, $p < 0.05$) indicating activation of the muscle metaboreflex. Meanwhile, SV decreased gradually (EX30: 108 ± 6 vs. 96 ± 5 , EX60: 119 ± 5 vs. 108 ± 5 ml, $p < 0.05$) reflecting reductions in venous return. Consequently, in despite of the rise in HR, CO was maintained at control level (EX30: 10.4 ± 0.5 vs. 10.3 ± 0.5 , EX60: 16.6 ± 0.6 vs. 16.8 ± 0.8 L/min, $p > 0.05$). **CONCLUSIONS:** Our results demonstrate that the muscle metaboreflex-induced rise in HR cannot increase CO due to decrease in SV when venous return from exercising limbs is reduced. We conclude that the venous return from exercising limbs plays a pivotal role in the muscle metaboreflex-mediated SV and CO responses in humans.

958 Board #137 May 31 3:30 PM - 5:00 PM
Effects of Inversion Table Postural Positions on Cardiovascular Hemodynamics in Apparently Healthy Young Adults

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Treatment of low back pain by inverting one's body on a tilt table permits unloading of bones, joints and discs of the low back. This traction force through the spine has been theorized to decrease low back pain. Randomized controlled studies to evaluate the efficacy of this practice for low back pain are limited. Although the gravitational traction is short lived, patients with hypertension, glaucoma, or cardiovascular disease are cautioned to avoid the inversion treatment because of excessive elevations in blood pressure, heart rate and intraocular pressure. **PURPOSE:** To evaluate the influence of postural change on cardiovascular hemodynamics, 12 subjects (age 22.6 ± 1.8 yrs, ht 170.4 ± 9.2 cm, body mass 74.0 ± 13.0 kg, 7 ♀) volunteered to participate in 6 assessments in the following positions: seated (S), 45° head up (45HI), horizontal [H], modified Trendelenburg (-30° head down) [T], -60° head down [60HD], and -90° inversion [I]. **METHODS:** Baseline measures of hemodynamic function (cardiac output [Q], stroke volume [SV], heart rate [HR], systemic vascular resistance [SVR] and cardiac index [CI]) were obtained with an impedance cardiography system, and blood pressure [BP] by auscultation in a seated position [S], followed by a 5 minute assessment in each of the 6 aforementioned positions. Reliability was ensured with repeat trials separated by 48 hours. ANOVA with repeated measures ($p < .05$) was applied to the data. **RESULTS:** Total mean BP (mmHg), EDV (mL) & SVR [dyn.s/cm] were $114.6/70.5$, 129.7 & 1164.6 , respectively, with NSD among trials. Q (L/min) of 6.6, 6.9, 6.1, 5.9, 5.8, & 6.2; SV [mL/b] of 87.7, 87.9, 88.1, 86.2, 85.1, & 83.8; HR [b/min] of 75.5, 78.8, 68.6, 65.9, 68.3, & 74.7; SVR [dyn.s/cm] of 1030, 986, 1248, 1280, 1288, & 1212; and CI [L/m²] of 3.5, 3.7, 3.2, 3.1, 3.1, & 3.3 were obtained for S, 45HI, H, T, 60HD, and I, respectively. Although statistical analysis revealed differences among several conditions ($p < .05$), they do not appear clinically significant. **CONCLUSION:** Postural changes induced by acute exposure to tilt table inversion did not provide clinically significant changes in measures of cardiovascular hemodynamics in a healthy population and thus appears relatively safe.

B-65 Free Communication/Poster - Body Composition

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

959 Board #138 May 31 3:30 PM - 5:00 PM
Total and Segmental Body Composition Examination in Collegiate Football Players Using Multifrequency BIA and DXA

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 (No relationships reported)

PURPOSE: To examine the influence of player position on the agreement between multi-frequency bioelectrical impedance analysis (BIA) and dual x-ray absorptiometry (DXA) when assessing percent body fat (BF%) and total and segmental (arms, legs, trunk) fat mass (FM) and lean mass (LM) in male NCAA Division I collegiate football athletes.

METHODS: Forty-four male collegiate athletes (age=19±1 yrs; height=1.9±1.0 m; weight=106.4±18.9 kg; body mass index=30.1±4.2) participated in this study. Player

positions included: offensive linemen (OL; n=7), tight ends (TE; n=4), wide receivers (WR; n=9), defensive linemen (DL; n=6), defensive backs (DB; n=8), linebackers (LB; n=6), and running backs (RB; n=4). Total and segmental body composition was measured using multi-frequency BIA and compared with values obtained using DXA. Paired t-tests using a Bonferroni-adjusted p-value of 0.007 examined differences between the two methods and Bland-Altman analyses evaluated agreement. ANOVA assessed effect of position on total and segmental differences between methods and Tukey's HSD determined differences between each position.

RESULTS: Compared with DXA multi-frequency BIA significantly underestimated BF% ($3.0 \pm 3.8\%$), total FM (2.5 ± 4.3 kg), leg FM (2.8 ± 2.0 kg), and leg LM (3.6 ± 2.3 kg) (all $p < 0.001$) and significantly overestimated total LM (-6.9 ± 4.5 kg) ($p < 0.001$). Limits of agreement (1.96*SD of the mean difference) were: $\pm 7.39\%$ (BF%), ± 10.45 kg (total FM), ± 3.83 kg (leg FM), ± 2.28 kg (leg LM), and ± 8.89 kg (total LM). No significant differences were found between the two devices for trunk FM (-0.3 ± 3.0 kg; $p = 0.565$) and trunk LM (-1.0 ± 2.4 kg; $p = 0.009$) measures, with limits of agreement ± 5.92 kg for trunk FM and ± 4.71 kg for trunk LM. Player position had a significant effect on the mean difference of all measures, including BF%, total FM and LM, leg FM and LM, and trunk FM and LM (adjusted $p < 0.05$). OL demonstrated the greatest effect on the mean difference of each variable.

CONCLUSIONS: Compared to DXA, multi-frequency BIA does not appear to be a valid way to assess segmental measures of body composition in collegiate football players. BIA may thus be limited by non-traditional body types (e.g. football players) indicating between-player comparisons should be limited. Further research in other athletic populations is warranted.

960 Board #139 May 31 3:30 PM - 5:00 PM
Body Composition And Bone Mineral Density Of Division I Collegiate Track And Field Athletes

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PURPOSE: To examine the effect of gender and event on total and regional measures of body composition in male and female NCAA Division I collegiate track and field athletes using dual X-ray absorptiometry (DXA). Data was used from the Consortium of College Athlete Research (C-CAR) group.

METHODS: A total of 590 [male (M)/female (F) = 274/316] athletes had their height, weight, total and regional fat mass (FM), lean mass (LM), and bone mineral density measured (BMD). Athletes were classified into one of seven categories: Jumps (M/F=28/30); Long Distance (LD; M/F=104/110), Middle Distance (MD; M/F=27/24), Multi-Event (ME; M/F=11/9), Pole Vault (PV; M/F=21/27), Sprints (M/F=54/96), and Throws (M/F=29/20). Total and segmental differences between categories and gender were assessed by ANOVA.

RESULTS: Events that were significantly different than each other were the same for M and F (Table). Only M and F throwers were classified as overweight based on BMI (> 25 kg/m²). Except for throwers, mean percent body fat for the other events was low, but healthy (M: 10.3-12.6%, F: 17.5-21.6%) and low visceral fat mass (< 500 g). As expected throwers had significantly ($p < 0.05$) higher total and regional FM and LM than other events (Table). One area of concern is that some events (i.e., LD) had negative z-scores for BMD (range M: -1.5 to 3.5, F: -1.5 to 6.3).

CONCLUSIONS: The data presented here provide normative data for total and regional FM, LM, and BMD in NCAA Division I male and female track and field athletes. Most athletes had relatively low body fat and visceral fat, which is important for the health of collegiate athletes during and after their playing career. However, some athletes had low BMD, which may have health consequences.

Event	Total Mass (kg)		Fat Mass (kg)		Lean Mass (kg)		BMD (g/cm ²)	
	Male	Female	Male	Female	Male	Female	Male	Female
Throws	103.5+ 6.5 ^a	89.5+ 16.0 ^a	21.6+ 10.8 ^a	27.5+ 9.9 ^a	78.0+ 9.2 ^a	58.5+ 8.1 ^a	1.5+ 0.1 ^a	1.4+ 0.1 ^a
Sprints	76.5+ 7.6 ^{bc}	61.6+ 6.1 ^{bc}	8.3+ 2.1 ^b	10.8+ 2.9 ^b	65.0+ 6.8 ^{bc}	48.2+ 4.8 ^b	1.4+ 0.1 ^{bc}	1.3+ 0.1 ^{ab}
MD	70.9+ 6.8 ^{cd}	59.0+ 4.9 ^{cd}	7.3+ 1.7 ^b	12.2+ 2.7 ^b	60.8+ 6.5 ^c	44.3+ 4.2 ^c	1.3+ 0.1 ^c	1.1+ 0.1 ^c
LD	66.0+ 6.5 ^a	54.8+ 5.5 ^d	7.9+ 2.1 ^b	11.4+ 3.2 ^b	55.4+ 5.2 ^d	41.2+ 3.8 ^a	1.2+ 0.1 ^d	1.2+ 0.1 ^d
ME	81.6+ 7.5 ^b	67.1+ 10.1 ^b	9.9+ 3.1 ^b	13.7+ 3.4 ^b	68.6+ 6.4 ^b	50.8+ 6.8 ^b	1.4+ 0.1 ^{bc}	1.4+ 0.1 ^{ab}
Jumps	78.7+ 6.5 ^b	63.3+ 5.5 ^{bc}	9.2+ 2.5 ^b	12.7+ 3.4 ^b	65.7+ 5.3 ^b	47.9+ 3.6 ^{bc}	1.4+ 0.1 ^b	1.2+ 0.1 ^{bc}
PV	78.5+ 5.5 ^b	60.2+ 4.5 ^{bc}	9.9+ 3.1 ^b	13.0+ 2.4 ^b	65.4+ 4.7 ^{bc}	44.6+ 3.8 ^c	1.4+ 0.1 ^b	1.2+ 0.1 ^c

For each column by gender, if an event does not share a letter it is significantly different at an adjusted ($p < 0.05$). BMD=Bone Mineral Density, MD=Middle Distance, LD=Long Distance, ME= Multi-Event, PV=Pole Vault

961 Board #140 May 31 3:30 PM - 5:00 PM
A Comparison of Body Composition Methods Across Two Phases of the Menstrual Cycle.

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(No relationships reported)

Estimating body fat percent (BF%) is an important fitness assessment for determining health status, monitoring weight loss and improving athletic performance. Women have a unique consideration when assessing BF% due to possible fluid retention, weight gain, and hormonal fluctuations that are happening throughout the menstrual cycle, and it has been questioned as to whether or not menses could negatively impact the accuracy of BF% assessments. **PURPOSE:** To identify whether or not body composition results would be affected by a woman during menses and to investigate the effects of birth control on the accuracy of body composition results. **METHODS:** 40 women (26.1 \pm 7.1 yrs) had their BF% estimated with dual energy x-ray absorptiometry (DXA), air displacement plethysmography (ADP), and 3 different hand-to-foot bioelectrical impedance analyzers (BIA1, BIA2, and BIA3). Participants completed BF% testing during 2 different phases of their menstrual cycle. Visit 1 was on day 1 or 2 of menses and visit 2 was 7 to 14 days later. Visit 2 was estimated to be in the pre-ovulatory phase of the menstrual cycle. Prior to testing participants did not exercise for 12 hours, consume alcohol for 24 hours, or eat or drink for 4 hours with the exception of water. All testing was administered per manufacturer specifications. **RESULTS:** 24 women were not on birth control (non-BC) and 16 were on a form of hormonal birth control (H-BC). The BF% means \pm SE between visits for non-BC were: DXA = 30.6 \pm 1.3 vs. 30.3 \pm 1.4, $p = 0.077$, ADP = 28.8 \pm 1.6 vs. 28.3 \pm 1.6, $p = 0.083$, BIA1 = 26.7 \pm 1.5 vs. 27.1 \pm 1.5, $p = 0.122$, BIA2 = 26.1 \pm 1.5 vs. 26.3 \pm 1.5, $p = 0.498$, BIA3 = 27.0 \pm 1.4 vs. 26.8 \pm 1.5, $p = 0.523$. The BF% means \pm SE between visits for H-BC were: DXA = 30.1 \pm 1.5 vs. 30.2 \pm 1.5, $p = 0.677$, ADP = 29.3 \pm 1.8 vs. 28.8 \pm 1.8, $p = 0.215$, BIA1 = 26.2 \pm 2.0 vs. 26.4 \pm 1.9, $p = 0.508$, BIA2 = 26.3 \pm 1.9 vs. 26.3 \pm 1.7, $p = 0.988$, BIA3 = 26.9 \pm 1.9 vs. 26.9 \pm 1.6, $p = 1.000$. **CONCLUSIONS:** For the H-BC group there were no differences for BF% between visits for all methods indicating that results should not be affected by menstrual cycle phase. However, the non-BC group had mixed results with no differences with the 3 BIAs but p -values near 0.05 for DXA and ADP methods. These data suggest that non-BC women should be tested post menses with certain methods, especially when BF% is being tracked over time.

962 Board #141 May 31 3:30 PM - 5:00 PM
A-mode and B-mode Ultrasound Measurement of Subcutaneous Fat Thickness: A Cadaver Analysis Validation Study

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With technological advances, there has been a resurgence in the use of ultrasound as a method to measure subcutaneous fat thickness. Despite the increased interest in this methodology, there is a lack of research comparing A-mode and B-mode ultrasound devices. **PURPOSE:** Compare subcutaneous fat thickness measured by a low resolution A-mode ultrasound and a high resolution B-mode ultrasound to the actual fat thickness in dissected cadavers. **METHODS:** Six cadavers (3 male, 3 female), 80.8 \pm 8.9 y at the time of death, were measured. Subcutaneous fat thickness was measured at six sites (chest, abdomen, thigh, triceps, suprailiac, calf) with both ultrasound devices before the cadavers were dissected and site-specific thickness was measured. **RESULTS:** Correlations between both ultrasounds and the dissected measurement exceeded 0.90 at all sites with a few exceptions. At the abdomen, the relationship between the two devices was 0.76, and the B-mode and dissected measurement was also 0.76. The correlation between dissection and A-mode was 0.75 for the suprailiac site, but it was not possible to discern the separation of tissue at this site when using the B-mode device. There were no significant differences ($P > 0.05$) between the devices and the dissected measurement at any of the six sites. The mean difference in fat thickness between A-mode and B-mode was < 0.7 mm at all sites except the calf (1.2 mm). **CONCLUSION:** With the exception of the suprailiac site, which was difficult to measure, both A-mode and B-mode ultrasound are equally capable of providing measurements of subcutaneous fat thickness with an accuracy of < 1 mm at most sites.

963 Board #142 May 31 3:30 PM - 5:00 PM
Effect of Water Consumption and Moderate Intensity Exercise on Body Composition Measures

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(No relationships reported)

Although the data are not clear, manufacturers of body composition devices often recommend that users avoid exercise prior to measurement. These measures can potentially be impacted by acute exercise and hydration levels. **Purpose:** To determine the effect of water consumption and moderate intensity exercise on body composition measurements using air displacement plethysmography (ADP) and three bioelectrical impedance devices (T, O5, and O3). **Methods:** Twenty four participants (age = 22.3 \pm 23.9y; height = 166.8 \pm 9.9 cm; mass = 77.4 \pm 17.8 kg) completed the study. Pre-exercise (PreE) body composition was measured following manufacturers' guidelines. Participants then exercised on a treadmill at moderate intensity (~50% of HRR) for 30 minutes on two separate occasions. During one visit, participants were allowed water ad libitum following exercise (W) while no water was allowed during the other session (NW). Body composition was measured immediately post-exercise (PE0), 15 minutes post-exercise (PE15), 30 minutes post-exercise (PE30), 45 minutes post-exercise (PE45) and 60 minutes post-exercise (PE60). Repeated measures ANOVA (2 x 6) were used to determine if water consumption and moderate intensity exercise influenced body composition measures for each device. Where appropriate, pairwise comparisons with Bonferroni adjustment were performed to locate differences among the post-exercise time points. **Results:** All devices showed a significant effect of time ($P < 0.01$) and O5 was the only device to demonstrate a significant interaction of group and time ($P < 0.05$). ADP showed no significant differences among the time points during either condition. PreE was significantly greater than all other time points ($P < 0.01$) for T and O5 and was significantly greater than PE0, PE15, PE30, and PE45 for O3 ($P < 0.01$). **Conclusion:** Moderate intensity exercise can impact body composition to varying degrees. Ingestion of water post exercise does not appear to impact most measurements of body composition. Investigators should consider limitations of the device(s) which could impact the interpretation of data.

964 Board #143 May 31 3:30 PM - 5:00 PM
Predictive Validity Of The Body Adiposity Index In Obese Adults Using Dual-Energy X-Ray Absorptiometry

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PURPOSE: The body adiposity index (BAI) is a recent anthropometric measure proven to be valid in predicting body fat percentage (BF%) in some populations. However, the results have been inconsistent across populations. The study was designed to verify the validity of BAI in predicting BF% in a sample of obese adults, using dual-energy X-ray absorptiometry (DEXA) as the reference method. **METHODS:** A cross-sectional study was conducted in 48 participants (54% female, mean age 41.0 \pm 7.3 years old). DEXA was used as the "gold standard" to determine BF%. Pearson's correlation coefficient was used to evaluate the association between BAI and BF%, as assessed by DEXA. A paired sample t-test was used to test differences in mean BF% obtained with BAI and DEXA methods. To evaluate the concordance between BF% as measured by DEXA and as estimated by BAI, we used Lin's concordance correlation coefficient and Bland-Altman agreement analysis. **RESULTS:** The correlation between BF% obtained by DEXA and that estimated by BAI was $r = 0.844$, $p < 0.001$. Paired t-test showed a significant mean difference in BF% between methods (BAI = 33.3 \pm 6.2% vs. DEXA 39.0 \pm 6.1; $p < 0.001$). The bias of the BAI was -6.0 ± 3.0 BF% (95% CI = -12.0 to 1.0), indicating that the BAI method significantly underestimated the BF% compared to the reference method. Lin's concordance correlation coefficient was considered stronger ($\rho_c = 0.923$, 95% CI = 0.862 to 0.957). **CONCLUSIONS:** In obese adults BAI presented low agreement with BF% measured by DEXA; therefore, BAI is not recommended for BF% prediction in this Latin American obesity sample studied. Supported by Universidad del Rosario (Code N° FIUR DN-BG001)

965 Board #144 May 31 3:30 PM - 5:00 PM

A Longitudinal Retrospective Study of Body Composition Trends in Police Recruits

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Mapping body composition patterns of those hired as police officers has implications not only to the health of officers during their careers but also in their ability to perform in emergency situations.

PURPOSE: To evaluate body composition changes that occur in police recruits from 1990 to 2013 with gender comparisons. **METHODS:** During the first week of police recruit training in a large southeastern metropolitan area, physical fitness levels were evaluated in 2,468 recruits. This study's variables of interest are: body mass (kg), lean mass (kg), and % body fat. ANOVA and Bonferroni post hoc procedures were used to evaluate data. **RESULTS:** The initial ANOVA shows significance for males in all three variables at $p < 0.05$. Males tended to increase in body mass and lean mass from 1990 to 2000 (80.6 ± 1.2 kg to 87.3 ± 1.2 kg, $p < 0.05$) (68.9 ± 0.8 kg to 73.4 ± 0.8 kg, $p < 0.05$), respectively. These values remained relatively constant between 2000 and 2013. No discernable pattern was seen in female lean mass nor body mass. Males tended to increase in % body fat from 1994 to 2010 (13.6 ± 5.0 to 16.7 ± 7.2 , $p < 0.05$). Although not significant, female % body fat means increased from 1990 to 2013 (22.9 ± 1.0 to 26.2 ± 1.2). **CONCLUSIONS:** Even though there was an increase in body mass, pre lean mass and % body fat over time in males, these increases were low. In addition, these increases were lower in females.

966 Board #145 May 31 3:30 PM - 5:00 PM

Creating an Overall Body Composition Index to Predict 1.5-Mile Run Performance among University Students

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PURPOSE: While body mass index (BMI), body fat percent (%BF), and waist circumference (WC) each can be used as a body composition index (BCI) to establish associations with cardiorespiratory fitness, it is desirable to use an overall BCI to establish the association. This study was intended to create an overall BCI from the above three BCIs and see how the overall BCI could predict 1.5-mile run performance among university students.

METHODS: Three different BCIs (BMI, %BF, WC) and 1.5-mile run were measured for 123 university students (mean age: 20.71 ± 98 ; 70 males and 53 females), and an overall BCI was created by converting the three BCIs into z scores and then adding them together. The overall BCI was used to predict students' 1.5-mile run performance with linear regression. All data analyses were conducted separately for males and females.

RESULTS: For both males and females, the scatterplots showed that 1.5-mile run performance increased when the overall BCI decreased, indicating a linear relationship between the two variables. The regression equation for predicting the 1.5-mile run performance from the overall BCI for males was: predicted 1.5-mile run performance (in seconds) = $704.64 + 33.32$ overall BCI, with the 95% confidence interval for the slope ranging from 24.84 to 41.58. The regression was significant ($p < .001$) as $F(1, 68) = 62.68$. Prediction strength was very strong with $r = .69$ ($p < .001$) and $r^2 = .48$. With respect to females, predicted 1.5-mile run performance (in seconds) = $851 + 27.51$ overall BCI, and the 95% confidence interval for the slope ranged from 12.91 to 42.12. The regression was significant ($p < .001$) as $F(1, 51) = 14.30$. Prediction strength was strong with $r = .47$ ($p < .001$) and $r^2 = .22$.

CONCLUSIONS: The overall BCI can predict students' 1.5-mile run performance very well, accounting for 48% of the variance of 1.5-mile run performance for males and 22% of the variance for females. In addition, based on the regression equations, one unit increase in the overall BCI will result in 33.32 seconds slower for males or 27.51 seconds slower for females, on average, in 1.5-mile run for university students.

967 Board #146 May 31 3:30 PM - 5:00 PM

Accuracy of Commercial Body Composition Scales Versus Clinical Dual-Energy X-ray Absorptiometry and Bioelectrical Impedance Analysis

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Background. Body composition (BC) analysis is increasingly available to consumers in the form of wifi-connected bioelectrical impedance analysis (BIA) bathroom scales. However the accuracy of current generation scales to criterion methods is not known.

Purpose. To determine the accuracy and precision of BC measurements using scales for men and women compared to dual-energy X-ray absorptiometry (DXA). In addition, we investigate the use of scales for quantifying resting metabolic rate (RMR).

Methods. We recruited a sample of convenience of healthy adults to undergo a series of BC measurements. Height and weight was assessed using a Seca 284. BC was assessed using whole-body DXA (Horizon A), a clinical tetrapolar multifrequency BIA (InBody770), and 7 bathroom scales: Tanita BF-684W, Weightwatchers WW701Y, Taylor 7226SFC, Withings Smart Body Analyzer WS-50 and Body Cardio WBS04, Fitbit Aria, and QardioBase. Duplicate measures were taken on the scales to evaluate the test-retest precision. RMR was calculated using Nelson RMR equations for DXA and BIA measures, and Harris-Benedict (HB) using weight.

Results. In total, 22 participants were recruited (12 male) with an average age of 29.6 (± 7.3 years), weight of 70.0 (± 13.4 kg) and height of 170.0 (± 10.1 cm). PBF was highly correlated between the 770 and DXA for both men and women ($r = 0.9$) but less correlated between the scales and DXA ($0 < r < 0.65$). However, all BIA devices underestimated PBF by 2 to 11 units. There was poor obesity classification between the scales and DXA as well ($\kappa < 0.2$). RMR was highly correlated between DXA and scales for both men and women ($r = 0.50$ to 0.99). RMR was overestimated by all scales compared to DXA from 21 to 184 kcal but in all cases were improvements over the HB RMR estimate (HB-DXA 260 kcal). The test-retest precisions (% coef of var, standard deviation) for PBF and RMR varied by model for men and women (0.2 to 0.5 %, NA) and (0.2 to 0.6 %, 2 to 9 kcal) respectively. Overall, we found the Tanita to have the best correlation to DXA measures, Taylor and Weight Watchers to have the best precision.

Conclusions. We conclude that the use of bathroom scales may provide a more accurate assessment of RMR than the HB equation, and that the precision is comparable to previously-reported DXA values. However, our results varied substantially by make.

968 Board #147 May 31 3:30 PM - 5:00 PM

Relationships Between Bodpod And Field Assessments Of Body Composition In NAIA Athletes

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(No relationships reported)

PURPOSE: The purpose of this study was to examine the relationships between body composition measures derived from air displacement plethysmography (BodPod) and several field methods of body composition in a population of National Association of Intercollegiate Athletics (NAIA) athletes. **METHODS:** Twenty-three NAIA athletes visited the lab for a single visit. Percent body fat and lean mass were assessed in all subjects using the BodPod (BP), handheld bioelectrical impedance analysis (HBIA), standing bioelectrical impedance analysis (SBIA), and skinfolds using the 3-site Jackson and Pollack equation. Body mass index (BMI), upper arm circumference (AC), waist circumference (WC), and hip circumference (HC) were also assessed. Relationships between percent body fat as assessed by BP and all field non-lean mass assessments as well as relationships between BP lean mass and all field non-percent body fat assessments were examined using Spearman's correlation coefficients.

RESULTS: Percent body fat (19.1 ± 8.4 %) as assessed by BP was significantly related to BMI ($29 + 8$ kg/m²; $r = 0.515$; $p = 0.012$), percent body fat calculated from skinfolds ($14 + 7$ %; $r = 0.855$; $p < 0.001$), percent body fat from HBIA ($17.9 + 6.2$ %; $r = 0.855$; $p < 0.001$), percent body fat from SBIA ($14.1 + 3.7$ %; $r = 0.748$; $p < 0.001$), AC ($33 + 4$ cm; $r = 0.563$; $p = 0.005$), WC ($90 + 10$ cm; $r = 0.720$; $p < 0.001$), and HC ($102 + 18$ cm; $r = 0.788$; $p < 0.001$). Lean mass as assessed by BP ($73.3 + 8.7$ kg) was significantly related to BMI ($29 + 8$ kg/m²; $r = 0.483$; $p = 0.020$), lean mass calculated from skinfolds ($76 + 10$ kg; $r = 0.817$; $p < 0.001$), lean mass from HBIA ($72.7 + 8.6$ kg; $r = 0.851$; $p < 0.001$), lean mass from SBIA ($76.5 + 11.7$ kg; $r = 0.802$; $p < 0.001$), AC ($33 + 4$ cm; $r = 0.596$; $p = 0.003$), WC ($90 + 10$ cm; $r = 0.496$; $p = 0.016$), and HC ($102 + 18$ cm; $r = 0.570$; $p = 0.005$). **CONCLUSION:** Skinfolds, HBIA, and SBIA appear to be most related to both percent body fat and lean mass in this population of NAIA athletes. Thus, when testing these athletes in a field setting, these tests could be performed to provide useful body composition information. If it were not possible to perform these tests, BMI, UAC, WC, and HC could also be used although these tests did not correlate as strongly as did skinfolds, HBIA, and SBIA with BP assessments.

969 Board #148 May 31 3:30 PM - 5:00 PM
The Effects of a Periodized Resistance Training Program on Body Composition of ROTC Cadets
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BACKGROUND: Similar to the general US population, the rate of cardiovascular disease, sedentary lifestyle, and obesity in military populations is growing. Android obesity, a type of obesity where excess fat accumulates around the thoracic and abdominal cavities, is associated with an increased risk of cardiovascular and metabolic deficiencies. Military populations are confronted with high physiological demands therefore it is crucial for them to be in good physical condition and minimize excess body fat in the thoracic and abdominal areas. **PURPOSE:** This research investigated the effects of a 7-week periodized training program on body composition of ROTC cadets. **METHODS:** Subjects consisted of 23 Army and Air Force ROTC cadets (male=18, female=6), Age (yrs)= 2.26±5.96, Height (cm)=172±8.68, Weight (kg)=72.98±12.91. The intervention group (IG n=14) trained for 1 hour/day, 4 days/week and the control group (CG n=9) participated in traditional military training protocol for 1 hour/day, 3 days/week. **RESULTS:** Findings revealed that both groups demonstrated a significant decrease in overall body fat percentage ($p=0.005$) pre to post training, but only the IG demonstrated a significant training effect evidenced by decreases in the abdominal area ($p=0.009$) and mid-axillary ($p=0.025$). **CONCLUSION:** Although this research demonstrated that periodized resistance training reduces abdominal body fat among ROTC cadets, it is important that future studies address certain limitations (small sample size and length of training period) this study encountered. Due to the health risks associated with android obesity, including increased cardiovascular and metabolic disease risk factors, implementing a periodized training program may be beneficial in diverse military populations.

970 Board #149 May 31 3:30 PM - 5:00 PM
Validation of a Three-Dimensional Body Scanner for Body Composition Measures
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PURPOSE: The accuracy of a three-dimensional (3D) body scanner in determining body composition was compared against other laboratory methods (i.e., hydrostatic weighing, bioelectrical impedance analysis (BIA)). **METHODS:** A total of 176 (males/females= 83/93) young adults [mean±SD: age= 22.2±2.9 years, body mass index (BMI) =24.5±3.8 kg/m²] were recruited. Subjects had muscle mass estimated from the 3D body scanner, hydrostatic weighing, skinfolds, circumference measurements and BIA. The Jackson and Pollock equation was used to estimate body fat percent (BF%) from the sum of three skinfolds (males: chest, abdomen and thigh; females: triceps, suprailium, and thigh). The Navy circumference-based equation was used to estimate BF% (males: waist, neck, height; females: waist, hip, neck, and height). **RESULTS:** Males and females were not significantly different in age ($p=0.192$). As expected, females had lower body mass ($p<0.001$), BMI ($p=0.016$) and height ($p<0.001$). A repeated measures ANOVA indicated significant ($p<0.001$) differences among the methods. Bonferonni post-hoc indicated that BF% from the 3D body scanner (17.6±7.7%) was significantly less than BF% from hydrostatic weighing (22.1±8.7%, $p<0.001$), skinfolds (19.8±9.6%, $p<0.001$), BIA (19.0±8.6%, $p<0.001$), and circumferences (21.3±9.5%, $p<0.001$). The main effects of sex and method were significant ($p<0.001$) with a non-significant interaction ($p=0.060$). Among males, BF% from the 3D scanner (10.6±4.0%) was significantly less than BF% from hydrostatic weight (16.0±6.0%, $p<0.001$), BIA (11.9±3.9%, $p=0.002$), skinfolds (11.8±5.1%, $p=0.03$), and circumferences (13.8±4.4%, $p<0.001$). Among females, BF% from the 3D scanner (23.9±4.0%) was significantly less than BF% from hydrostatic weight (27.6±6.9%, $p<0.001$), BIA (25.2±6.5%, $p=0.003$), skinfolds (26.8±6.6%, $p<0.001$), and circumference measures (28.4±9.3%, $p<0.001$). BF% from the 3D scanner was highly correlated with BF% from hydrostatic weight ($r=0.82$, $p<0.001$), BIA ($r=0.89$, $p<0.001$), skinfolds ($r=0.85$, $p<0.001$), and circumferences ($r=0.85$, $p<0.001$). **CONCLUSIONS:** The 3D body scanner consistently underestimated BF% despite being highly correlated with other established methods. Further research is needed to validate 3D scanning as a reliable method for measuring body composition.

971 Board #150 May 31 3:30 PM - 5:00 PM
A Comparison Of DXA And A Joint Diameter-based System For The Measurement Of Body Composition
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PURPOSE: Body composition (BC) is a frequently assessed component of health-related fitness. Recently, a portable joint diameter-based body composition assessment system, sold by Integrative Body Composition Assessment (IBC) has become commercially available for estimating BC. This method involves measuring both right and left wrist diameters using calipers, waist circumference, height and weight. These measurements are entered into the IBC software together with age and gender and the average amount of both cardiorespiratory and resistance training exercise the subject has done on average per week for the past six months. However, little is known how IBC BC estimates compare to the dual-energy X-ray absorptiometry (DXA) estimate of body composition in college aged students. The purpose of this study was to determine the accuracy of the IBC as a way to estimate BC.

METHODS: Participants percent body fat (%fat) was estimated using IBC and dual-energy X-ray absorptiometry (DXA), which served as the criterion estimate. Subjects were 162 (75 males, 87 females) physically active college students [age 21 (3) yrs. height 1.73 (0.1) m, body mass 76.09 (15.74) kg. and BMI 25.4 (4.1) kg/m²]. **RESULTS:** The validity of the IBC %fat estimate was based on a comparison to the criterion value from the DXA by calculating the mean, SD, coefficient of determination (r²), and standard error of estimate (SEE) from linear regression analysis. To assess the average deviation of individual scores from the line of identity, total error (TE) was calculated for each IBC estimate. Paired t-tests determined paired-wise differences between measurements with significance set at $p<0.05$. The mean %fat was significantly lower for the IBC [23.0 (9.3) %] estimate than the DXA [25.9 (11.5) %] estimate ($p<0.001$). The r² value was 0.669; SEE was 6.6 %fat; and total error (TE) was 7.2 %fat. When separated by sex, the IBC %fat estimate was still significantly lower for both male [-1.6 (5.9) %fat, r^2 0.456, SEE=5.8 %fat, TE=6.16 %fat] and female [-4.0 (6.9) %fat, r^2 0.462, SEE=6.9 %fat, TE=7.9 %fat] participants. **CONCLUSIONS:** In this study the IBC did not provide a valid estimate of body composition and underestimated %fat compared to the DXA estimate. Based on this preliminary analysis, this method cannot be recommended for estimating BC in college aged students.

972 Board #151 May 31 3:30 PM - 5:00 PM
Changes in Anthropometric and Physiological Characteristics of Male Collegiate Rugby Union Players throughout a Season
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 (No relationships reported)

Rugby Union is a physically demanding sport requiring a variety of anthropometric and physiological characteristics to maximize performance. Factors such as muscular power, speed, agility, maximal aerobic power, mobility, and body composition all factor into player performance. **PURPOSE:** To determine changes in body composition, height, speed, muscular power, maximal aerobic power, mobility, and agility of collegiate rugby union players throughout a competitive season. **METHODS:** Participants included 29 (20.32 ± 1.49yrs) men from a collegiate rugby club. Muscular power (vertical jump), speed (10m and 20m sprint), agility (L-drill), mobility (FMS active straight leg raise and shoulder mobility) maximal aerobic power (VO_{2 peak} via 20m multi-stage shuttle run SR), height, body mass, fat mass (ADP), fat-free mass (ADP), and body fat levels (ADP and sum of 7 skinfolds (SKBF%)) were assessed during the pre-season (PRE) and mid-season (MID). Training and match loads were estimated for each player by multiplying each player's rating of perceived exertion (RPE: 6-20) by the amount of training/playing time. **RESULTS:** PRE and MID variables were compared using a Paired-Samples T-Test with an alpha level of $p < .05$. The mean PRE SKBF% of 16.57 ± 6.29 was significantly higher than the mean MID SKBF% of 13.77 ± 7.61 ($t(28) = 2.472$, $p = .02$). The mean PRE 10m sprint time was 1.81 ± .12s and was significantly faster than the MID mean 10m sprint time 1.94 ± .11s ($t(19) = -4.782$, $p < .001$). The mean PRE 20m sprint time 3.15 ± .16s was significantly faster than the mean MID 20m sprint time of 3.3 ± 1.8s ($t(20) = -4.155$, $p < .001$). The mean PRE VO_{2 peak} was 44.65 ± 5.43ml.kg⁻¹.min⁻¹ and was significantly lower than the mean MID VO_{2 peak} of 46.97 ± 6.43ml.kg⁻¹.min⁻¹ ($t(19) = -2.26$, $p = .036$). **CONCLUSION:** Maximal aerobic power increased from PRE to MID while the estimated body fat levels decreased from PRE to MID. Improvements in both

variables are likely due to conditioning during training and increased activity levels of participating in sport. Speed may have decreased from PRE to MID due to fatigue from the first-half of the season with accumulating training and match loads.

in FP across ranked BC groups. Furthermore, these differences were not consistent across BC method and not consistent across sex groups. Practitioners using BC data to predict FP should be aware of these inconsistencies.

973 Board #152 May 31 3:30 PM - 5:00 PM
Effect Of Hydration Status On Body Composition Assessment Using Dual Energy X-ray Absorptiometry And Ultrasound

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The accurate measurement of percent body fat (%BF) is very important in the determination of a wrestler's minimum wrestling weight under the National Collegiate Athletic Association Wrestling Weight Management Program. Skinfold measurements (SF), air displacement plethysmography (ADP), and hydrostatic weighting remain as the only three approved methods. Dual energy x-ray absorptiometry (DXA) is considered a criterion method while type-A ultrasound (US) serves as a less expensive, field alternative; however, a dearth of literature has examined the influence of hydration status on DXA and US determined %BF. **PURPOSE:** To determine the effect of hydration status on fat mass, lean body mass, and %BF using SF, ADP, US, and DXA. **METHODS:** Sixteen college-aged men (20.8 ± 1.6 yrs) participated in this study. Participants reported to the lab on two separate occasions in either a euhydrated state (Usg < 1.020) or a hypohydrated state (Usg > 1.020) using a randomized crossover design. Usg was assessed in order to verify hydration status and %BF was determined using SF, ADP, DXA, and US methods. **RESULTS:** Usg and body mass (BM) measurements were significantly different between the euhydrated (Usg=1.014 ± 0.006; BM=79.1 ± 14.3kg) and hypohydrated (Usg=1.026 ± 0.004; BM=78.4±14.2) assessments (Usg: p<0.001; BM: p=0.006). However, hydration status had no significant effect on %BF observed in the euhydrated or hypohydrated states (p=0.730) although significant differences were observed between the different assessment methods (SF=10.3±1.3%; ADP=13.0±1.9%; US=13.2±1.3%; DXA=19.5±1.8%; p<0.001). Pairwise comparisons identified significant differences between all methods (p<0.001-p=0.018) except for the comparison between ADP and US (p=1.000). %BF measured by DXA was significantly greater than all of the other methods (2.8-9.2%; p<0.004). **CONCLUSION:** Hydration status did not have an effect on %BF measurements when using SF, ADP, US, or DXA. The significant differences among these four methods remain a concern. The difference between two approved methods (SF and ADP) suggests that a wrestler may lose additional weight when using ADP, thus potentially allowing for certification at a lower weight class.

975 Board #154 May 31 3:30 PM - 5:00 PM
Skinfolds Thickness And Body Surface Area Evaluated With Anthropometry And Its Relationship With Body Fat

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In 1921 Matiegka proposed a strategy for estimating adipose tissue mass by calculating the half of average of some skinfolds thickness and multiplying it by body surface area (BSA), but this strategy has not been evaluated with modern body composition methods.

PURPOSE: To describe the utility of the product of skinfold thickness measured by anthropometry and BSA in relation with body fat (% and mass) in varsity athletes. **METHODS:** 10 skinfold thicknesses were assessed in 97 varsity athletes (50 males [age 21.5 ± 2.0 y, weight 72.0 ± 10.9 kg, height 175.7 ± 6.7 cm, BMI 23.3 ± 3.0 kg/m²], 47 females [20.8 ± 1.9 y, 60.1 ± 10.2 kg, 164.7 ± 7.3 cm, 22.1 ± 2.9 kg/m²]). Body fat mass and percentage was assessed by DXA whole body scanning. Body surface area was calculated with two anthropometric equations (DuBois, Biering), additionally Behnke's body building factor was calculated. We performed the Pearson correlation test for body fat mass and body fat percentage with each skinfold thickness, the sum of 10 skinfolds (10SKF), the sum of 8 skinfolds (8SKF) and the product of multiplying 10SKF or 8SKF with either a) DuBois BSA, b) Biering BSA, c) Behnke's factor. **RESULTS:** There was a higher correlation with body fat mass than with body fat percentage when the skinfolds were multiplied by BSA, this correlation was higher in males than females. In males, triceps skinfold thickness had a high correlation with body fat percentage and axilla with body mass. **CONCLUSIONS:** The product of 10SKF (or 8SKF) multiplied by BSA had high correlation coefficients with body fat mass. We propose using the sum of skinfolds (both 10 and 8) and multiplying it by BSA as an adiposity indicator in varsity athletes. There is still need to test if this strategy is useful for monitoring changes in body fat.

Table 1. Correlation coefficients between skinfold thickness and body fat.

	Females				Males			
	Variable	Fat (kg)	Variable	Fat (%)	Variable	Fat (kg)	Variable	Fat (%)
SKF	SKF10	0.840	SKF10	0.826	SKF10	0.913	SKF10	0.897
	SKF8	0.851	SKF8	0.838	SKF Axilla	0.914	SKF8	0.902
SKF * Behnke	SKF10	0.881	SKF10	0.826	SKF10	0.919	SKF8	0.895
	SKF8	0.895	SKF8	0.837	SKF Axilla	0.925	SKF Triceps	0.899
SKF * Biering	SKF10	0.903	SKF10	0.818	SKF8	0.921	SKF8	0.887
	SKF8	0.916	SKF8	0.825	SKF Axilla	0.925	SKF Triceps	0.896
SKF * DuBois	SKF10	0.898	SKF10	0.813	SKF10	0.919	SKF8	0.887
	SKF8	0.911	SKF8	0.821	SKF8	0.921	SKF Triceps	0.895

SKF: Skinfold

974 Board #153 May 31 3:30 PM - 5:00 PM
Fitness Performance Across Ranked Body Composition Groups Assessed by Different Methods

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PURPOSE: Body composition (BC) is a valuable indicator of performance both across and within certain sporting events. However, the specific relationship between BC and fitness performance (FP) is less understood. Therefore, the purpose of this study was to examine the relationship between BC and FP in a population of college students. An additional purpose was to determine if identified relationships were consistent across different BC methods. **METHODS:** A total of N=131 college students were used in this study. After signing IRB approved consent forms, subjects participated in a series of fitness tests conducted by trained research assistants. BC was assessed using five different methods: 1) body mass index (BMI), 2) percent body fat (PBF) by skinfold technique (SF), 3) PBF by circumference method (CM), 4) PBF by handheld bioelectric impedance (HH), and 5) waist circumference (WC). Fitness test outcome measures included 1) maximal oxygen consumption (VO2max) from the Queens College Step Test, 2) 1-repetition maximum bench press (BP) scores, 3) maximum repetition push-up (PU) scores, and 4) sit-and-reach (SR) flexibility scores. Subjects were categorized into one of three tertile groups where larger tertiles represented greater BC values. Analysis of variance (ANOVA) was used to examine mean FP differences across BC tertiles. Follow-up contrasts were performed to test for linear and quadratic trends. Significance was set to p<.05 for all tests. **RESULTS:** Male VO2max scores showed a significant indirect linear trend in all five BC methods. Male BP scores showed a significant direct linear trend in BMI and WC only. Male PU scores showed a significant indirect linear trend in all BC methods except BMI. And male SR scores showed no significant differences or trends in any BC method. Female VO2max scores showed a significant indirect linear trend in all BC methods except WC. Female PU scores showed only a significant negative quadratic trend in SF, CM, and HH. Finally, female BP and SR scores showed no significant differences or trends in any BC method. **CONCLUSIONS:** Results from this study show clear differences

976 Board #155 May 31 3:30 PM - 5:00 PM
Association Between Physical Activity, Total Cholesterol, Fasting Blood Glucose, And Body Fat Among Hispanic Males

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PURPOSE: To examine the correlation between physical activity (PA) level, total cholesterol (TC), high-density lipoprotein (HDL), and fasted blood glucose (FBG) among college-aged Hispanic males.

WEDNESDAY, MAY 31, 2017

METHODS: Thirty-five (35) Hispanic males (age = 23.2 ± 2.8) volunteered to participate in the study. Each subject read and signed the consent form prior to any measurement to take place. PA level objectively measured via Actigraph accelerometers. Each subject wore an accelerometer for 7 consecutive days - 5 weekdays and 2 weekend days. At the end of 7 days, the subjects returned to the lab fasted for at least eight hours and gave blood sample to measure TC, HDL, and BG. The ratio of TC to HDL and non-HDL were also calculated. Air-displacement plethysmography was used to determine percent body fat (BF)

RESULTS: Very vigorous PA was positively correlated with levels of HDL ($r=0.557$, $p<0.01$) and negatively correlated with TC-HDL Ratio ($r=0.453$, $p<0.01$). A positive correlation was found between minute length of sedentary bouts and levels of glucose ($r=0.459$, $p<0.01$). There was also a strong negative correlation occurred between max length of breaks in sedentary time with non-HDL ($r=-0.439$, $p<0.01$).

CONCLUSIONS: The results indicate that the intensity of exercise matters for obtaining higher levels of HDL cholesterol and a lower TC-HDL ratio. The findings also suggest that longer durations of sedentary state correlated with an increased FBG and breaks from prolonged sedentary bouts may decrease the risk of developing non-HDL cholesterol related health problems in college-aged Hispanic males. Future studies should be performed to determine the minimum amount of vigorous exercise and length of breaks in sedentary time to improve variables tested in this study.

977 Board #156 May 31 3:30 PM - 5:00 PM
Validity and Reliability of a Consumer Bioelectrical Impedance Analysis Scale

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PURPOSE: Bioelectrical impedance analysis (BIA) scales have gained popularity in monitoring fitness progress at home, yet their accuracy is unknown. We assessed the validity and reliability of body fat percentage (BF%) measurements from a consumer bioelectrical analysis (cBIA) scale compared to the "gold standard" of hydrostatic weighing (HW). **METHODS:** Forty-three [male (n=22); female (n=21)] healthy volunteers [age: 27.9±5.6y; height: 170.0±8.6cm; mass: 69.0±13.7kg; body mass index (BMI) range: 16.8-33.1] arrived at the laboratory 3h fasted after 12h without exercise and underwent measures of residual lung volume (for HW calculations), hydration status, and BF% via cBIA scale ('Lean' and 'Regular' modes) and HW. We assessed cBIA scale validity using Bland-Altman Plots (identifying Mean Biases±Limits of Agreement) and reliability using intraclass correlation coefficients (ICC). **RESULTS:** With HW as the validity criterion, mean BF% was 22.3±6.1% for all participants (range: 5.3-35.8%; male mean: 20.8±6.4%; female mean: 23.9±5.5%). Compared to HW, the cBIA scale in 'Lean' mode underestimated BF% by -5.3±9.1% for all participants (males: -7.9±6.9%; females: -2.6±8.0%) ($p\leq0.05$). In 'Regular' mode, the cBIA scale agreed with HW for all participants (BF% -0.8±9.3%; $p=0.27$) and females (BF% 0.4±10.8%; $p=0.73$); however, there was a significant difference for males (BF% -2.0±7.1%; $p\leq0.05$). The cBIA was reliable when comparing day-to-day ('Lean' mode: 0.5±1.0%, ICC:0.99; 'Regular' mode: 0.4±1.0%, ICC:0.99) and week-to-week ('Lean' mode: -0.4±1.4%, ICC:0.98; 'Regular' mode: -0.2±1.5%, ICC:0.97) BF% for all participants. **CONCLUSIONS:** Compared to HW, the cBIA underestimated BF% in 'Lean' mode, and this discrepancy was more pronounced in males. However, the cBIA scale agreed with HW when analyzing BF% in 'Regular' mode for all participants and females, signifying the "mode" chosen on consumer BIA devices greatly impacts validity. The cBIA was reliable when comparing day-to-day and week-to-week BF% measures for all participants, suggesting this can be a reliable at-home BF% analysis scale.

978 Board #157 May 31 3:30 PM - 5:00 PM
Interrater Reliability For Dxa And Bia Analysis For Measuring Total And Regional Lean Mass

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Dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are capable of assessing total and regional body composition using different technologies. DXA is considered more reliable than BIA to evaluate body composition, while BIA is a more cost-efficient and portable option. The agreement between these measures has not been determined in Rugby athletes. **PURPOSE:** To assess the interrater reliability between two devices that are capable of assessing total and regional lean mass in rugby athletes. **METHODS:** Body composition was measured in sixteen male rugby players (21.1 ± 1.6 years; 88.3 ± 14.2 kg; 1.78 ± 0.06 m) prior to the onset of their competitive season. Total body estimates of percent fat (%FAT),

fat mass (FM), and lean mass (LM) were determined by DXA (Lunar iDXA) and BIA (InBody 770). Regional LM estimates were also determined for the arms and legs from both devices. To assess the agreement between DXA and BIA on these measures, intraclass correlation coefficients (ICC), 95% limits of agreement (95% LOA), and coefficients of variation (CV%) were calculated. **RESULTS:** The agreement between DXA and BIA for total body estimates of %FAT (ICC_{2,1} = 0.81, 95% LOA = 0.91 - 1.34%, CV% = 10.5%), FM (ICC_{2,1} = 0.48, LOA = 0.63 - 0.92 kg, CV% = 10.1%) and LM (ICC_{2,1} = 0.67, LOA = 0.92 - 1.00, CV% = 2.3%) was variable, while regional values for lean arm mass (ICC_{3,1} = 0.91, 95% LOA = 0.93 - 1.06%, CV% = 3.3%) and lean leg mass (ICC_{3,1} = 0.89, 95% LOA = 1.05 - 1.15%, CV% = 2.4%) agreement was consistent. **CONCLUSION:** These data suggest that the interrater reliability between DXA and BIA is high when estimating total and regional lean mass, but not for estimating fat mass or body fat percentage. Although limited by the cross-sectional nature of the study design, our findings suggest it may be possible to use these devices interchangeably for tracking total and regional lean mass.

979 Board #158 May 31 3:30 PM - 5:00 PM
Effects Of Undulating Periodization On Physical Fitness And Body Composition In Women Practitioners Of Hydrogymnastics

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(No relationships reported)

Recently, new ways of manipulating the different training variables have been discussed in the aquatic environment. However, little attention has been considered in use of periodization theory training. **PURPOSE:** To compare the effect of two types of [daily (DUP) versus weekly (WUP)] undulating periodization on body composition, functional strength and flexibility in women practitioners of hydrogymnastics.

METHODS: 24 women practitioners of hydrogymnastics (age: 56.8 ± 2.4 years) were allocated in DUP (n=12) and WUP (n=12) groups. Both training protocols were periodized integrating a hydrogymnastics program composed by 39 sessions, 3 times per week, alternating in low or high intensity [Borg Rating of Perceived Exertion (RPE)], or per daily (DUP) or per week (WUP). Before and after the experimental protocol the individuals completed four items from the Senior Fitness Test (SFT) and body composition analysis. The SFT task were: Chair Stand test, which assessed lower body muscle strength and endurance; Arm Curl, which assessed arm muscle strength endurance, specifically of the biceps; Chair Sit-and-Reach a test of lower body flexibility; and the Back Scratch Test, which assessed upper body flexibility, particularly of the shoulders. Body composition was performed using the In-Body (720) equipment. Data were analyzed using two-way ANOVA (group and time with a significance level of 5%). **RESULTS:** DUP and WUP treatment produced similar increase ($p<0.05$) of scores related to Arm Curl (~18%) and Chair Stand (~17%) tests; maintenance of Chair Sit-and-Reach scores. Differences between the groups ($p<0.05$; ~25%) were showed only in Back Scratch test with a higher score in DUP group. **CONCLUSION:** Both daily and weekly undulating periodization were able to increase or maintain the physical fitness status and reduce fat mass in women practitioners of hydrogymnastics. Also, it seems that upper body flexibility may be influenced more by DUP than WUP.

980 Board #159 May 31 3:30 PM - 5:00 PM
Relationship of Fat-Free Mass and Fat Mass to Body Weight in College Male Athletes Players

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Body mass differs widely across the sports spectrum. While some sports are dominated by large athletes, other sports participants benefit from a small size or weight class restrictions. Perhaps the most frequent measurement of body composition has been %fat with less frequent emphasis on the major components of body composition, fat-free mass (FFM) and fat mass (FM). FFM is the functional component as it is closely associated with maximal voluntary strength, while FM plays an important role in energy balance. With the ever increasing emphasis on control and manipulation of these components in modern sports, perhaps there should be greater focus on the relationship between FFM and FM. **PURPOSE:** To determine the relationship of FFM and FM to height and body mass across the wide range of size typically observed in college athletes. **METHODS:** Two hundred and sixty-seven NCAA D-II male athletes (age = 20.2 ± 1.2 y, height = 180.6 ± 7.9 cm, body mass = 87.3 ± 16.9 kg) volunteered to serve as subjects. Body composition was assessed using dual-energy x-ray absorptiometry (DEXA). This allowed compartmentalization and regional estimates of lean (bone, muscle, etc.) and fat tissue from which FFM and FM are determined. **RESULTS:** The relationship between height and body mass are curvilinear and moderately correlated ($r=0.61$). FFM and FM were significantly related to height

($r = 0.69$ and 0.35 , respectively) and body mass ($r = 0.92$ and 0.91 , respectively), with the relationships being more curvilinear in the latter. FM accounted for 60% of the variance in body mass, while FFM accounted for only 40%. The relationship between FFM and FM was significant ($r = 0.62$) and curvilinear, showing a greater accumulation of FM at higher body masses. **CONCLUSIONS:** FFM and FM increase linearly with height, but showed a curvilinear relationship with body mass suggesting that this population of male athletes may be approaching a theoretical limit of FFM accumulation. In contrast, the accumulation of FM follows a linear pattern with height but increases exponentially with body mass. The curvilinear relationship between body weight and height is not typical and appears to be related to a relative increase in body weight with fat accumulation beyond 180 cm height and 110 kg body weight. Depending on the sport, accumulation of FM may become a hindrance to performance.

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Relationship Of Fat-free Mass And Fat Mass To Body Weight In College Female Athletes

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Body mass differs widely across the sports spectrum in female athletes. While some sports are dominated by large athletes, other sports participants benefit from a smaller size and/or are limited by weight class. The most traditional measure of body composition has been %fat with less frequent emphasis on the major components of body composition: fat-free mass (FFM) and fat mass (FM). FFM is the functional component since as it is closely associated with maximal voluntary strength, while FM plays an important role in energy balance. With the ever increasing emphasis on control and manipulation of these components in modern sports, closer observation should be given to the relationship between FFM and FM accumulation. **PURPOSE:** To determine the relationship of FFM and FM to height and body mass across a wide-range of size typically observed in college female athletes. **METHODS:** One hundred and thirty-two NCAA Division-II female athletes (age = 19.9 ± 1.2 y, height = 169.1 ± 7.9 cm, body mass = 67.8 ± 12.2 kg) volunteered to participate. Body composition was assessed using dual-energy x-ray absorptiometry (DEXA) to assess regional estimates of lean (bone, muscle, etc.) and fat tissue which allowed determination FFM and FM. **RESULTS:** Height was linearly correlated with body mass ($r=0.58$). FFM and FM were significantly related to height ($r = 0.63$ and 0.40 , respectively) and body mass ($r = 0.91$ and 0.93 , respectively), with the relationships being linear in all four cases. FFM accumulated at approximately 0.35 kg/cm height and 0.50 kg/kg body mass; accounting for 91% of the variance in body mass, while FM accounted for only 9%. The greatest accumulation of FFM was at a height of 169 cm (0.402 kg/cm height) and body mass of 105 kg (0.663 kg/kg). The relationship between FFM and FM was significant ($r = 0.71$) and curvilinear. Accumulation of FM per kg of FFM increased at FFM > 55 kg. **CONCLUSIONS:** In female athletes, body mass appears to be the significant determinant of FFM accumulation. The accumulation of FM is determined by FFM, while the rate of accumulation of FM increases significantly at a threshold of 55 kg FFM.

982 Board #161 May 31 3:30 PM - 5:00 PM
The Importance Of Body Composition In The National Hockey League Testing Combine

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The National Hockey League (NHL) combine was designed to assess draft-eligible players based on speed, power, strength, and physical size. Body composition (anthropometric measures and skin fold values) are recorded for all players, with the belief that it may play a role in physical performance. **PURPOSE:** To examine the role of body composition in the battery of physical tests and to compare differences in combine results based on position.

METHODS: Over two seasons, thirty-seven elite male Canadian university hockey players (age = 22.86 ± 1.55 years, weight = 87.21 ± 6.52 kg, height = 181.69 ± 6.19 cm, body fat percentage = $16.06 \pm 3.93\%$) participated in the study at the beginning of their hockey seasons. All participants underwent physical testing (as outlined in the 2016 NHL combine) and a day after testing, one total body dual energy x-ray absorptiometry (iDXA) scan to measure body composition. **RESULTS:** Pearson product correlations were used to explore the relationship among anthropometric measures (body fat percentage, visceral fat (kg), height, weight, leg lean mass per kg, upper lean mass per kg, and wingspan) with NHL fitness tests (bench press, maximum pull ups, grip strength, long jump, and Wingate anaerobic test). Multiple linear regression was used to explore the association among regional body

composition and NHL combine tests. Upper body lean mass/kg ($R^2 = .417$) explained the most variance in the bench press while height ($R^2 = .566$) explained the most variance in the long jump. Between positions, defensemen displayed greater right grip strength compared to forwards ($p < 0.05$). All other comparisons were non-significant. **CONCLUSIONS:** There are numerous factors that may influence performance on combine-specific physical tests. Body composition and anthropometric measures both seem to influence combine-specific tests, which may help sport scientists better tailor training programs to optimize performance in elite hockey players.

983 Board #162 May 31 3:30 PM - 5:00 PM
Reference Standards for Lean Mass Measures using GE Dual Energy Xray Absorptiometry

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Body composition (BC) assessments focus predominantly on fat mass, however lean mass (LM) measurements also provide useful information on clinical and nutritional status. LM measurements have been shown to be predictive of health outcomes, including sarcopenia, which has been associated with frailty and reduced quality of life. Dual energy x-ray absorptiometry (DXA) is an established technique used to assess BC, including total and regional LM. Reference values for LM derived from DXA are necessary for interpretation and detection of LM deficits and its associated health issues. Recently reference values for LM measures specific to Hologic DXA systems were developed, however it is known that BC, including LM measures differ by DXA manufacturer. There currently are no LM reference values available for GE-Healthcare DXA systems. **PURPOSE:** To develop reference values by age and sex for LM measures using with GE-Healthcare DXA systems.

METHODS: A de-identified sample, considered exempt from IRB review, was obtained from Ball State University's Clinical Exercise Physiology Laboratory and University of Wisconsin-Milwaukee's Physical Activity & Health Research Laboratory. DXA scans of 2,076 women and 1,251 men were completed using a GE Lunar Prodigy or iDXA. Variables of interest included total LM and appendicular lean mass index (ALMI; leg lean mass + arm lean mass (kg) / height (m²)). Percentiles (%ile) were calculated and a factorial ANOVA was used to assess differences for each variable between age groups and sex, as well as the interaction between age and sex. **RESULTS:** Men had higher mean total LM and ALMI than women ($p < 0.01$), across all age groups. Total LM and ALMI decreased over the 5 decades in men and women ($p < 0.01$). The 50th %ile for total LM of men and women aged 20-29 years decreased from 63.9 and 42.5 kg to 54.2 and 39.1 kg for ages 70-79 years, respectively. The rate of decline in total LM during a 5 decade period was approximately 3% and 2% for men and women per decade, respectively.

CONCLUSIONS: These age and sex-specific LM reference values are the first developed specifically for use with GE-Healthcare DXA systems. These reference values provide for a more accurate interpretation of DXA-derived LM measurements providing an initial resource to aid in the early detection and assessment of LM deficits.

984 Board #163 May 31 3:30 PM - 5:00 PM
How Much Weight Have Senior Kinesiology Students Gained?

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Several research studies have examined the belief of freshman 15 myth as it is well known that an amount of weight gained during a student's first year at college in the United States and Canada. However, mixed results have been found that freshmen gain as much as 15 pounds, whereas other suggests minimal weight gain. There is still limited information available to systematically examine the weight gained in Kinesiology/Exercise Science major senior college students. **PURPOSE:** The present study was to examine the senior college student's body weight compared to the ideal body weight. **METHODS:** Two hundred and thirty-two exercise science major students were participated in the study (age = 21.6 ± 72 yrs; Height = 170.8 ± 12.2 cm; weight = 77.8 ± 14.8 kg; Body mass index = 26.8 ± 5.0 kg-m²; Body Fat% = $19.2 \pm 8.2\%$; ideal body weight = 69.8 ± 14.2 kg) and the ideal body weight was calculated based on using the body fat % obtained by the bio-electrical impedance device. Descriptive for all variables were calculated and Pearson product-moment correlations were calculated to test the association between the actual weight and the ideal body weight. Dependent t-tests were performed to examine the statistically significant difference between the actual weight and the ideal body weight and also examine the ideal body weight differences between the male and female students. **RESULTS:** The difference between the actual weight and the ideal weight was 5.88 kg for male

students and 10.79 kg for female students. A strong correlation was observed between the actual weight and the ideal body weight, $r=.832$ ($p < 0.01$) and $r=.829$ ($p < 0.01$) for male and female students, respectively. The dependent t-test indicated that there are significant differences between the actual body weight and the ideal body weight for both male ($t(133)=9.1$, $p < 0.01$) and female ($t(97)=14.49$, $p < 0.01$). **CONCLUSIONS:** This finding demonstrates that even exercise science major students were heavier than their ideal body weight and female students are heavier than male students. Future researchers should focus on the mechanisms of college student's weight gain to initiate the college level interventions to prevent unhealthy weight gain.

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Influence Of Body Fat Percentage And Sex On Mechanical Efficiency Of Rock Climbing

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(No relationships reported)

PURPOSE: The purpose of this study was to determine if there is a relationship between mechanical efficiency (ME) and body fat percentage (BF%) in rock climbers. The secondary aspect was to determine if there is a difference in ME between male and female rock climbers. Years of experience and frequency of climbing was analyzed to correct for variability.

METHODS: 10 experienced rock climbers (7 males, 3 females) mean age of 25 ± 5.8 years volunteered to participate in the study. Each participant climbed up a 30 ft. indoor vertical rock climbing wall at a self-selected pace. VO_2 was analyzed at rest and during the climb using a portable COSMED device. BF% was measured using bioelectrical impedance (BIA) and years of climbing and climbing frequency was self-reported. Participants were separated in two groups based on whether they fell above or below the median BF%. Males and female participants were also analyzed by group. Correlation and independent t-tests were ran using Microsoft Excel 2016.

RESULTS: A negative correlation ($r = -0.37$) was found between ME and body fat percentage. No significant difference in ME was seen between groups ($p = 0.086$). No significance was found between ME and years or frequency of climbing. There was no significant difference in ME between males and females although the difference in BF% was significant ($p = 0.00698$).

CONCLUSIONS: Individuals with higher BF% tend to have lower ME but this difference is not significant. Previous studies have shown that training state has the largest effects ME. Therefore, self-reported years of experience and frequency of climbing may not be an accurate estimator for training status.

986 Board #165 May 31 3:30 PM - 5:00 PM

Validity of Whole and Regional Body Composition Testing Devices

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Obesity has been established as a risk factor for multiple diseases and is an increasing problem throughout the world. Advances in technology have enabled health professionals to use many devices to diagnose individuals as healthy, overweight, or obese. However, there are discrepancies between the validity of the devices.

PURPOSE: The purpose of this study is to validate InBody 520 and InBody S10 against the Hologic dual-energy X-ray absorptiometry (DXA) system. **METHODS:** 50 male and female subjects performed body composition testing on an InBody 520, InBody S10, and a Hologic DXA, followed by repeat measurements on the InBody 520 and S10. **RESULTS:** JMP Statistical Discovery Software Version 12.2.0 (Cary, NC) was used to run a matched pairs T-test and one-way analysis of variance (ANOVA) statistical analysis on all data collected. The significance level was set as $p < .05$ with a confidence interval of 95%. Subjects were (31 males, 19 females) mean weight was 87.8 ± 19.6kg (male) and 63.9 ± 10.7 kg (female), mean height was 178.7 ± 6.6cm (male) and 161.9 ± 7.1cm (female), mean age was 23.1 ± 2.7 years (male) and 22.9 ± 2.0 years (female). Body fat percentage was significantly greater for the DXA (28.9 ± 8.2) when compared to the InBody 520 (20.4 ± 9.6), $p < .001$, and significantly greater when compared to the the InBody S10 (21.8 ± 9.8), $p = .001$. Lean body mass was significantly less for the DXA (54.7 ± 14.4) when compared to InBody 520 (62.2 ± 15.1), $p = .036$, but not significant when compared to the InBody S10 (61.0 ± 15.6), $p = .096$. Body fat mass was significantly greater for the DXA (22.3 ± 9.4) compared to the InBody 520 (16.5 ± 10.6), $p = .0156$, but not significant when compared to the InBody S10 (17.9 ± 10.9), $p = .091$. **CONCLUSION:** The overall conclusion of this project is significant differences existed when measuring body composition variables between the DXA and the InBody devices. The InBody devices however, were not significantly different to each other when measuring body fat mass, lean body mass, and percent body fat, but again, they were significantly different when compared to the DXA.

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Changes in Body Composition among Female College Basketball Players Pre and Post-Preseason Training

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(No relationships reported)

PURPOSE: To examine changes in area-specific lean mass and body fat among female, division I college basketball players before and after preseason training. **METHODS:** Body composition was measured before and after preseason training using a dual-energy x-ray absorptiometry (iDXA) scan. Total and area-specific (arms, trunk, legs, android, and gynoid) lean mass and body fat were analyzed. Preseason training lasted 1 month and consisted of 8 hours per week of a combination of weight training, high-intensity interval sprint training, and skill workouts. Paired-sample t-tests were used to examine change pre- and post-intervention. Pearson correlations were conducted to examine potential associations among variables.

RESULTS: Female athletes (N=11) completed this study. Total body mass significantly increased ($p = .001$) after preseason training from 152.8 to 155.6 lbs. Total and area-specific fat mass did not significantly change after preseason training. Total lean mass significantly increased ($p = .004$) from 109.6 to 112.0 lbs. However, for area-specific lean mass, only lean mass in the trunk ($p = .01$) and in the android region ($p = .013$) significantly increased from 51.2 to 52.3 lbs. and from 6.8 to 6.9 lbs., respectively. Individual lean mass responses to training varied widely. Specifically, changes in total lean mass ranged from +.02 to +7.9 lbs. Changes in total fat mass also varied widely between individuals, ranging from a loss of 2.2 lbs. to a gain of 3.5 lbs. Change in total lean mass was not significantly correlated with baseline total lean mass, age, year in school, or position played. Change in total body fat was negatively correlated ($r = -.82$, $p = .001$) but not significantly correlated with age, year in school, or position played. One athlete experienced an ACL tear midway through the season. Although her data was not included in pre-post analysis, her iDXA scan indicated a loss of 11.3 lbs. in lean mass, with the majority of this reduction seen in the legs (-6.4 lbs.).

CONCLUSIONS: Because there were significant increases in total body mass and lean mass but not body fat, it is important to directly measure body composition to examine effects of training. In addition, these data demonstrate that athletes' responses to training can vary widely thus highlighting the potential use of individualized training programs.

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Relationships Between Body Composition And Sports Performance In Collegiate Baseball

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Purpose: Baseball requires a multifaceted list of skills and athletic abilities in order to be successful. This varies even further depending on the player's role within the team, such as pitchers and hitters. There is currently little data seen within the realm of baseball depicting the relationships between athlete body composition and their performance.

Methods: Athletes from a NCAA division I collegiate baseball team were recruited for this study (n=28). The athletes were measured for height, weight, and body composition. Body composition was measured utilizing air displacement (Cosmed, USA). The players were broken into two categories; allocated by their role as a pitcher in the team or as a batter. Pitchers were noted for their earned run average (ERA) and batters for their batting average (BA). Statistics were accessed from season performance data.

Results: The pitchers within this squad had a mean body weight of 186 ± 12.3 lbs., (Mean±STD) a mean BF% of 17.3 ± 4.6, and a mean ERA of 7.31 ± 4.9. The batters had a mean body weight of 194 ± 23.7 lbs., a mean BF% of 16.4 ± 8.2, and a mean BA of .270 ± 0.1. Correlations between body fat percentages and BA were non-significant, and so were correlations between body fat percentages and ERA.

Conclusions: From these results, no significant difference appeared to show how body fat percentage along with total body weight would play a major role in determining the overall ability of the pitchers or the batters. This research shows that variety of body weight and body compositions can be successful when playing baseball since no clear trend was identified. Further research should be conducted with baseball with comparisons at the professional level.

989 Board #168 May 31 3:30 PM - 5:00 PM
Comparing Body Composition Changes Between Skinfold and Air Plethysmography in Division II Men's Basketball Players

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(No relationships reported)

Body composition can be used as an indicator of health in the general population and athletes alike. Men's college basketball players are encouraged to make healthy (body composition, aerobic and anaerobic markers, etc.) changes between Post-season and Pre-season, often overseen with a strength and conditioning staff intervention. The ability to measure percent fat, and track those changes during an athlete's career, including the off-season, is a vital measurement for strength and conditioning coaches.

PURPOSE: To compare changes in body density (BD), body fat percentage (BF%) and fat-free mass (FFM) obtained from skinfolds (SKF) using calipers and BodPod values in men's basketball players from Post-season to Pre-season during an off-season college-level strength and conditioning intervention.

METHODS: Certified Strength and Conditioning (CSCS) staff supervised the off-season (April to October) training intervention. SKF were performed by a single, experienced technician on 7 Division II men's basketball players (21.0 ± 0.6 yrs, 1.91 ± 0.11 m, 94.9 ± 17.2 kg) following ACSM Guidelines. BD via SKF was calculated via Jackson-Pollock seven-site formula. For SKF, the BD to BF% conversion utilized either BF% = (4.86/Db) - 4.39 or BF% = (4.95/Db) - 4.50, based on age, sex, and ethnicity. BodPod was performed in accordance with manufacturer's directions. A dependent, t-test was used to determine differences in BD, BF%, and FFM obtained from SKF and BodPod.

RESULTS: Changes in BD did not differ between the two groups (SKF 0.002 ± 0.002 kg/L, BodPod 0.004 ± 0.007 kg/L). The change in BF% did not differ significantly between skinfold and BodPod (SKF 1.2 ± 1.2%, BodPod 2.4 ± 2.2%). Changes in FFM did not differ significantly between the two assessment methods (SKF 1.1 ± 0.9 kg, BodPod 1.4 ± 0.6 kg). Body weight did not change significantly in the off-season (April 94.9 ± 17.1 kg, Oct 94.2 ± 14.5 kg).

CONCLUSION: The changes in body composition were accounted for equally by SKF and BodPod. While SKF and BodPod values may vary in the actual measurement of BD, BF% and FFM, the absolute change in BD, BF%, and FFM from Post-season to Pre-season was assessed equally by both modes of testing. Regardless of the body composition assessment tool, its variation can be presumed accurate as long as the same mode of testing was used at both time points.

990 Board #169 May 31 3:30 PM - 5:00 PM
Differences in Total Body Fat and Body Fat Percentage Between Performance and Aesthetic Collegiate Athletes

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Aesthetic sport athletes may believe that they can achieve a higher score if their body conforms to an ideally perceived body image. These athletes may follow extreme diets that can lead to a low body fat percentage, fluctuations in weight, and eating disorders in order to achieve their desirable body image. Although, performance sports do not score points from judges, these athletes may be very lean in response to their training demands. **Purpose:** To compare absolute and relative total fat, android fat, gynoid fat, between synchronized swimming (aesthetic sport) to hockey (performance sport) in female collegiate athletes. **Methods:** 41 female collegiate athletes ($n=22$ hockey players, $n=19$ synchronized swimmers) completed a total body iDXA scan to evaluate total and regional body fat percentage. The average age of the athletes was 20.30 ± 1.77 yrs. The average weight of the athletes was 65.36 ± 8.37 kg where synchronized swimmers weighed 62.62 ± 8.45 kg and hockey players weighed 67.73 ± 7.73kg, ($F(1,40)=4.09, p<0.05$). ANOVA was used to compare between sport differences in total body fat and body fat percentage as well as in the android and gynoid regions. **Results:** Synchronized swimmers had higher total body fat percentages (30.64 ± 6.76% vs 26.74 ± 4.63%, $F(1, 39) = 4.756, p=0.035$), higher android percent fat (27.83 ± 9.91% vs 22.4 ± 7.09% $F(1,39) = 4.156 p=0.048$) and gynoid percent fat (35.18 ± 6.96% vs 30.50 ± 4.86% $F(1,39) = 6.372 p=0.016$) than hockey players. Moreover, there was no significant differences in total body fat (18.79 ± 5.87kg vs 17.57 ± 4.64kg) $F(1,39) = 0.550 p=0.463$, android fat (1.14 ± 0.53kg vs 0.97 ± 0.46kg) $F(1,39) = 1.280 p=0.265$ and gynoid fat (3.68 ± 1.18kg vs 3.51 ± 0.82kg) $F(1,39) = 0.301 p=0.586$ between the two groups. **Conclusion:** Previous literature suggests that synchronized swimmers (aesthetic sports) have lower body fat percentage in order to achieve a higher score from judges. However, our results indicate that collegiate hockey players (performance sports) have lower body fat in all the tested regions.

Factors such as body image perception, training, and diet during the competitive season should be further investigated in order to better tailor health and training programs for female student athletes.

991 Board #170 May 31 3:30 PM - 5:00 PM
Effect of Body Composition and Mass Adjustments on Workload Estimation in NCAA Division I Football Players

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PURPOSE: Global Positioning Systems (GPS) and accelerometer integrated wearable technology (IWT) is often used to quantify an athlete's work output. Differences in body composition may impact an athlete's workload. This study examined the relationship between IWT determined total workload (TWL) and body composition measurements between 9 football positions. **METHODS:** TWL was measured in 78 NCAA Division I football athletes [9 Safeties (S), 6 Cornerbacks (CB), 12 Wide Receivers (WR), 5 Running Backs (RB), 5 Quarterbacks (QB), 6 Tight Ends (TE), 13 Linebackers (LB), 13 Defensive Linemen (DL), and 9 Offensive Linemen (OL)] using IWT during summer training sessions (June-July). Body fat percentage (BF%) and total upper body – lean lower mass ratio (TULLR) were determined using dual X-ray absorptiometry. Average TWL for the measured period was multiplied by BF%, BMI, and TULLR to obtain relative values for each player. An ANOVA was used to test the effect of position on each workload variable. When position had a significant effect, a Tukey test determined positional differences. **RESULTS:** Position had an effect on TWL ($p<0.001$) with S having a higher TWL than OL. When TWL was adjusted for BF% OL had significantly ($p<0.025$) higher TWL than all positions. There were no differences in TWL by position when adjusted for BMI ($p=0.174$) or TULLR ($p=0.107$). Table 1 presents the positional comparisons for each measure of TWL. **CONCLUSION:** Data from this study suggests that adjustments of TWL influences the interpretation of positional differences. Given that TWL is estimated based on changes in acceleration, the amount, and composition, of the athlete's mass is critical to understanding the actual work being performed. Based on the observed variance in physiological response to similar TWL, future studies should examine relative player loads based on body mass and composition.

Table 1: Total Workload and Relative Adjustments mean (±SD)

	S n = 9	CB n = 6	WR n = 12	RB n = 5	QB n = 5	TE n = 6	LB n = 13	DL n = 13	OL n = 9
Total (AU) Workload	242.9 ^a (41.0)	230.5 ^{ab} (29.7)	234.4 ^{ab} (28.1)	239.6 ^{ab} (11.1)	225.7 ^{ab} (33.3)	208.1 ^{ab} (22.8)	224.3 ^{ab} (47.4)	209.3 ^{ab} (32.0)	187.4 ^b (27.6)
BF% (AU)	3392.5 ^b (760.0)	3177.9 ^b (739.2)	3628.4 ^b (482.8)	3453.4 ^b (676.2)	3475.0 ^b (332.7)	3762.8 ^b (861.7)	4016.8 ^b (997.4)	4637.9 ^b (1255.4)	5941.7 ^a (1241.3)
BMI (AU)	6818.1 ^a (1222.7)	6114.9 ^a (1064.9)	6217.6 ^a (763.8)	7252.3 ^a (400.2)	5933.0 ^a (521.8)	5980.0 ^a (632.3)	6725.4 ^a (1360.1)	6977.2 ^a (1206.5)	7065.9 ^a (1347.8)
TULLR (AU)	398.8 ^a (61.8)	363.0 ^a (64.6)	386.7 ^a (49.4)	382.0 ^a (33.1)	365.6 ^a (46.7)	351.3 ^a (47.0)	360.5 ^a (82.7)	331.8 ^a (53.7)	325.2 ^a (38.0)

*If values do not share a letter in each row they are significantly different from one another

992 Board #171 May 31 3:30 PM - 5:00 PM
Changes in Division I Collegiate Ice Hockey Player Anthropometrics and Fitness Over 36 Years

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(No relationships reported)

Over the past several decades, fitness training has become integral to collegiate ice hockey, with the objective being to improve on-ice performance. However, the change in anthropometric and fitness profiles of collegiate ice hockey players has not been addressed. In addition, it is unknown whether these characteristics differ in athletes who later play in the National Hockey League (NHL) compared to those who do not. **PURPOSE:** The purposes of this study were to describe anthropometric (height, weight, %fat) and aerobic fitness (VO_{2max}) characteristics of collegiate ice hockey players over 36 years, and to evaluate whether these characteristics differ from those athletes who later play professionally in the NHL. **METHODS:** Physiologic and anthropometric profiles were obtained through preseason fitness testing of all players from a NCAA Division I men's ice hockey team from 1980 through 2015. Athletes (N=56) who later played at least one year in the NHL were also compared to non-NHL

athletes (N=220). Descriptive statistics (means, standard deviations) were calculated for non-NHL team players, as well as NHL players. Changes over time in variables of interest for each year's team were evaluated via regression analysis using linear and polynomial models. Characteristics of average non-NHL characteristics and future NHL players were compared via analysis of variance. **RESULTS:** Regression analysis revealed that a cubic model best predicted changes in mean height ($R^2=0.65$) and weight ($R^2=0.77$), while a quadratic model best fit change in %fat by year ($R^2=0.30$). Non-NHL averages were slightly, yet significantly ($P<0.01$) greater for %fat (12.4±3.5 % vs. 11.2±3.3 %), but there was no difference in height (181.8±6.2 cm vs 182.5±4.8 cm), weight (84.6±7.7 kg vs 85.0±5.7 kg), and VO_{2max} (58.0±4.6 ml·kg⁻¹·min⁻¹ vs 58.6±5.0 ml·kg⁻¹·min⁻¹) between non-NHL and future NHL players, respectively. **CONCLUSION:** While average player heights and weights fluctuated over time, increased emphasis on fitness training did not appear to affect athletes' relative aerobic fitness levels.

993 Board #172 May 31 3:30 PM - 5:00 PM
Anthropometric Evolution Of Professional Basketball Positions: A 20-year Retrospective View Of NBA Players
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 (No relationships reported)

Coaches and management should constantly monitor long-term development of both current and prospective athletes in order to ensure proper fit into their system. Longitudinal analysis of player development and changing physical requirements of specific player positions can help to further evaluate player characteristics and allow for more effective comparison within their organization. **PURPOSE:** To identify whether the anthropometric characteristics of professional basketball positions have changed over the past 20 years (1997-2016). **METHODS:** Anthropometric assessments (height, weight, body fat, wingspan, and wingspan:height ratio) were taken by staff from multiple NBA settings (combines, individual team tryouts, etc.) over the course of 20 NBA seasons (1997-2016) and pooled together in order to evaluate changes in anthropometric characteristics of each the following positions: point guard (PG), shooting guard (SG), small forward (SF), power forward (PF), and center (C). All players included in the analysis were either current NBA players or prospective NBA players selectively chosen by the NBA and its respective organizations. Multilevel modelling was used to explore trends in anthropometric variation over time using linear regression analysis. **RESULTS:** With the exception of PG (2.626 cm), average height decreased for all positions over the course of 20 years (SG: -1.072 cm; SF: -0.335 cm; PF: -0.625 cm; C: -1.646 cm). Weight decreased for the PF position over time (-2.549kg), while all other positions reported increases in average weight (PG: 1.085 kg, SG: 1.301 kg, SF: 0.368 kg; C: 0.017 kg). Wingspan increased for all positions (PG: 2.306 cm; SG: 2.322 cm; SF: 2.581 cm; PF: 1.991 cm) with the exception of C (-0.655 cm). Improved body composition was observed with body fat percentage decreasing for all positions (PF: -2.55%; SG: -1.45%; SF: -1.45%; C: -2.48%; C: -0.72%). PG showed minimal change in wingspan:height ratio (-0.02%), while all other positions reported a slight increase in this ratio (SG: 1.80%; SF: 1.40%; PF: 1.20%; C: 0.60%). **CONCLUSION:** Findings demonstrate the long-term evolution of professional basketball players has resulted in minimal changes in height and weight, while all positions appear to have become longer and leaner over the past 20 years.

994 Board #173 May 31 3:30 PM - 5:00 PM
Validation Of Air-displacement Plethysmography And Bioimpedance With Dxa In Measuring Body Fat Among Chinese Athletes
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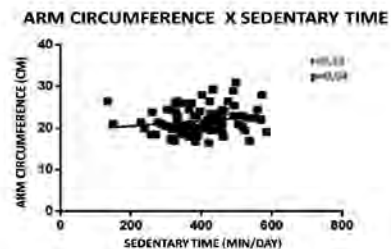
Estimates of body composition are used to assess nutritional status and training effect in athletes. However, most equations that predict relative body fat were derived from predominantly white samples, and ethnic difference may cause discrepancies in body composition assessment. Moreover, musculoskeletal development in athletes may affect the density of the fat-free mass, which is the primary factor limiting the accuracy of body composition estimates from body density. **PURPOSE:** To validate air-displacement plethysmography and bioelectrical impedance in body fat estimates in Chinese professional athletes. **METHODS:** Body composition was measured by BOD POD and by Inbody 720 (BIA). Dual-energy X-ray absorptiometry (DXA) was used as the criterion measurement. Comparisons were made among three different BMI groups, LOW (BMI<18.5), NOR (BMI 18.5-24.99), and HIGH (BMI 25+). **RESULTS:** A heterogeneous group of 111 professional athletes were randomly recruited from Shanghai, including 63 males and 48 females. An almost perfect

correlation of body fat percentage (%BF) estimated from BOD POD and DXA was found in all three BMI groups (ICC=0.841 for LOW, 0.909 for NOR, and 0.937 for HIGH, respectively), and the same happened for BIA and DXA (ICC=0.818 for LOW, 0.900 for NOR, and 0.909 for HIGH, respectively). The paired-samples t tests also showed significant correlation between BOD POD, BIA and DXA estimates in all three BMI groups ($p<0.001$). Estimated %BF from BOD POD was significantly lower than that from DXA in all three groups ($p<0.001$). Estimated %BF from BIA was significantly lower than that from DXA ($p<0.001$) in HIGH but not significantly different in LOW ($p=0.946$) and NOR ($p=0.681$) groups. Bland-Altman plots showed that BIA tends to overestimate %BF in thinner subjects and underestimated %BF in heavier participants. **CONCLUSION:** Both BOD POD and BIA appear to measure %BF in Chinese athletes reliably; however, findings suggest that BOD POD seems to underestimate %BF compared to DXA, and BIA estimates is valid in low to normal BMI subjects but it may deviate from DXA estimates in high BMI group. Consequently, modifications should be given to the embedded equations in BOD POD and BIA devices when measuring %BF in Chinese athletes.

995 Board #174 May 31 3:30 PM - 5:00 PM
Association Among Arm Circumference, Anthropometric Variables And Sedentary Time In Children
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 (No relationships reported)

PURPOSE: to verify the association of arm circumference and anthropometric variables. **METHODS:** this study is part to the Mixed-Longitudinal Project of Growth, Development, and Physical Fitness from Ilhabela. A convenient sample of 89 children of both sexes, aged 9-11 years-old, was taken from two public schools of Ilhabela. Anthropometric variables included body weight (kg), body height (cm), body mass index (BMI; kg/m²), arm (AC) and waist (AW) circumference (cm), and adiposity (AT; mm), measured by the mean of seven skinfolds (biceps, triceps, subscapular, supra-iliac, medial axillar, abdominal, an calf. Sedentary time was determined objectively by Actigraph GT3X+ accelerometer (ActiGraph, Pensacola, USA). Children wore the accelerometers for seven consecutive days. The cut-off criteria for sedentary time in the accelerometer was ≤25 counts/15 seconds, according to Evenson, et al., 2008. A Spearman-rho correlation was determine, and a significant level of $p\leq.05$ was taken. **RESULTS:** **CONCLUSIONS:** A significant but weak association was found between arm circumference and sedentary time. However, arm circumference was strongly associated to all anthropometric variables. Then, it seems that arm circumference may be an important obesity predictor in children from 9 to 11 years-old.

Variables	r	IC95%	p
Body Weight (kg)	0.83	0.75-0.88	<0.0001
Body Height (cm)	0.54	0.37-0.67	<0.0001
BMI (kg/m ²)	0.93	0.90-0.96	<0.0001
Waist Circumf (cm)	0.63	0.75-0.88	<0.0001



B-66 Free Communication/Poster - Cancer

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

- 996 Board #175 May 31 2:00 PM - 3:30 PM
Effect of Periodized Training on Sarcopenic Obesity and Physical Function in Prostate Cancer Survivors
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(No relationships reported)

For prostate cancer survivors (PCS) on androgen deprivation therapy (ADT), the loss of skeletal muscle and increase in adiposity, together called sarcopenic obesity, is a common adverse effect. Sarcopenia is also associated with decreases in strength and mobility. No studies to date have concomitantly improved sarcopenic obesity and physical function in PCS on ADT. This study attempts to improve on existing interventions by employing periodization to optimize physiological and performance adaptations. **PURPOSE:** This ongoing pilot trial investigates the effects of 12 weeks of periodized resistance training on sarcopenic obesity and physical function in PCS on ADT. **METHODS:** Eighteen PCS (65.6 ± 8.8 yr) on current or previous ADT were recruited from the USC Norris Comprehensive Cancer Center and randomized to periodized resistance training (PRT; n=9) or an attention control stretching program (CS; n=9). Outcomes were assessed at baseline and after the 12-wk intervention. Body composition was measured through dual-x-ray absorptiometry, estimated 1 RM strength was tested on leg press and seated row, and mobility was assessed through timed up and go. Appendicular skeletal muscle index (ASMI), a common index of sarcopenia, was calculated from body composition. PRT performed a supervised total-body resistance exercise and stretching program 3 times a week. CS performed home-based stretching 3 times a week. Baseline group differences were tested with univariate ANOVA, while differences in all outcomes were tested with 2 (group) x 2 (time) ANOVA.

RESULTS: No significant differences in characteristics or outcomes were found between groups at baseline ($P > 0.05$). Post-intervention, significant increases were observed in PRT compared to CS for appendicular skeletal mass (0.8 ± 4 kg; $P = 0.04$), ASMI ($0.3 \pm .1$ kg/m²; $P = 0.041$), leg press (126.6 ± 31.7 kg; $P = .004$) and seated row (23.0 ± 3.5 kg; $P < .001$). A nonsignificant decrease in body fat (%) was observed in PRT compared to CS ($1.3 \pm .7$ %; $P = .067$; $d = 0.89$). No differences were found in mobility. **CONCLUSIONS:**

In PCS on ADT, a 12-wk periodized resistance training program improved skeletal muscle mass and strength. Future work is warranted to determine if adiposity can be attenuated and improvements sustained beyond the 12-wk intervention. Supported by an NSCAF doctoral grant.

- 997 Board #176 May 31 2:00 PM - 3:30 PM
Efficacy Of An Adaptive Clinical Exercise Program For Cancer Survivors During And After Treatment
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Exercise programs for cancer survivors improve endurance, strength, and quality of life. Survivors exercising during cancer treatment tend to show smaller improvements, or performance maintenance, compared to those who have completed treatment.

Adapting exercise to the day-to-day status of survivors during and after treatment is recommended and may improve program efficacy. **PURPOSE:** To investigate a three month adaptive clinical exercise program for cancer survivors during and after treatment. **METHODS:** Cancer survivors undergoing treatment (chemotherapy and/or radiation) at enrollment or within six months of completing treatment were included. No cancer types were excluded. Estimated VO₂peak, grip strength, the Piper Fatigue Scale (PFS), and the Beck Depression Inventory (BDI) were assessed at baseline and program completion. The number of exercise sessions completed was recorded. Age, sex, and body mass index (BMI) at baseline were compared between treatment groups (undergoing treatment and completed treatment). ANOVAs (Exercise [within-participant] x Treatment [between-participant]) were performed for each performance measure in all participants and separately for breast cancer survivors. **RESULTS:** Participants undergoing treatment (N=58) did not significantly differ from those who had completed treatment (N=61) in age (57±12 years; Mean±SD), sex (71% women), or BMI (26.4±5.6 kg/m²). The number of exercise sessions completed was not different between groups (18±5 out of a possible 24, $p > 0.05$). The main effect of Exercise was significant for all measures ($p < 0.01$), with improvements seen from

baseline to program completion (estimated VO₂peak: 3.1 ± 4 ml/min/kg, grip strength: 1 ± 3 kg, PFS: -1 ± 2 , BDI: -3 ± 6), while the main effect of Treatment and Treatment-Exercise interactions were not significant ($p > 0.05$). These results were replicated when only breast cancer survivors were analyzed (N=48, 24 undergoing treatment). **CONCLUSIONS:** Cardiorespiratory fitness, strength, fatigue, and depressive symptoms improved significantly with exercise, regardless of treatment status. These results suggest that cancer survivors currently undergoing treatment can experience benefits equal to those of survivors who have completed treatment through an adaptive exercise program.

- 998 Board #177 May 31 2:00 PM - 3:30 PM
Randomized Controlled Trial of Peer Led Intervention for Prostate Cancer Patients to Increase Exercise Participation

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(No relationships reported)

PURPOSE: To evaluate the effectiveness of a peer-led multimodal intervention for increasing exercise participation in patients with localized prostate cancer.

METHODS: A randomized controlled trial with 463 prostate cancer patients 10.8 months post-curative therapy, enrolled from September 2011 until November 2012, from Queensland, Australia were randomized into a peer-led multimodal intervention (INT) (n=232) targeting exercise and unmet supportive care needs or usual care (UC) (n=231). The intervention included self-management materials, exercise equipment, and monthly telephone-based group peer-support for 6 months. Patients were assessed for compliance with exercise guidelines for cancer survivors, psychological distress, and quality of life (QoL) at baseline, 3, 6 and 12 months. **RESULTS:** 81.6% completed the final assessment at 12 months. Patients in INT engaged in significantly more resistance exercise than UC at 3 months (19.4 [95% CI 6.52 to 32.28] min/wk, $p = 0.003$) and 6 months (14.6 [95% CI 1.69 to 27.58] min/wk, $p = 0.027$). There was no difference between groups for aerobic-based activity at any time point nor for resistance exercise time at 12-month follow-up. At 3 months 40.3% of UC were inactive compared to 29.3% of INT ($X^2 = 6.12$, $p = .013$), while 7.8% of UC were sufficiently active compared to 18.0% for INT ($X^2 = 8.89$, $p = .003$). INT had significantly higher Assessment of Quality of Life (AQoL)-8D Relationships subscale scores at 3-month follow-up (.03 [95% CI .00 to .06], $p = .038$) compared with UC, with no change in psychological distress. **CONCLUSION:** The intervention was effective in increasing patients' resistance exercise participation in the short- to medium-term, however, this behaviour change was not accompanied by overall improvements in QoL or psychological distress. Further investigation is required to increase effectiveness and maintain long-term adherence.

- 999 Board #178 May 31 2:00 PM - 3:30 PM
Effects of Exercise Program on Prostate Cancer Patients with Androgen Deprivation Therapy
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(No relationships reported)

PURPOSE: The purpose of this study is to identify the effects of 12-week exercise program on physical and psychological health outcome in older prostate cancer patients with androgen deprivation therapy (ADT). **METHODS:** Nineteen prostate cancer patients (mean age 75.26 ± 6.9) receiving ADT at least 3 months were randomized into an exercise program comprising supervised (once a week) and home-based (more than 3 days/week) exercise session ($n = 11$) or usual care ($n = 8$) for 12 weeks. The exercise program was composed of stretching, resistance, and walking based aerobic training. Thigh circumference, level of physical activity, muscle strength, functional fitness, quality of life, and fatigue were assessed at baseline and after 12-week intervention. Data were analyzed using repeated measures ANOVA. **RESULTS:** The exercise group showed improvements in thigh circumference (exercise group (EG) 1.2 vs. usual care group (UCG) -0.5 cm, $p = .013$), level of physical activity using

accelerometer (daily steps: EG 2,247.1 vs. UCG -1,204.3 steps/day, $p=.027$; moderate to vigorous physical activity: EG 85.6 vs. UCG -12 min/day, $p=.008$), muscle strength using hand grip dynamometer (grip strength: EG 2.1 vs. UCG -0.3 kg, $p=.034$; knee extensor: EG 44.2 vs. UCG 6.1 Nm/kg, $p=.004$; knee flexor: EG 18.8 vs. UCG -21.3 Nm/kg, $p<.001$), and functional fitness (chair stand: EG 9.2 vs. UCG 5.1 count/sec, $p<.001$; up and go: EG -1.5 vs. UCG 0.3sec, $p=.003$; 2-min step: EG 67.7 vs. UCG -14.2count/sec, $p<.001$) compared with usual care group. Exercise group also improved quality of life using Functional Assessment of Cancer Therapy-Prostate (EG 21.2 vs. UCG -22.1 points, $p<.001$) and reduced fatigue using Functional Assessment of Chronic Illness Therapy-Fatigue (EG 18.6 vs. UCG 1.9 points, $p=.004$). There were no adverse events during the testing or exercise intervention period. **Conclusion:** Twelve-week exercise program not only significantly improved physical and psychological health but also increased level of physical activity in older prostate cancer patients with ADT. Supported by the Korean society of sports medicine.

1000 Board #179 May 31 2:00 PM - 3:30 PM
Functional Capacity Of Gastrointestinal Cancer Patients - A Pre-therapy Comparison To Breast Cancer Patients And Healthy Women

Lutz Vogt¹, Katrin Stücher¹, Claus Bolling², Axel Dignass², Winfried Banzer, FACS¹. ¹J.W.Goethe-University, Frankfurt/Main, Germany. ²Agaplesion Markus Hospital, Frankfurt/Main, Germany. (Sponsor: Winfried Banzer, FACS¹)
 (No relationships reported)

PURPOSE: Many studies of cancer patients report that frailty, cachexia and decreased physical function during chemotherapy (CT) predict a higher mortality risk. Although a high prevalence of these symptoms in gastrointestinal (GI) cancer patients is known, there is almost no data on functional status and body composition in this population. The aim of the study is to assess and compare the pre-therapy motor performance of advanced GI cancer patients in contrast to breast cancer patients and healthy controls. **METHODS:** In a 3-arm cross-sectional study female patients with advanced cancer (UICC ≥ III) (GI: n=17; 70.1±3.1 yrs; BMI 23.6±5.3 kg/m²; breast: n=17; 66.9±2.3 yrs; BMI 23.6±3.8 kg/m²) before first-line CT and 17 healthy age-matched women (69.4±1.4 yrs; BMI 24.2±3.3 kg/m²) are examined. Body composition was obtained from bioelectrical impedance analysis. The amount of daily physical activity (steps; MVPA/min-wk⁻¹) was calculated from accelerometer (Actigraph) readings. A capacitive force platform (Zebris) was used for gait speed recordings during free level walking. Maximal isometric voluntary contraction force (MIVF) of the quadriceps muscle was assessed by a strain gauge force transducer (ASYS). **RESULTS:** ANOVA with post-hoc test and Bonferroni correction show significant differences in outcome measures of GI cancer patients compared to breast cancer patients and healthy women. GI cancer patients show lower values in phase angle (4.5±0.8°; 5.3±0.5°; $p<.01$) and isometric strength (5.5±2.2; 9.1±3.3; 8.4±1.8 N/kg; $p<.01$). Steps per day (3125±2396; 8703±4104 stp, $p<.001$), moderate to vigorous activity (7.3±11.9; 36.9±28.5 MVPA/min-wk⁻¹; $p=.001$) and gait speed (3.5±1.1; 4.9±0.6 km/h; $p<.001$) are decreased compared to healthy women. **CONCLUSIONS:** Patients with advanced GI cancers demonstrate sufficient deficits in functional status and motor performance before CT compared to advanced breast cancer patients and healthy women. Gait speed, phase angle and force are below cut-off values for low prognosis of survival and may reflect a diminished tolerance of CT. Measures to improve muscle status, physical function and its effects on treatment is warranted in patients with advanced GI cancers.

1001 Board #180 May 31 2:00 PM - 3:30 PM
Feasibility of Exercise for Improving Inflammation in Advance Stage Prostate Cancer Patients

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BACKGROUND: Cancer cachexia is a burdensome side effect in prostate cancer patients, with advanced stage (ADV) patients having the highest risk. Chronic activation of immune response as a result of cancer and its treatments is a key stimulator of the chronic pro-inflammatory response hypothesized to result in cachexia in prostate cancer patients. Exercise reduces inflammation in cancer patients; however, it is unclear if exercise is feasible and effective at reducing inflammation among ADV prostate cancer patients with a high risk of cachexia. **PURPOSE:** This study aimed to assess the feasibility of ADV prostate cancer patients completing an exercise intervention and the efficacy of the intervention for reducing inflammation in these men compared to early stage (ERL) patients. **METHODS:** A secondary data analysis was performed on a two-arm randomized clinical trial examining the influence of a 6-week home-based aerobic and resistance exercise program. Participants included 57 sedentary prostate cancer patients aged

67 ± 8.1 years, who were receiving hormone therapy and/or radiation therapy. Each participant was randomly assigned to usual care (UC) or usual care plus exercise (UCE). ERL and ADV cancer was defined based on NCCN guidelines. Mean steps/day, minutes of resistance training/day and serum protein levels of IL-6, IL-1b, IFN_γ, IL-10, IL-8, and TNFR1 were measured at baseline and post-intervention. **RESULTS:** Attrition was minimal, with no significant difference between ERL and ADV patients (5 total withdrawals). No adverse events (AEs) were attributed to exercise and there were no significant differences between ERL and ADV patients in number of AEs. Results also showed no significant difference in the number of steps walked or minutes of resistance exercise between ERL and ADV patients in the exercise arm. (Steps Walked: ERL = 6859 ± 899; ADV = 8939 ± 1359; $p>0.05$); Minutes of Resistance Training per Session ERL = 13 ± 4 (3 days/week); ADV = 19 ± 13 (3 days/week); $p>0.05$). Changes in levels of IL-1b, IFN_γ, IL-10, IL-8, and TNFR1 were similar among ERL and ADV (all $p>0.05$), however changes in IL-6 did significantly differ between groups ($p<0.05$). **CONCLUSIONS:** Findings suggest exercise is feasible and safe, and may have positive effects on chronic inflammation in ADV prostate cancer patients. R25 CA102618, DOD PC061518

1002 Board #181 May 31 2:00 PM - 3:30 PM
Effects Of Exercise Training On Physiological And Psychological Measurements Of Cancer-related Fatigue

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While there is extensive evidence connecting exercise to a reduction in psychological fatigue, the effect of exercise on objectively measured muscular fatigue has yet to be studied in cancer patients. Evaluating how exercise modulates physiological and psychological fatigue dimensions either similarly, or independently, could aid in our understanding of how exercise reduces cancer-related fatigue. **PURPOSE:** To evaluate the effect of exercise on self-reported psychological fatigue measures and objectively measured muscular fatigue in cancer survivors. **METHODS:** A total of 21 cancer survivors (62 ± 14 years of age) were asked to complete both physiological and psychological measures of fatigue prior to, at midpoint, and following a 24-week exercise intervention. Participants completed the revised Piper Fatigue Scale (PFS), a subjective and psychological measure of fatigue. The PFS produces a total score (PFST) and four subscale scores: behavioral/severity (PFSB), affective (PFSA), sensory (PFSS), and cognitive/mood (PFSC). For the measurement of objective, physical fatigue, a handgrip fatigue index (HFI) was determined for each participant by repetitively squeezing a handgrip dynamometer 15 times with maximal force for each repetition. Participants also completed 15 maximal force knee extensions at a joint angular velocity of 60 deg·s⁻¹ and a quadriceps fatigue index (QFI) was computed. Following testing, participants completed 24 weeks of supervised exercise training. **RESULTS:** Significant main effects were found for PFST and all four subscales ($p<.05$). Results indicate significant decreases in PFST (-30%; $p=.001$), PFSB (-32%; $p=.015$), PFSA (-33%; $p=.001$), PFSS (-32%; $p=.001$), and PFSC (-25%; $p=.004$) following 12 weeks of the exercise intervention. Testing following 24 weeks of the intervention resulted in significant decreases in PFST (-30%; $p=.031$), PFSA (-32%; $p=.023$), and PFSS (-31%; $p=.016$). **CONCLUSION:** Improvements in psychological fatigue did not mirror the changes in physiological fatigue, indicating that exercise may be a more powerful modulator of emotional fatigue as opposed to muscular fatigue. Clinicians may find utilizing subjective evaluations of cancer-related fatigue more assistive and informative when prescribing exercise interventions in the cancer population.

1003 Board #182 May 31 2:00 PM - 3:30 PM
Validity of The Six-Minute Walk Test For Predicting VO_{2peak} in Cancer Survivors

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 (No relationships reported)

Exercise improves cardiovascular function in cancer survivors (CS) suffering from treatment-related toxicities, such as decreased peak oxygen consumption (VO_{2peak}). Establishing valid assessment protocols that determine VO_{2peak} are essential for developing individualized exercise prescriptions for cancer rehabilitation programs. The University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI) has developed a valid cancer-specific VO_{2peak} treadmill protocol to address this need. The six-minute walk test (6MWT) is an exercise assessment used in many populations with chronic disease to predict VO_{2peak} but it is not clear whether this test accurately assesses VO_{2peak} in CS. The 6MWT is simple, inexpensive, and representative of daily living

activities. **PURPOSE:** To assess the validity of predicted VO_{2peak} from the 6MWT compared to the UNCCRI treadmill protocol in CS. **METHODS:** 128 CS completed a UNCCRI treadmill protocol and a 6MWT one week apart in randomized order to obtain VO_{2peak} (mL/kg/min). VO_{2peak} values from the UNCCRI treadmill protocol were compared against four common 6MWT VO_{2peak} prediction equations. **RESULTS:** All four 6MWT prediction equations significantly ($p < 0.001$) underestimated VO_{2peak} . Equations 1, 2, 3 and 4 yielded VO_{2peak} values of 18.9 ± 3.0 , 14.2 ± 4.6 , 8.3 ± 3.8 , and 16.4 ± 2.3 , respectively, while the UNCCRI treadmill yielded a much higher VO_{2peak} of 24.7 ± 7.4 . A positive strong correlation occurred between the UNCCRI treadmill protocol and 6MWT prediction equation 1 ($r = 0.83$). A moderately strong correlation occurred between the UNCCRI treadmill protocol and 6MWT equation 3 ($r = 0.70$). Maximum heart rates were significantly higher ($p < 0.001$) during the UNCCRI treadmill protocol compared to the 6MWT (150 ± 21 bpm vs. 109 ± 21 bpm), respectively. **CONCLUSION:** These findings suggest that the 6MWT is not a valid test for predicting VO_{2peak} in CS due to its underestimation of all four equations. The UNCCRI treadmill protocol is much more accurate for assessing VO_{2peak} in CS in order to correctly prescribe an individualized exercise rehabilitation program.

1004 Board #183 May 31 2:00 PM - 3:30 PM
Relationship between Survivorship Time and Physical Activity Level in Puerto Rican Breast Cancer Survivors
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Cancer is one of the major public health problems in Puerto Rico, especially breast cancer. There is evidence that suggests that engaging in physical activity (PA) during and after cancer treatment improved fatigue, body composition, cardiorespiratory fitness, psychological state, and quality of life. Thus, it is important to assess PA level in breast cancer survivors.

PURPOSE: To assess: 1) the level of PA in a group of breast cancer survivors women; and 2) the relationship of survivorship time and PA level. **METHODS:** 21 breast cancer survivors participated. PA was assessed: 1) using the International Physical Activity Questionnaire - Long Version (IPAQ-L), and 2) pedometer that the participants wore for a week (OMRON-HJ320).

RESULTS: The participants average age was 54 years, height 62.2 ± 2.5 inches, weight 148.1 ± 22.6 pounds, estimated basal metabolic rate 1607.2 ± 132.9 calories. The average survivorship time was 4.24 ± 3.9 years, distributed as follows: 0-11 months, $n=4$; 1-2 years, $n=5$; 3-5 years, $n=4$ and >5 years, $n=8$. The average scores of the IPAQ-L were: Work 393.9 ± 927.4 METS-mins/week, Transportation 976.6 ± 1068.1 METS-mins/week, Home Chores $2,369.7 \pm 3,111.2$ METS-mins/week, Recreational activities $752.6 \pm 1,184.4$ METS-mins/week, Sitting time Week 201.4 ± 176.8 minutes, Sitting time Week End 157.1 ± 151.6 minutes. The average daily steps was $4,870.8 \pm 2,612.5$. A Spearman Correlation analysis did not showed significant relationship between survivorship time and physical activity level.

CONCLUSIONS: There were no significant relationship between survivorship time and physical activity. The participants did not meet the recommendation of 10,000 steps/day. The results from the IPAQ-L showed that the participants engaged in moderate physical activity in some of the domains of the questionnaire such as transportation, home chores and recreational activities.

1005 Board #184 May 31 2:00 PM - 3:30 PM
Feasibility Of Supervised Aerobic Interval Exercise Training Following Treatment For Breast Cancer
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 (No relationships reported)

Aerobic interval training (AIT) can be more effective in improving cardiorespiratory fitness, and muscle oxidative capacity than moderate continuous training (MCT) in a variety of healthy and clinical populations. Due to physical deconditioning associated with breast cancer treatment, AIT is of interest in this population. However, the feasibility and safety of AIT among breast cancer patients is unknown.

PURPOSE: To assess the feasibility and occurrence of major adverse events (MAE) with AIT among breast cancer patients immediately post completion of adjuvant chemotherapy and radiation.

METHODS: Women with early stage breast cancer were enrolled in the Nutrition and Exercise During Adjuvant Treatment trial within the first half of chemotherapy. MCT aerobic exercise was prescribed 3x/week during chemotherapy and radiation (20-30 min at 50-75% Heart Rate Reserve (HRR)). Upon treatment completion, eligible participants were prescribed AIT (4 sets of 4 min at 75-85% VO_{2R}/HRR and 4 min at 40-65% VO_{2R}/HRR) at least 1x/week, with the choice of either MCT or

AIT for remaining sessions. AIT eligibility included an absence of angina, dyspnea, uncontrolled hypertension, asthma or current prescription for heart medications. The ACSM's metabolic equation for treadmill walking was used to prescribe interval speed/grade, while HRR was used for intervals performed on a cycle ergometer or elliptical trainer.

RESULTS: 57 women (age 51 ± 11) entered the post-treatment phase of the study, of which 44 (75%) were eligible for AIT. 36 (82%) participants performed at least one AIT session. 66% of the total sessions performed were AIT workouts, indicating a potential preference for AIT vs. MCT. Those performing AIT attended significantly more sessions overall relative to those who were not performing AIT (18 ± 6 vs 13 ± 8 , $p = 0.01$). Adherence to AIT intensity was achieved in 68% of all sessions, with no difference between those performed on the treadmill, bike/elliptical, nor relative to MCT sessions. The most common barrier to AIT intensity adherence was the prescription being too difficult (75%). No MAE occurred.

CONCLUSIONS: AIT after treatment completion for breast cancer appears to be feasible, potentially preferable to MCT, and may result in greater attendance than MCT alone.

1006 Board #185 May 31 2:00 PM - 3:30 PM
Effect of Combined Aerobic and Resistance Exercise on Remnant Cholesterol in Breast Cancer Survivors
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PURPOSE: An increased risk of cardiovascular disease (CVD) and mortality is apparent in breast cancer survivors (BCS). Remnant cholesterol, defined as a product of partially catabolized chylomicrons and very-low-density lipoprotein, is a recently identified novel blood marker for increased CVD risk. In fact, the risk for CVD is two-fold greater in patients with high remnant cholesterol possibly due to higher density of remnant cholesterol per particle than LDL-C. The combination of aerobic and resistance exercise has been recommended to reduce cholesterol levels and risk of CVD in BCS, but it is unclear as to whether combined exercise improves remnant cholesterol level. This study sought to examine the effects of a 16-week progressive aerobic and resistance exercise intervention on remnant cholesterol in BCS.

METHODS: Thirty sedentary BCS diagnosed with Stage I-III breast cancer who completed cancer-related treatment within 6 months prior to enrollment were randomized to the Control (CON; $n=15$) or the Exercise (EX; $n=15$) group. The EX group underwent supervised aerobic and resistance exercise sessions 3 times a week for 16 weeks set at a moderate-vigorous intensity. The CON group was asked to maintain their current level of activity. Remnant cholesterol was calculated as total cholesterol-HDL-LDL. Paired t-test and two-way repeated measures ANOVA were used to examine the effects of exercise training on remnant cholesterol.

RESULTS: Prior to the intervention, the EX and CON did not differ by age (52.7 ± 7.9 yr), body mass index (33.9 ± 6.4 kg/m²), waist circumference (99.8 ± 4.2 cm), total cholesterol (196.4 ± 37.5 mg/dL), LDL-C (101.9 ± 31.2 mg/dL), HDL (42.7 ± 5.7 mg/dL), and remnant cholesterol (51.7 ± 28.8 mg/dL). Following the 16-week intervention, mean remnant cholesterol levels were significantly reduced (45.2 ± 13.8 to 9.9 ± 2.5 mg/dL; 78% mean decrease) in the EX group compared to CON group ($P = 0.02$; group x time interaction). There were no significant changes in remnant cholesterol levels in the CON group ($P > 0.05$).

CONCLUSIONS: A 16-week supervised progressive aerobic and resistance exercise intervention is an effective approach to reduce remnant cholesterol in BCS. Participation in combined exercise during cancer survivorship should be considered to reduce the risk for CVD mortality in BCS.

1007 Board #186 May 31 2:00 PM - 3:30 PM
Breast Cancer- And Metabolic-related Predictors Of Vo2peak Amongst Active Post-menopausal Women
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 (No relationships reported)

Peak oxygen consumption (VO_{2peak}) is reported to be lower amongst breast cancer patients both during and after adjuvant treatment relative to healthy sedentary controls. It is not known whether this is attributable to direct effects of treatment or indirect effects on whole body metabolism and exercise behaviour. **PURPOSE:** To identify metabolic and breast cancer-related predictors of relative VO_{2peak} amongst active post-menopausal women. **METHODS:** 10 subjects were selectively recruited to each of three groups: 1) breast cancer patients 3 weeks post chemotherapy (BC1); 2) breast cancer patients 1-3 years post chemotherapy and radiation (BC2); 3) healthy controls (CON). All women were 45-60 years, self-reported as post-menopausal and performing ≥ 90 min/week of moderate intensity aerobic exercise. Gas analysis measurements were made during rest, a maximal incremental treadmill test, and steady state exercise

(60% VO2R). Univariate linear regressions were performed with adjustment for age and BMI. RESULTS: Group was a significant predictor ($p=0.01$), resulting in β coefficients of -7.5 and -2.5 mL/kg/min for BC1 and BC2 relative to CON. In BC1 and BC2 combined, receipt of non-anthracycline but not anthracycline-containing chemotherapy protocols relative to CON was predictive of a lower VO2peak ($\beta=-8.8$, $p<0.01$). The amount of moderate intensity exercise self-reported in the past month (hours/week) ($\beta=1.5$, $p=0.03$), and surrogates of cardiovascular function, including O2 pulse (ml/beat) during steady state exercise ($\beta=1.7$, $p<0.01$), and five-minute heart rate recovery (bpm) ($\beta=0.3$, $p=0.03$) were also significant predictors. Receipt of fluorouracil chemotherapy or trastuzumab treatments, resting heart rate, resting VO2, substrate utilization (RER) at rest and for moderate intensity exercise, time since last menstruation, and occurrence of chemotherapy-induced menopause were not significant predictors. CONCLUSION: Among post-menopausal women, receipt of chemotherapy for breast cancer, in particular non-anthracycline-containing protocols and more recent completion, are associated with lower VO2peak, but resting and exercise metabolic parameters are not. Better recent exercise behaviour and cardiovascular function are associated with higher VO2peak.

1008 Board #187 May 31 2:00 PM - 3:30 PM
The Effects of Exercise Program on Quality Of Life and Fatigue Level During Autologous Hematopoietic Stem Cell Transplantation
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 (No relationships reported)

PURPOSE: The purpose of the study was to investigate the effects of exercise program on quality of life (qoL) and fatigue among the patients who undergo autologous hematopoietic stem cell transplantation (AHSCT).
METHODS: Twenty two patients with different diagnosis (9 multiple myeloma, 10 lymphoma, 3 other cancer type) participated in this study. The mean age was 47 ± 13 years. All patients underwent AHSCT. The exercise program started before this procedure and continued until discharge day (mean 15 days). The program included breathing, range of motion, and resistive exercises focusing large muscle groups and brisk walking duration 5-10 minutes in corridor. The Borg Rating of Perceived Exertion was used to estimate the intensity of the program to light to moderate intensity exercise prescription was based on a rating of "somewhat hard" (10-13). The fatigue was evaluated with Fatigue Impact Scale. The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) was used to assess qol.
RESULTS: The mean score of Fatigue Impact Scale was 32 ± 32 points before the procedure and 23 ± 17 points at discharge day, but there was not statistical significant difference. Global health status, functional scale and symptom scale scores which are the sub-tests of the EORTC QLQ-C30 were 47 ± 31 , 65 ± 18 , 31 ± 18 points before the treatment and 41 ± 25 , 69 ± 18 , 31 ± 17 points at the discharge day. There were not statistical significant differences between two time points in qoL scores.
CONCLUSIONS: As a result of our study exercise program was effective in reducing fatigue levels and raising qol in AHSCT patients, however the results were not statistically significant. It was thought because of the clinical status of the patients is not recover completely at the discharge day and two week is not enough to show the effects of the exercise program, we could not demonstrate effectiveness of the exercise program statistically.

B-67 Free Communication/Poster - Carbohydrate Metabolism and Exercise
 Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

1009 Board #188 May 31 2:00 PM - 3:30 PM
Metabolic Differences Between A Bout Of Eccentric, Concentric And Traditional Resistance Exercise
 Stephen M. Fischer, Jon Stavres, John McDaniel. *Kent State University, Kent, OH.*
 (No relationships reported)

Eccentric, concentric and traditional resistance exercises that incorporate both eccentric and concentric phases are often used to improve musculoskeletal fitness. Although there is evidence that indicates concentric contractions are metabolically more costly than eccentric contractions, the extent to which this translates to whole body metabolism during an entire resistance workout is less clear. **PURPOSE:** To determine the extent to which metabolic variables such as VO2(ml/kg/min), RER, and HR as well as blood glucose and lactate vary between resistance workouts comprised of only eccentric, concentric or traditional bouts. **METHODS:** N=12 men and women

completed a traditional (TRAD), concentric (CONC), and eccentric (ECC) full-body resistance workout at 65% of a pre-determined 1 repetition max with each condition matched for work. The traditional condition required 3 sets of 10 repetitions on each exercise (6 total). 3 sets of 20 repetitions were required for the eccentric and concentric conditions. During each condition, the subject was fitted to a metabolic cart and the aforementioned metabolic variables were recorded through indirect calorimetry and heart rate monitor. Blood glucose and blood lactate were taken using the ACCU-CHEK glucose monitor and Lactate Plus at five different stages (Pre, Post Leg Curl, Post Ex., 30 min Post, and 60 min Post). **RESULTS:** Both the TRAD (9.26 ± 1.83 ml/kg/min) and CONC (10.03 ± 1.63 ml/kg/min) conditions resulted in significantly ($p < 0.001$, and $p < 0.001$ respectively) greater VO2 values when compared to the ECC condition (6.67 ± 1.25 ml/kg/min). TRAD ($1.03 \pm .04$) and CONC ($1.00 \pm .03$) conditions also resulted in significantly (both $p < 0.001$) greater RER compared to the ECC ($0.88 \pm .09$) with the TRAD condition being significantly ($p = 0.045$) greater than the CONC condition. Accumulation of lactate from Pre to Post Exercise was also significantly (both $p < 0.001$) greater in the TRAD (6.17 ± 2.68 mmol) and CONC (5.73 ± 3.29 mmol) compared to the ECC (1.10 ± 1.60 mmol). **CONCLUSIONS:** Results indicate a much greater metabolic demand from concentric and traditional contractions compared to eccentric contractions on a whole body level.

1010 Board #189 May 31 2:00 PM - 3:30 PM
The Influence of a Single Bout of High-Intensity Interval Exercise on Postprandial Lipemia and Glycemia
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 (No relationships reported)

PURPOSE: Examine the effects of high-intensity interval exercise (HIIE) on postprandial (PP) triglyceride (TG), glucose, and insulin concentrations following a mixed meal (MM). **METHODS:** Physically active men ($n=10$; age= 22.2 ± 2.1 yrs; body mass = 82.7 ± 13.2 kg; body fat% = 13.3 ± 3.1) completed two trials in random order: 1) Rest and 2) A single bout of high-intensity interval exercise (HIIE). Both trials were performed at 0800 hours. HIIE consisted of performing eight (15-second) maximal effort sprints on a stationary bicycle. Each sprint was followed with approximately 3 minutes of passive cycling with no resistance. Rest consisted of sitting quietly for 30 minutes. Approximately 30 minutes following the completion of each trial, a fasting (12hr) blood sample was collected followed by the consumption of the MM providing 7.5 ± 1.2 kcal/kgBM (body mass) with a macronutrient composition of 35% carbohydrate (CHO), 5% protein, and 60% fat. The MM was blended with whole milk, ice cream, and whipping cream. Blood was collected again at 0.5, 1, 2, and 3 hours post-MM and analyzed for TG, insulin, and glucose concentration. Postprandial responses were quantified via the incremental area under the curve (AUC) using the trapezoidal method. Significant differences ($p < .05$) between trials were determined using a one-way, repeated measures ANOVA and Bonferroni post hoc test. **RESULTS:** The duration of the HIIE was 24 minutes (not including a 5-minute warm up). HIIE expended 90.1 ± 11.8 kcal. HIIE significantly reduced the glucose AUC₁ (Rest: 9.9 ± 43.1 mg·dl⁻¹·3hr⁻¹; HIIE: -39.9 ± 37.0 mg·dl⁻¹·3hr⁻¹; $p=.010$) and insulin AUC₁ (Rest: 36.2 ± 25.4 μIU·ml⁻¹·3hr⁻¹; HIIE: 5.9 ± 30.7 μIU·ml⁻¹·3hr⁻¹; $p=.035$) with no significant effect on TG AUC, (Rest: 57.2 ± 52.8 mg·dl⁻¹·3hr⁻¹; HIIE: 78.7 ± 46.5 mg·dl⁻¹·3hr⁻¹; $p=.20$). **CONCLUSION:** HIIE blunted the postprandial glucose and insulin response to high-fat mixed meal in young physically active men. The lack of change in the TG concentration might be explained by the lower energy expenditure of the HIIE due to its short duration. Future investigations should evaluate the applicability of HIIE within an at-risk populations (i.e. obesity, diabetes). This study was supported by the Stephen F. Austin State University Research Pilot Study Grant and the Texas ACSM Student Research Development Grant.

1011 Board #190 May 31 2:00 PM - 3:30 PM
Effects of Acclimatization to High Altitude on Exogenous Carbohydrate Oxidation During Steady-State Exercise
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 (No relationships reported)

In a previously reported study, oxidation of exogenous glucose consumed before and during exercise was the same in acute hypoxia as normoxia, despite higher endogenous carbohydrate (CHO) oxidation. However, how altitude acclimatization affects exogenous carbohydrate oxidation is unknown. **PURPOSE:** To determine how altitude acclimatization affects exogenous CHO oxidation during exercise. **METHODS:** Male sea level (SL) residents ($n = 17$, mean \pm SD, age, 23.4 ± 5.6 y; body mass, 81.9 ± 13.9

kg; VO_{2peak} 4.17 ± 0.65 L/min at SL and 2.77 ± 0.46 at HA) performed metabolically-matched 80-min exercise bouts (~ 1.7 L/min, $\sim 55\%$ of HA VO_{2peak}) at SL, within 6 h of arrival at 4,300 m (acute HA) and after 21-day residence at 4300 m. Immediately before and every 20 min during exercise, volunteers consumed either a CHO beverage ($n = 9$, 45 g fructose/L + 55 g glucose/L; 0.8 fructose/glucose ratio, CHO ingestion rate = 1.8 g/min) or a flavor-matched, non-nutritive placebo beverage (PLA, $n = 8$). Total, endogenous and exogenous CHO oxidation rates were determined during the last 40 min of exercise by indirect calorimetry and $U-^{13}C$ -glucose. Exogenous CHO oxidation efficiency was the ratio (expressed as %) of exogenous CHO oxidation rate to the CHO ingestion rate. **RESULTS:** Exogenous CHO oxidation rate of volunteers consuming PLA was zero during all trials. For volunteers consuming CHO, exogenous CHO oxidation rate (g/min) during exercise was lower ($P < 0.05$) at acute HA (0.39 ± 0.22) than at SL (0.75 ± 0.16). After altitude acclimatization, oxidation rate (0.62 ± 0.18) was higher ($P < 0.05$) than with acute HA, and not different from SL. Efficiency of CHO oxidation (%) followed the same pattern (SL = 41 > acute HA = 22 < chronic HA = 34), but efficiency did not reach SL values after acclimatization. For those consuming CHO, endogenous CHO oxidation rate at acute HA (1.35 ± 0.48) tended to be but was not significantly higher than at SL (1.05 ± 0.53). After altitude acclimatization, endogenous CHO oxidation rate (0.67 ± 0.45) was lower ($P < .05$) than either SL or acute HA. **CONCLUSION:** Acute hypoxia impairs exogenous CHO oxidation, but adaptations with altitude acclimatization alleviate that impairment, and contribute to a reduction in endogenous CHO oxidation. Supported by U.S. Army Medical Research and Materiel Command; authors' views not official U.S. Army or DoD policy.

1012 Board #191 May 31 2:00 PM - 3:30 PM
Pre-exercise Carbohydrate Ingestion and Transient Hypoglycemia During Exercise: Effects of Fasting vs. Feeding

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Previous studies demonstrated that carbohydrate feeding 30-45 min before exercise results in transient hypoglycemia shortly after onset of exercise in some but not all subjects. However, it remains unclear whether the transient hypoglycemia after pre-exercise carbohydrate intake is more likely to occur under fed or fasted condition. **PURPOSE:** The purpose of this study was thus to directly compare the effects of fasting vs. feeding on plasma glucose kinetics following pre-exercise carbohydrate ingestion and to elucidate the contributing factors of the transient hypoglycemia in each condition. **METHODS:** Sixteen subjects performed 60-min cycle ergometer exercises at 75% VO_{2max} in overnight fasted and fed (3 h after breakfast) states in random order. In both conditions, they consumed 500 ml of a beverage containing 150 g of glucose 30 min before the start of exercise. Plasma glucose and serum insulin levels are determined before and during the exercise. **RESULTS:** In the fasted state, plasma glucose levels dropped transiently below 4.0 mmol/l in 5 subjects, who showed substantially higher serum insulin level at the onset of exercise, while plasma glucose levels remained above this level in the other subjects. On the other hands, 7 subjects developed transient hypoglycemia in the fed state and their VO_{2max} (3285 ± 286.6 L/min) was significantly higher than that in the other subjects who did not demonstrate a decline in plasma glucose (2915 ± 262.7 L/min). **CONCLUSIONS:** Subjects with higher aerobic fitness and enhanced insulin secretory capacity seem to be more prone to transient hypoglycemia following pre-exercise carbohydrate ingestion under fed and fasted conditions, respectively.

1013 Board #192 May 31 2:00 PM - 3:30 PM
Pentraxin 3 And Glucose Responses To Acute High-intensity Interval Exercise Vs. Continuous Moderate-intensity Exercise

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 (No relationships reported)

PURPOSE: Pentraxin 3 (PTX3) is an anti-inflammatory/cardioprotective protein and responds promptly to down-regulate pro-inflammatory mediators. It may potentially play a role in the regulation of glucose metabolism. Therefore, this study investigated the relationship between plasma PTX3 and glucose responses following both acute high intensity-interval exercise (HIIE) and continuous moderate-intensity exercise (CMIE). **METHODS:** Nine healthy males were recruited to participate in HIIE and CMIE on a cycle ergometer. HIIE consisted of 10 repeated 60 second of cycling at 90% max watts (W_{max}) separated by 2 minutes of cycling without resistance, while CMIE was 28 minutes of cycling at 60% W_{max} . Blood samples were collected prior to, during (4 min, 10 min, 16 min, 22 min), immediately post, and 30 and 60 minutes

into recovery following exercise. A linear mixed model for repeated measures was conducted to control for total work output (kilojoules). **RESULTS:** A significant increase in PTX3 across time was found in both acute HIIE and CMIE ($p = 0.030$), whereas no change was observed in glucose response ($p = 0.108$). Although no difference was shown in carbohydrate (CHO) oxidation between both exercise protocols, fat oxidation and total energy expenditure were greater during acute CMIE ($p = 0.001$, $p < 0.001$, respectively). Furthermore, the percent change in PTX3 from baseline to immediately following acute HIIE was negatively correlated with fat oxidation ($r = -0.769$; $p = 0.015$), while the relationship with CHO oxidation approached significance ($r = 0.608$; $p = 0.082$). **CONCLUSION:** Our results indicate that acute HIIE could be a practical model to understand the potential role of PTX3 in the regulation of energy metabolism during exercise.

1014 Board #193 May 31 2:00 PM - 3:30 PM
Effects of Varying Physical Activity Level on Glucose Tolerance Testing

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The oral glucose tolerance test (OGTT) is a commonly used method for the diagnosis of insulin resistance. Currently the only level of control prior to an OGTT is an 8-10 hour fast. Physical activity is known to influence glucose uptake kinetics. Thus, our **PURPOSE** was to determine if varying the level of physical activity, the day prior to an OGTT, influenced the blood glucose and insulin responses to an OGTT. We hypothesized that higher levels of physical activity the day prior to an OGTT would result in attenuated blood glucose and insulin responses to an OGTT. **METHODS:** Ten healthy adults (6 m/4 f; age = 21.5 ± 0.3 y; BMI = 24 ± 5 kg·m⁻²) participated in three OGTT trials the morning after performing 50%, 100%, or 150% of their habitual physical activity in randomized order. Habitual physical activity as average steps/day ($12,318 \pm 1310$ steps·day⁻¹) was determined using 7-day pedometer. Pedometers were worn for 24 hrs prior to each OGTT trial and used to confirm steps·day⁻¹ for the 50%, 100%, and 150% conditions. Trials were separated by at least one week and subjects were asked to follow a similar diet the day prior to each OGTT trial. For each OGTT trial, plasma glucose and insulin were measured after an overnight fast and at 30 min intervals for two hours following ingestion of the glucose beverage (1-gm glucose·kg⁻¹ body mass). Area under the curve (AUC) for glucose and insulin for each OGTT was calculated using the trapezoidal method. Between trial differences for these variables were analyzed using a general linear model with repeated measures. Significance was set to $p < 0.05$. **RESULTS:** Subjects successfully achieved the desired percentage of habitual steps prior to each trial: 52±1%, 98±2%, and 146±3%. Fasting plasma glucose (50%: 95 ± 2 mg·dl⁻¹; 100%: 91 ± 2 mg·dl⁻¹; 150%: 91 ± 2 mg·dl⁻¹); glucose AUC (50%: $12,932 \pm 769$ mg·min·dl⁻¹; 100%: $13,239 \pm 1,008$ mg·min·dl⁻¹; 150%: $13,016 \pm 471$ mg·min·dl⁻¹), and insulin AUC (50%: $5,562 \pm 1810$ μU·min·ml⁻¹; 100%: 5181 ± 1839 μU·min·ml⁻¹; 150%: 4735 ± 1776 μU·min·ml⁻¹) did not differ between trials. **CONCLUSIONS:** Our data suggests that varying the physical activity level (from 50 to 150% of habitual activity) the day prior to an oral glucose tolerance test does not influence the blood glucose or insulin responses to this commonly utilized diagnostic test.

1015 Board #194 May 31 2:00 PM - 3:30 PM
Prior Acute Resistance Exercise Enhances Postprandial Fat Oxidation in Response to a High-Fructose Meal

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 (No relationships reported)

A fructose-rich, mixed-macronutrient meal rapidly increases carbohydrate oxidation and decreases fat oxidation during the post-prandial period. An acute strenuous bout of weight-lifting exercise has been shown to elevate fat oxidation for many hours following cessation of exercise. **Purpose:** To determine whether or not a single resistance exercise bout performed approximately 15 hours before consumption of a high-fructose, mixed-meal could attenuate the meal-induced shift from fat oxidation to CHO oxidation. **Methods:** Seven apparently healthy men who were recreational weight lifters (Mean ± SEM; age = 27 ± 2 years, BMI = 24.2 ± 0.3 kg/m²) completed three separate two-day conditions in a random order: (1) EX-COMP: a full-body superset weightlifting workout (12 different exercises x 4 sets x 10 reps) with the provision of additional kilocalories to compensate for the energy expended during exercise on day 1, followed by the consumption of a high-fructose, mixed-macronutrient test meal (kcal = 600 ± 8 kcal; 0.75 g fructose/kg body weight) the next morning (day 2) and the determination VO_2 , VCO_2 , and respiratory exchange ratio (RER) for determination of fat and carbohydrate oxidation during a six-hour post-prandial period; (2) EX-NoCOMP: same as EX-COMP condition but without energy

intake compensation for the exercise on day 1; and (3) CON: no exercise control. **Results:** Post-prandial RER was significantly lower in the EX-NoCOMP (0.789±0.01) condition compared to CON (0.809±0.01) ($p=0.005$). Fat oxidation was significantly higher in EX-NoCOMP (0.094±0.009 g/min) compared to CON (0.084±0.009 g/min) ($p=0.001$). CHO oxidation was significantly lower in the EX-NoCOMP (0.09±0.012 g/min) compared to CON (0.108±0.011 g/min) ($p=0.037$). For the EX-COMP condition, postprandial RER (0.787±0.009), fat oxidation (0.095±0.008 g/min) and CHO oxidation (0.091±0.011 g/min) were almost identical to EX-NoCOMP, but these values compared to CON did not quite reach statistical significance. **Conclusion:** A single acute bout of high intensity resistance exercise completed 15 hours prior to a high-fructose, mixed-macronutrient meal results in greater post-prandial fat oxidation than does lack of exercise followed by the same meal.

1016 Board #195 May 31 2:00 PM - 3:30 PM
Differential in Aerobic Capacity Among Collegiate Distance Runners Consuming a Low Carbohydrate Diet

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Although current sports nutrition recommendations advocate for a high carbohydrate (CHO) intake among endurance athletes, recent research has suggested that training with low CHO availability may augment adaptations to aerobic training. When adopted during the competitive season, when training intensity and the demand for glycogen replenishment is high, low CHO diets may be detrimental to training adaptations by preventing adequate recovery between concurrent high-intensity endurance sessions. **PURPOSE:** To observe the dietary habits of collegiate distance runners and to investigate the effects of habitual CHO intake on aerobic performance (PostVO_{2max}) during a competitive season. **METHODS:** During an 8-week trial period, 12 collegiate track athletes (males, n=8; females, n=4) recorded their self-selected dietary intake via 24-hr recall. Analysis of CHO intake was conducted by a registered dietitian using NutriCalc software. Pre (PreVO_{2max}) and post season aerobic capacity assessments were performed. A one-way ANCOVA with two covariates controlling for PreVO_{2max} and CHO intake compared the variance in PreVO_{2max} and PostVO_{2max} by sex. **RESULTS:** The average CHO intake was 4.11 ± 1.03 g/kg with only one female athlete meeting dietary recommendations, consuming > 6 g/kg. Male distance runners had a lower CHO intake than females (3.64±0.77g/kg; 5.03±0.91g/kg). After adjusting for PreVO_{2max} and CHO, the male improvement in PostVO_{2max} was 12.62 ml/kg/min (95% CI 2.12-23.12, $p=0.02$) greater than the effect observed in females. There were no differences in weight and body composition changes by sex throughout the season ($p=0.48$; $p=0.86$). CHO accounted for 18% of the variance in PostVO_{2max}. **CONCLUSIONS:** Collegiate distance runners were able to make improvements in their aerobic capacity during a competitive season while consuming a low CHO diet, with a predominant effect in male athletes. Therefore, it may not be detrimental for endurance athletes to consume low CHO diets while undergoing training at high intensities from an aerobic adaptation standpoint.

1017 Board #196 May 31 2:00 PM - 3:30 PM
The Physiological Effects of 12-Weeks of Ketogenic Dieting While Cross-Training

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 (No relationships reported)

PURPOSE: Recent literature has suggested impaired strength and anaerobic performance outcomes with ketogenic dieting. Herein, we sought to determine the metabolic and performance effects of 12 weeks of ketogenic dieting while cross-training in cross-trained individuals. **METHODS:** Volunteers were divided into a control group (CTL; n=9) and a ketogenic group (KD; n=9). Pre and post-testing involved body composition assessment via dual x-ray absorptiometry (DEXA), vastus lateralis (VL) thickness using ultrasound, resting energy expenditure (REE), phlebotomy to determine serum health biomarkers, an aerobic capacity evaluation, one repetition maximum (1RM) testing, and 400-m sprint time assessments. All subjects were instructed to follow a cross-training routine for 12 weeks. The KD group was given dietary guidelines to follow for 12 weeks, while the CTL group continued their normal diet. Blood ketone bodies were measured weekly to ensure nutritional ketosis was reached by the KD but not CTL. **RESULTS:** KD blood ketone levels were significantly higher than the CTL at each week following intervention ($p<0.05$) except week 9 ($p=0.09$). DEXA fat mass declined in the KD (-3.47 ± 1.06 kg) compared to CTL (-0.06 ± 0.45 kg) ($p<0.01$).

DEXA lean mass and visceral fat mass changes were not different between groups ($p=0.99$ and $p=0.23$, respectively). At rest, respiratory quotient delta scores were not different between CTL (-0.012 ± 0.027) and KD (-0.067 ± 0.020) ($p=0.19$). REE was not altered between groups ($p=0.24$). No between-group differences in delta scores were observed for fasting glucose ($p=0.31$), HDL-C ($p=0.49$) or triglycerides ($p=0.19$), although LDL-C trended with increases in the KD (+33.8 ± 14.3 mg/dL) but not CTL group (+0.2 ± 8.0 mg/dL) ($p=0.052$). Neither VL nor total mid-thigh thickness delta scores were different between groups ($p=0.46$ and $p=0.14$, respectively). There were no between-group differences in delta scores for 1RM Squat ($p=0.15$), 1RM overhead press ($p=0.37$), 400-m sprint times ($p=0.90$) or VO_{2max} ($p=0.57$). **CONCLUSIONS:** Ketogenic dieting improves body composition without negatively impacting muscle mass and/or aerobic, anaerobic or strength performance in recreational cross-trained subjects.

1018 Board #197 May 31 2:00 PM - 3:30 PM
7,12-dimethylbenz(a)-anthracene (DMBA) & High Fat High Sugar Diet Decrease Physical Activity in Female Mice

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BACKGROUND: Regular exercise has been shown to diminish the risk of certain cancers. DMBA, (7, 12-dimethylbenz(a)-anthracene) is a complete carcinogen that is used to induce tumors in mice. It has yet to be established whether DMBA has an effect on voluntary wheel running (WR) in mice, and whether these effects may be exacerbated via consumption of a high fat high sugar (HFHS) diet. **PURPOSE:** Determine if DMBA treatment altered voluntary WR in female SENCAR mice, and whether a HFHS diet exacerbated treatment effects on voluntary WR. **METHODS:** Offspring of SENCAR breeder pairs were weaned at 3 weeks (wks) of age onto either an ad lib fed HFHS (20% protein, 45% fat/24% sucrose + 10% fructose water) or a diet restricted (DR) (12% kcal restriction, 20% protein, 10% fat, 57% cornstarch) diet. Animals were double-housed and randomly assigned to either a DMBA (n=40) treatment with HFHS (n=20) and DR (n=20) diets; or a control (CNTL) (n=18) treatment with HFHS (n=10) and DR (n=8) diets. At 4 wks of age, two plastic running wheels were mounted inside standard rat cages, and connected to a computer to record WR duration and distance. At 7-9 wks of age, mice were gavaged with DMBA dissolved in corn oil (20 µg/mouse/day) or with corn oil vehicle only (CNTL) for 5 days/wk for 6 weeks. A two-way ANOVA was employed to determine the effect of DMBA on activity with factors of treatment and diet for wks 9-20. **RESULTS:** Compared to CNTL, DMBA significantly decreased distance (7.41 ± 0.45 vs. 11.08 ± 0.68 km/day; $p=0.0002$), and duration (175.19 ± 8.24 vs. 261.23 ± 12.36 min; $p<0.0001$). No significant difference in speed was noted (40.31 ± 1.37 vs. 40.34 ± 2.05 m/min; $p=0.77$). HFHS diet compared to DR diet significantly decreased distance (5.84 ± 0.60 vs. 11.08 ± 0.55 km/day; $p<0.0001$), duration (168.41 ± 10.9 vs. 233.14 ± 10.1 min; $p<0.0001$), and speed (33.04 ± 1.81 vs. 47.12 ± 1.67 m/min; $p<0.0001$). No significant interactions were observed between treatment and diet groups. **CONCLUSIONS:** DMBA and HFHS diet decrease WR distance and duration, while only the HFHS diet decreased WR speed. Although DMBA and HFHS independently decreased WR, a lack of interaction suggest that they are not additive or synergistic. **ACKNOWLEDGMENTS:** Project was funded by the US Army through the Department of Defense projects W81XWH-13-1-0278 (Fuchs-Young) and W81XWH-13-1-0279 (Lightfoot).

B-68 Free Communication/Poster - Cardiovascular

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1019 Board #198 May 31 2:00 PM - 3:30 PM
Lower-body Compression On Leg Vessel Morphology And Systemic Hemodynamic Responses In Healthy Participants

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The efficacy of compression garment (CG) application in exercise performance and recovery remains controversial, as limited information exists on the physiological mechanisms of CG action, specifically its effect on vessel morphological and systemic hemodynamic responses.

PURPOSE: To investigate the effect of thigh-length compression tights (CG) on leg vessel morphological and systemic hemodynamic responses in healthy participants.

METHODS: Leg vessel caliber in thirty-two participants (16 males and 16 females) was measured, using 0.25T MRI, at four leg positions; calf, knee, lower-thigh and mid-thigh, in both a supine and upright position. Exerted pressure (EP) from three CGs (Low: G1; Medium: G2; High: G3) were measured at the four leg positions on the right leg during standing. Systemic hemodynamic variables including cardiac output (CO), stroke volume (SV), heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DPB) and systemic vascular resistance (SVR) were monitored using non-invasive Doppler ultrasound, in a supine and upright position.

RESULTS: The average EP from G1, G2 and G3 were 2.2 ± 1.3 , 12.2 ± 3.7 and 26.7 ± 8.1 mmHg, respectively. The EP at the calf was higher than in the other leg positions ($P < 0.001$). CO, SV, HR, DBP and SVR were lower in the upright than supine position ($P < 0.001$). Wearing G3 elicited higher CO than wearing G2 ($P < 0.005$) but not G1 ($P > 0.05$). SV was higher in G3 compared to G1 and G2 ($P < 0.05$). Deep vein and great saphenous vein (GSV) calibers were larger at all leg positions in the upright than supine position ($P < 0.001$). Furthermore, G3 elicited smaller superficial vessels caliber than G1 and G2, but the largest deep vessels caliber at calf level ($P < 0.001$) only. The G3 also elicited the smallest GSV caliber followed by G2 and G1 respectively, at knee level ($P < 0.001$). The G1 elicited the largest but similar GSV caliber, among G2 and G3, at lower-thigh and mid-thigh level ($P < 0.005$).

CONCLUSIONS: Leg vessel morphological and systemic hemodynamic responses to compression garment application were greatest in compression garments with a higher exerted pressure and were most pronounced at the calf level.

1020 Board #199 May 31 2:00 PM - 3:30 PM
Cardiovascular Strain Associated With Spinning Practice In Women

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Spinning (SP) is a very popular indoor stationary cycling advertised as an efficient exercise to foster cardiovascular fitness and weight loss. However, its absolute and relative cardiovascular intensity has been poorly described.

PURPOSE: To evaluate the cardiovascular strain during regular SP classes performed by women.

METHODS: We evaluated 23 women (36.9 ± 11.3 yrs; BMI 24.0 ± 4.1 kg/m²), from 5 fitness centers randomly selected in Brasília-Brazil. Cardiovascular strain was evaluated by the absolute and relative time spent in different effort intensities and by the heart rate (HR) in different moments during SP classes. HR was registered with a RS800 Polar monitor. Each volunteer was monitored in 3 classes to obtain the mean HR of each moment. Effort intensity was classified in 4 HR zones based on percentage of predicted Maximal HR (MHR=220-age): very heavy ($\geq 94\%$); heavy (77-93%); moderate (64-76%) and light (<64%). HR was analyzed in 4 moments: initial (in) (5min average-HRin), highest HR (HRpk), class ending (5min average-HRe1) and after cool down (HRe2). Data was non-normal (Shapiro-Wilk) and presented as median (min-max) values. HR comparisons used Friedman/Dunns post-hoc test at 5% level of significance.

RESULTS: HRpk 167 (127-186)bpm was greater than HRin: 90 (60-122)bpm, HRe1: 135 (111-150)bpm and HRe2: 113 (89-137)bpm ($p < 0.05$). The HRe1 was greater than HRin ($p < 0.05$), but similar to HRe2, which was similar to HRin ($p > 0.05$). Absolute

and relative increase of HR to HRpk was 74 (34-111)bpm, 80.9 (36.6-185.0)%, respectively. The HRe1 reduced 26 (13-57)bpm or 19 (11.4 - 44.2)% from HRpk. HRe2 was similar to HRin ($p > 0.05$). Absolute and relative time in each HR zone are shown in Table_1.

HR Zone	Absolute (min:sec)		Relative (%)	
	Median	Extremes	Median	Extremes
Light	7:06	2:05 - 19:07	15.3	5.0 - 43.1
Moderate	11:00	3:08 - 37:36	23.6	6.4 - 64.2
Heavy	25:00	8:00 - 35:00	50.2	1.5 - 79.3
Very heavy	0:02	0:00 - 13:08	0.1	0.0 - 27.5

CONCLUSIONS: We observed high cardiovascular strain. SP classes were performed usually on heavy or very heavy intensity (50.3%), which deserves safety considerations. The cool down period was effective in reestablishing HR to its initial pattern since HRin and HRe2 were similar.

1021 Board #200 May 31 2:00 PM - 3:30 PM
Cardiorespiratory Responses to a 20-minute Shallow Water Tabata Style Workout: A Gender Comparison

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PURPOSE: To compare physiological responses to a 20-min high intensity, Tabata-style shallow water exercise workout (TS-SWE) between healthy males (M, n=9, 24±1 y) and females (F, n=9, 26±6 y). **METHODS:** Participants first performed an incremental SWE test to exhaustion while metabolic (indirect calorimetry), heart rate (HR, telemetry) and blood lactate (Bla) responses were monitored. On a second visit, metabolic, HR, rating of perceived exertion (RPE, Borg scale 6-20), and Bla were measured while participants performed TS-SWE. TS-SWE consisted of 4, 4-min bouts with each bout alternating between 20s "all-out" exercise followed by 10s rest. Each bout was separated by 1 min rest (total of 32 "all-out" 20s efforts). For both visits, participants were immersed to axillary level at a water temp. of 83 F. **RESULTS:** M had a greater peak VO₂ and Bla (3.6 ± 0.4 vs 2.7 ± 0.3 l·min⁻¹; 10.9 ± 1.3 vs 8.1 ± 1.7 millimolar (mM); $p < 0.05$) while peak HR was similar (185 ± 7 (M) vs 181 ± 7 bpm (F) ($p > 0.05$)). For the overall TS-SWE workout, %VO₂ peak for M and F was 72.9 ± 4.7 and 72.4 ± 6.5 , respectively, while %HR peak was 83.9 ± 4.9 (M) and 86.3 ± 2.2 (F), ($P > 0.05$). RPE for the overall workout was ~18-19 (very, very hard) for both M and F. %VO₂ peak for M and F was similar for each bout and increased from ~70% (Bout 1), 74% (Bout 2), to 77% (Bout 3) with the greatest metabolic load achieved during Bout 4 (~85%) ($P < 0.05$, main effect bout). %HR peak was also similar between M and F for each bout: ~82% (Bout 1), 85% (Bout 2), 88% (Bout 3) and ~94% for Bout 4 ($P < 0.05$, main effect bout). Bla (mM) was similar between M and F for bout 1 (6.3 ± 1.8 vs 5.2 ± 1.6 , respectively ($p > 0.05$)), however, males accumulated a greater Bla in bouts 2 (9.0 ± 2.0 vs 6.0 ± 1.0), 3 (9.3 ± 2.3 vs 5.9 ± 0.9) and 4 (11.1 ± 2.2 vs 9.2 ± 1.7) ($P < 0.05$). **CONCLUSION:** TS-SWE elicited cardiometabolic and psychophysical responses for both males and females that are classified as vigorous to near-maximal to maximal intensity according to the American College of Sports Medicine. Furthermore, the presence of a cardiometabolic "end-spurt", as reflected in a substantially greater %VO₂, %HR peak, and blood lactate response during bout 4, suggests that a pacing strategy may have been employed despite a-priori instructions to exercise "all-out" throughout the workout.

1022 Board #201 May 31 2:00 PM - 3:30 PM
Long-term Effects Of Exercise On Cardiovascular Disease Risk Profile Following Weight Loss In Overweight Women

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(No relationships reported)

Despite the widely recognized benefits of weight loss, minimal research has examined the longitudinal effects of exercise training on cardiovascular disease (CVD) risk factors after weight loss. **PURPOSE:** To evaluate the long-term influence of exercise training on CVD risk factors after weight loss in previously overweight women.

METHODS: A randomized weight loss trial was conducted in 64 premenopausal women (BMI 28.3 ± 1.2 kg/m²; age 33.7 ± 6.4 yrs). Participants were assigned to either aerobic training (AT: continuous treadmill exercise at 67-80% of maximum heart rate), resistance training (RT: 10 total body exercises at 65-80% of 1-RM), or control (C: no exercise). All groups consumed a standardized diet until achieving

BMI <25kg/m². Exercise groups trained 3x/wk during the weight loss period and were encouraged to exercise 2x/wk for one yr following the initial weight loss. Body weight, % body fat, abdominal fat, resting blood pressure (BP), insulin sensitivity, total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, and triglycerides (TG) were measured. Two-way repeated measures ANOVA was used to analyze dependent variables at baseline, post-intervention, 1 yr post intervention, and 3 yrs post intervention. Post hoc paired sample t-tests were used to examine changes from baseline to 3 yrs post intervention. Significance was accepted at $p \leq 0.05$. **RESULTS:** Mean weight loss for all subjects was 11.92 kg. Significant group x time interactions were found for body weight, % body fat, systolic BP, TG, HDL, and TC:HDL ratio, with no significant interactions for any other variable. Three yrs after weight loss, body weight (74.9.4±5.7 to 71.1±9.6 kg), body fat (39.7±3.9 to 35.9±6.2%), systolic BP (120.0±13.0 to 111.4±8.0 mmHg), HDL (42.0±13.4 to 55.1±11.9 mg/dL), and TC:HDL ratio (4.2±1.6 to 3.3±1.2 mg/dL) were significantly improved from baseline in AT. TG (87.5±32.2 to 74.3±27.0 mg/dL), HDL (41.2±8.9 to 49.4±13.4 mg/dL), and TC:HDL ratio (3.9±0.8 to 3.5±0.8 mg/dL) significantly improved from baseline in RT. C had no differences. **CONCLUSIONS:** Three yrs after initial weight loss, several CVD risk factors were more favorable in women who exercise trained compared to non-exercisers. Further longitudinal research examining the effects of exercise on the maintenance of improved CVD risk factors is warranted.

1023 Board #202 May 31 2:00 PM - 3:30 PM
Cardiovascular Risk Profiles Of World Masters Games Participants

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 (No relationships reported)

Increasing evidence indicates adherence to exercise throughout life is concurrent with improved health. World masters games (WMG) have more participants than any other international sporting competition and is under investigated, particularly with regard to indices of cardiovascular disease (CVD) risk. **Purpose:** This study investigated selected CVD risk factors in WMG participants. **Methods:** This was a cross-sectional, observational study which utilized a web-based questionnaire to survey cardiovascular risk factors of WMG participants. The survey consisted of three sections: basic demographics, medical history and physiological parameters which included body mass index (BMI), waist circumference (WC), resting blood pressure (BP) and lipids (total cholesterol (TC), high density lipoprotein (HDL) and low density lipoprotein (LDL)). **Results:** A total of 1,435 participants (567 female & 868 male), aged 27-91 years participated in the study. Key findings included significant differences between genders where females were significantly lower in BMI (5.3%, $p < 0.001$), WC (10.6%, $p < 0.01$), resting SBP (5.8%, $p < 0.01$), resting DBP (8.4%, $p < 0.01$), significantly higher in HDLs (15.2%, $p < 0.001$) and significantly lower in both the TC:HDL ratio (12.6%, $p < 0.001$) and LDL:HDL ratio (19.0%, $p < 0.001$). Significant differences ($p < 0.001$) were also identified when comparing WMG lipid results to the Australian general population (AGP). WMG demonstrated healthier TC (4.47±1.11 mmol/L), HDLs (1.75±0.79 mmol/L), and LDLs (2.92±0.96 mmol/L) when compared to AGP parameters (TC: 5.07 mmol/L, HDL: 1.34 mmol/L, LDL: 3.13 mmol/L). **Conclusions:** WMG participants demonstrated improved values in a number of CVD risk factors when compared to the general population with female WMG participants presenting healthier CVD risk factors when compared to males. Hence, within the parameters of this study, masters athletes exhibit evidence of superior health when compared to the general population within Australia.

1024 Board #203 May 31 2:00 PM - 3:30 PM
Progressive, High Intensity Endurance Exercise Training Significantly Increases Maximal Cardiac Power Output In Middle Aged, Previously Sedentary Adults

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 (No relationships reported)

High intensity, endurance exercise increases maximal cardiac power output (CPO) in young, healthy adults. It is less clear whether such gains are realized among sedentary adults who begin such a program during middle-age. **PURPOSE:** To determine whether a progressive, high-intensity endurance exercise program will increase CPO in healthy, middle-aged adults. **METHODS:** We studied 51 middle-aged adults (22 males; 52.7 ± 5.1 yrs). 23 (10 males) were randomized to a non-aerobic exercise group (Control). The remaining 28 (12 males) were assigned to an endurance training group (Exercise), all of whom completed a 24 month exercise training program. This progressive regimen was gradually expanded from 3*30min moderate intensity

sess./wk to 1-2*30 min and 1*60 min moderate intensity (55-70% of VO_{2max}) sess./wk + 2 high intensity aerobic interval (>95%peakHR) sess./wk; and 1 low intensity recovery sess./wk. After nine months, the exercise participants plateaued their training to one high intensity interval sess./wk. Endurance training sessions were monitored via both Polar heart rate monitoring and manual data logs. VO_{2max} was measured using the Douglas Bag method via an incremental treadmill protocol. Cardiac output (Qc) was measured by a non-invasive acetylene rebreathing method. Blood pressure was measured by SunTech Tango+ electrophygmomanometry. Mean arterial pressure (MAP) was calculated by MAP=(SBP-DBP)/3+DBP, where DBP is diastolic blood pressure and SBP the systolic blood pressure. CPO was calculated as follows: CPO(W)=MAP*Qc*K, where K is the conversion factor (2.22*10⁻³) to watts. **RESULTS:** Endurance training increased VO_{2max} 19.5% (28.8 to 34.4ml/kg/min) and maximal Qc 14.2% (14.5 to 16.6L/min) among the Exercising group, while MAP remained constant (114 to 114mmHg), resulting in a 18.1% increase in CPO_{max} (3.68 to 4.28W, $p < 0.01$). VO_{2max} (29.5 to 28.7ml/kg/min), Qc_{max} (14.8 to 15.2L/min), MAP (114 to 113mmHg) and CPO_{max} (3.80 to 3.84W) were all unchanged in the control group. **CONCLUSION:** Healthy, previously sedentary middle-aged adults who complete a progressive endurance exercise training program realize a significant increase in CPO during maximal exercise.

1025 Board #204 May 31 2:00 PM - 3:30 PM
Head-down Tilt High Aerobic Intensity Training Effect On Vo2max And Stroke Volume Adaptations

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The majority of evidence points to the stroke volume (SV) of the heart being the major limiting factor for maximal oxygen uptake (VO_{2max}) in healthy humans. High-intensity aerobic interval training has previously been found to improve VO_{2max} more than low and moderate intensity aerobic training when matched for total work. Haemodynamics are affected by venous return and positioning of the working muscles in relation to the heart. **PURPOSE:** It is the aim of the present study to investigate the effects of interval training with the legs placed above the heart. **METHODS:** A total of 28 young, healthy, untrained males were randomly assigned cycle training of 4x4 min intervals at 90 - 95% of HR_{max} with their legs higher than the level of the heart (STG) or on a conventional upright cycle (UTG) for 24 sessions over 6 weeks. VO_{2max}, maximal SV (SV_{max}), submaximal heart rate (HR_{100w}), and maximal power output (MPO) were examined before and after the training period. **RESULTS:** No significant difference was apparent between the groups in VO_{2max} improvement for from pre- to posttest when tested in either postural position. Both groups increased absolute VO_{2max} (L*min⁻¹) significantly, by 15.3% in UTG and 16.5% in STG ($P < 0.01$) in upright cycling, and 9.4% (UTG) and 15.9% (STG) in supine cycling ($P < 0.01$). These adaptations were accompanied by increased SV of 8.9% and 10.6% for UTG and STG, respectively ($P < 0.05$), and reduced submaximal HR ($P < 0.01$). **CONCLUSIONS:** High-intensity aerobic interval training performed in a 4x4 min fashion in either the upright or supine position does not lead to different adaptations in VO_{2max}. However, high-intensity interval training four times per week is an effective means to improve VO_{2max} in young, untrained males. Also, since the improvement in SV did not differ between groups this is further testament to the heart being an important modulating factor for VO_{2max} improvements.

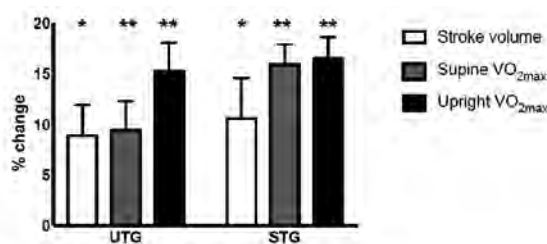


Figure 1. Percentage change in VO_{2max} (L*min⁻¹) and stroke volume (mL*beat⁻¹) from pre- to posttest for upright (UTG) and supine training group (STG). Values presented are means ± SE. Significantly different from pre- to posttraining within groups: * $P < 0.05$, ** $P < 0.01$.

1026 Board #205 May 31 2:00 PM - 3:30 PM

Relationship Between Maximal Oxygen Uptake And Field Endurance Tests By Aerobic Fitness Level In Korean

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(No relationships reported)

PURPOSE: To determine the relationships between maximal oxygen uptake (VO_{2max}), 1,500 meter run (1500-R), and the 20-m multistage shuttle run (MS-R) according to aerobic fitness level in Korean young men.

METHODS: Ninety nine young men (19.5±0.9 yrs; 175.6±5.6 cm; 67.8±8.8 kg; 22.0±2.4 kg/m²; 16±4.9 %fat) participated in three randomly ordered testings. In one occasion, they ran on a treadmill with an incremental work load to determine their VO_{2max} . In other occasions, they ran on a track for 1500-R time trial and performed MS-R, twice for each test. They were categorized according to ACSM guidelines based on the VO_{2max} (in ml·kg⁻¹·min⁻¹), into four fitness groups; average (A; 41.5-44.9, n=18), good (G; 45.0-49.9, n=21), very good (VG; 50.0-54.9, n=30), and excellent (E; 54.9<, n=30). The better score of two trials of 1500-R and MS-R was taken for the analyses.

RESULTS: The average VO_{2max} was 42.8±1.6, 47.2±1.5, 51.9±1.3, and 59.4±3.1 ml·kg⁻¹·min⁻¹ in A, G, VG, and E, respectively. The best record of 1500-R was 429±44, 416±66, 387±45, and 380±31 sec and that of MS-R was 65±16, 71±18, 76±21, and 82±19 repetitions in A, G, AG, and E, respectively. When the record were compared by groups, it was only different between A and E in both 1500-R (ANOVA, p<0.005) and MS-R (ANOVA, p<0.05). The Pearson Correlation Coefficients were only significant between 1500-R and MS-R in all groups (-0.676 in A, -0.779 in G, -0.671 in VG, and -0.461 in E; p<0.01) while no significance was noticed between VO_{2max} and two field tests.

CONCLUSION: Records of both 1500-R and MS-R appear to increase progressively by fitness level, but the outcome of field endurance tests only differentiate the maximal aerobic capacity between the average and the excellent aerobic capacity groups. Two field tests were highly correlated with each other, but not with VO_{2max} in all fitness levels.

1027 Board #206 May 31 2:00 PM - 3:30 PM

Association of Cardiovascular Fitness and Metabolic Syndrome in Male First Responders

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(No relationships reported)

Recent studies have concluded that the incidence of Metabolic Syndrome may be greater in male firefighters than in the US male population. However, research exploring this relationship is still lacking in male first responders (firefighters and police officers). Previous research has suggested that the prevalence of coronary artery disease (CAD) in police officers may be higher than in the general population.

Purpose: To determine the association of metabolic syndrome and cardiovascular fitness in male first responders. **Methods:** As part of an annual physical exam, 405 male first responders (average age 36 ± 9 yr) underwent evaluation of risk factors associated with metabolic syndrome as defined by NCEP III. These include the presence of three or more of the following: Waist Circumference > 40", HDL Cholesterol < 40 mg/dL, Triglycerides > 150 mg/dL, Blood Glucose > 110 mg/dL, and Resting Blood Pressure > 130/85 mm Hg. Cardiovascular fitness was determined by estimating VO_{2max} from time on treadmill during a Bruce protocol. **Results:** The subjects were ranked and divided into quartiles based on VO_{2max} . All data were analyzed using a Chi Square test (p < 0.05). Prevalence of metabolic syndrome increased across quartiles as cardiovascular fitness declined. **Conclusion:** These data suggest that as cardiovascular fitness improves, the likelihood of male first responders having metabolic syndrome decreases.

1028 Board #207 May 31 2:00 PM - 3:30 PM

Relationships Among Aerobic Capacity, Cardiovascular Fatigue Thresholds, And 1.5 Mile Run Times In ROTC Cadets

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(No relationships reported)

PURPOSE: To examine relationships among peak oxygen uptake (VO_{2peak}), the gas exchange threshold (GET), respiratory compensation point (RCP), and 1.5 mile run times during the Air Force physical fitness test (PFT) in Air Force ROTC cadets.

METHODS: Twelve male Air Force ROTC cadets (mean ± SD: age = 20 ± 1 yr; height = 178 ± 5 cm; mass 78 ± 9 kg) performed an incremental treadmill test to exhaustion to determine GET (ml/kg/min), RCP (ml/kg/min), and VO_{2peak} (ml/kg/min). The GET was determined as the VO_2 value corresponding to the intersection of two linear regression lines using the data points below and above the breakpoint in the carbon dioxide produced (VCO_2) vs VO_2 relationship. The RCP was determined as the VO_2 corresponding to the point of departure from linearity of the VE vs VCO_2 relationship. The 1.5 mile run times were collected during participants' ROTC physical fitness test. Relationships among the dependent variables were analyzed with Pearson correlation coefficients. Stepwise, multiple regression was used to determine the relative contributions of VO_{2peak} , GET, RCP, age, and BMI to 1.5 mile run time.

RESULTS: The means ± SDs for each variable, as well as the results of the Pearson correlation coefficients are shown in Table 1. The multiple regression analysis indicated that GET, RCP, and age contributed significantly to the prediction of 1.5 mile run time (Standardized regression coefficients = GET [-0.86], RCP = [-0.60], and age [-0.43]). **CONCLUSION:** There were significant relationships among peak aerobic capacity, cardiovascular fatigue thresholds, and 1.5 mile run time. However, these data suggest that improving cardiovascular fatigue thresholds may be especially important for improving 1.5 mile run performance. In addition, the contribution of age to the prediction of 1.5 mile run time may suggest that an increased exposure to ROTC training programs (i.e., older participants have a higher class standing) is beneficial to 1.5 mile run time performance.

Table 1. The means ± SDs for physical fitness test (PFT) 1.5 mile run time, peak oxygen uptake (VO_{2peak}), gas exchange threshold (GET), respiratory compensation point (RCP), & BMI. Pearson's r value reported from each variable to PFT 1.5 mile run time.

	Mean ± SD	Correlations				
		PFD Run Time	VO_{2peak}	GET (ml/kg/min)	RCP (ml/kg/min)	BMI
PFD Run Time	10:49 ± 0.056	1				
VO_{2peak}	59.60 ± 8.03	-0.699*	1			
GET (ml/kg/min)	47.80 ± 9.44	-0.769*	0.876*	1		
RCP (ml/kg/min)	63.30 ± 14.89	-0.626*	0.735*	0.506	1	
BMI	24.76 ± 2.33	0.154	-0.980	-0.164	-0.060	1

* = significant relationship (p < 0.05)

1029 Board #208 May 31 2:00 PM - 3:30 PM

Heart Rate Variability of College-level Athletes Exposed to Different Fatigue Protocols

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(No relationships reported)

Nowadays, sports scientists have explored various methods to predict and to assess physiological performance to pursue better athletic outcomes. The use of Heart Rate Variability (HRV) to evaluate the Autonomic Nervous System (ANS) seems to be a reliable indicator to measure athletes' physical adaptation to conditioning programs. The understanding of the behavior of the ANS plays a major role in identifying interaction between the parasympathetic and sympathetic activities during physiological stress and exercise adaptation. However, it is unknown whether or not HRV can assess the response of the ANS to different fatigue protocols. In this study, the non-linear Poincaré method was used to measure the self-similarity of consecutive R-R intervals to quantify the HRV at fatigue exposure.

PURPOSE: To examine the effects of four exercise-based fatigue protocols on the HRV.

METHODS: Ten healthy college-level handball athletes volunteered in this study (mean ± SD age: 21.10 ± 1.72 y/o, body mass: 81.10 ± 16.75 kg, body height: 173 ± 4.76 cm, and VO_{2max} : 47.80 ± 6.42 mL/kg/min). Participants completed a consent form approved by an Institutional Research Board. A cross-over design was followed to expose athletes to four fatigue protocols based on isotonic and sustained maximal isometric contractions, maximal anaerobic and incremental aerobic protocols in a cycloergometer. The SD1 Poincaré index was assessed immediately before fatigue (BF), after fatigue (AF), and during a 5-min recovery period (R). Differences were evaluated by a one-way ANOVA. The significance level was set at 5%.

RESULTS: The isotonic and isometric fatigue protocols showed similar results, significant differences were found between the SD1 values of BF and AF ($p < 0.01$). Also, the difference between SD1 values of AF and R was significant for both fatigue protocols ($p < 0.05$). Anaerobic and aerobic fatigue protocols depicted a significant difference between the SD1 mean values of BF and AF, and BF and R ($p < 0.05$). **CONCLUSIONS:** Findings demonstrated that the effects of fatigue on the HRV could be assessed by the non-linear Pointcaré SD1 feature. Additionally, it seems that the behavior of HRV depends on the fatigue protocol used. Therefore, the non-linear HRV analysis could be a promising method to assess different types of fatigues present in sports.

1030 Board #209 May 31 2:00 PM - 3:30 PM
Cardiovascular and Metabolic Responses of High Intensity Sprint Protocols on an Elliptical Cross Trainer
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Sprint interval training protocols have been shown to significantly improve aerobic capacity and select markers of health in both healthy individuals and in diseased patients, and in some cases, have been shown to be superior to traditional aerobic training. **PURPOSE:** The purpose of the current study was to investigate the metabolic and cardiovascular effect of 3 sprint interval training protocols using an elliptical cross trainer. **METHODS:** Twelve healthy (Male = 6, Female = 6; Weight = 70.52 ± 13.47kg; Height = 1.71 ± 0.11m) college-aged participants (ages 19 - 28 years) volunteered. After giving written consent, each participant performed an individualized maximal aerobic capacity test on a cycle ergometer for the determination of $\dot{V}O_2$ max (40.53 ± 5.94 ml/kg/min). Each participant then performed 3 different high-intensity interval protocols in a randomized fashion: ten 30/30 sec, 30/60 sec or 30/90 sec work-to-rest ratio bouts for a total of 10, 15 or 20 min. Oxygen consumption and heart rate were continuously collected and monitored during each training protocol. A one way repeated measures ANOVA (SPSS v22; $p < 0.05$) with post-hoc Bonferroni adjustment was used to examine differences between protocols. **RESULTS:** $\dot{V}O_2$ (mean of 15-sec averages) (30.1 ± 4.6, 29.5 ± 4.0, 28.2 ± 2.6 ml/kg/min), RER (1.0 ± 0.06, 0.95 ± 0.09, 0.98 ± 0.05) and average peak heart rate (177 ± 13, 176 ± 11, 171 ± 16) illustrated no statistical significance across the 30/30 sec, 30/60 sec and 30/90 sec protocols, respectively ($p > 0.05$). Total caloric expenditure was, however, significantly higher in the 30/60 (240.44 ± 34.30 kcal) and 30/90 (277.22 ± 57.78 kcal) protocols as compared to the 30/30 (182.64 ± 25.35 kcal) protocol ($F = 13.97, p < 0.01$). **CONCLUSION:** Under such work-to-rest ratios, varying rest duration between 30 and 90 seconds had limited impact on metabolic responses during repeated 30-sec high-intensity exercise bouts. These data suggest that a 30/60 sec or 30/90 sec approach may be advocated as a preferred strategy for producing higher caloric expenditure in a college-aged population. Future studies examining the minimum duration and frequency of HIIT bouts are warranted if HIIT is to be used as an alternative to current physical activity recommendations.

1031 Board #210 May 31 2:00 PM - 3:30 PM
The Effect Of Temperature And Experience On Acute Musculoskeletal And Cardiovascular Responses During Yoga.
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 (No relationships reported)

Purpose: The aim of this study was to compare the acute musculoskeletal and cardiovascular responses to a series of Hatha yoga postures performed at room temperature and in a hot environment by novice (N) and experienced (E) yoga practitioners. **Methods:** 20 N (35.2±9.1 years, 65% female) and 21 E (39.9±8.2 years, 81% female) yoga subjects were recruited. Subjects completed 2- 60 minute yoga sessions within 7-10 days. One session was RT (78°F 44% humidity) and one session was HY (99°F 55% humidity). Each session consisted of 23 yoga postures and 2 breathing exercises divided into a standing series and a floor series. Pre and post musculoskeletal (low back flexibility, shoulder mobility) and cardiovascular (heart rate, blood pressure) measures were conducted at each session. Rating of perceived exertion (RPE) was assessed during the standing and floor series. A two-way mixed methods ANOVA was used to examine the effect of temperature and experience level. Planned comparisons were conducted for significant main effects of temperature and experience. **Results:** The interaction between temperature and experience was non-significant for all measures ($p > 0.150$). There was a significant main effect of temperature for all variables ($p \leq 0.008$) except systolic BP. The main effect of experience was significant only for diastolic blood pressure (DBP) ($p < 0.037$). Regardless of experience level,

hot yoga resulted in higher RPE during both the standing (HY =13.5; RT=12.2) and floor series (HY=12.9; RT=11.6) ($p=0.001$). HR was significantly greater during the hot yoga class (max HR=145.6, average HR= 107.3) as compared to room temperature (max HR =134.4, average HR=97.7) ($p \leq 0.005$). There was a significantly greater decrease in DBP during hot yoga (9.9mmHg) as compared to RT (4.9mmHg) ($p=0.019$) and in N (9.9 mmHg) as compared to E (5.2 mm Hg) subjects ($p=0.037$). Musculoskeletal parameters showed significantly greater improvements in left shoulder mobility ($p=0.002$) and low back flexibility ($p=0.008$) after HY (4.3 cm; 2.2 cm, respectively) as compared to RT yoga (2.9 cm; 0.03 cm, respectively). **Conclusion:** The findings of this study demonstrate acute effects of yoga are greater when yoga is performed in a hot environment as compared to room temperature. Furthermore, these benefits are not dependent upon the experience level with yoga.

1032 Board #211 May 31 2:00 PM - 3:30 PM
Improved Muscular Strength Did Not Improve Resting Cardiac Vagal Activity In Young Healthy Men
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 (No relationships reported)

Purpose: The benefits of resistance training (RT) on cardiac function are well acknowledged but usually no effects of moderate load of RT on resting cardiac vagal modulation have been found in healthy subjects. Therefore, the aim of this study was to investigate the effects of more intensive RT period and consequent tapering period on nocturnal heart rate variability (HRV). **Methods:** Young, recreationally trained, healthy men (n = 15, age 24 ± 2 yrs, height 176 ± 6 cm, body mass 81 ± 15 kg, body fat 18 ± 5 %) performed a two-week intensive RT period (ITP) with five hypertrophic whole-body exercise sessions per week and a two-week tapering period (TAP) with two exercise sessions per week. Lower-body strength tests were performed before and after ITP and after TAP. Nocturnal RR-intervals were measured during three consequent nights before and at the end of both training periods. A mean of all three nights were used in the analysis. **Results:** Subjects were retrospectively divided to responders (Resp) and non-responders (Nonresp) according to the responses in strength tests in ITP. 1RM leg press (90°) in Resp improved 16,9 % ($P < 0.01$) after ITP when compared to baseline (296 ± 59 kg) with no further change after TAP. 1RM in Nonresp did not change after ITP (-5,3 %, ns.) or TAP when compared to the baseline (361 ± 90 kg). The root mean square of successive differences (RMSSD) in Resp decreased 14,1 % ($p < 0.05$) after ITP when compared to baseline (52 ± 21 ms²) with no further change after TAP. RMSSD in Nonresp did not change significantly either after ITP or TAP when compared to baseline (43 ± 7 ms²). **Conclusion:** An intensive two-week RT period improved performance and decreased nocturnal HRV in Resp but not in Nonresp. As previously reported in intensive endurance training, also the present increased RT load could be detected in resting HRV. It is presumable that a very high RT load is needed to achieve changes in HRV, as earlier studies with moderate load have not found changes in HRV. In contrast to the usual findings in endurance training, improved strength performance was not related to improved cardiac vagal modulation in the present study. It may be speculated that changes in the neuromuscular system may explain the improved performance despite the disturbed autonomic modulation, i.e. increased stress, detected as decreased resting HRV.

1033 Board #212 May 31 2:00 PM - 3:30 PM
Risk Factors for Cardiovascular Disease Among University Employees
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 (No relationships reported)

PURPOSE: The purpose of this study was to examine cardiovascular disease risk factors among university employees, and to compare these results with standardized norms based on age and gender from the National Health and Nutrition Examination Survey (NHANES) data and the American College of Sports Medicine (ACSM) recommendations. **METHODS:** Health and wellness assessments were performed on N = 47 public university employees aged 26 to 65 years. The assessments included body compositional analysis, blood lipid and glucose panels, dietary recalls, and blood pressure and then compared with the results of current NHANES data and ACSM recommendations using a multiple independent t-tests ($p < 0.05$) and descriptive analysis. **RESULTS:** Descriptive results indicated that the sample's means were above recommended values for male age, body fat percentage, low density lipoprotein cholesterol, and a diet too high in sodium and too low in calcium, fiber, and vitamin D. Results indicated that the sample also had significantly higher diastolic blood pressure ($p = .0008$) and High Density Lipoprotein ($p = .0005$) and significantly lower blood glucose ($p = .00001$) than the national average. **CONCLUSION:** These results

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indicate that the university employees were at significant risk for some cardiovascular disease risk factors and dietary choices, which indicates that they would benefit from health promotion programs that target those specific risk factors. :

B-69 Free Communication/Poster - Cellular/Molecular

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1034 Board #213 May 31 3:30 PM - 5:00 PM High-Intensity Interval Training Does Not Promote Fibrinolytic Adaptations in Healthy Men

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Blood clots cause the majority of adverse cardiovascular events, such as heart attack and stroke, and fibrinolysis, the capacity to dissolve blood clots, is recognized as an independent predictor of cardiovascular morbidity and mortality. Aerobic exercise training is theorized to enhance fibrinolytic potential, but studies have yielded inconclusive results. High intensity interval training (HIIT) is a novel exercise training strategy that has been shown to improve several components of health in various populations, but the effect of a HIIT regimen on fibrinolytic potential is unknown. **Purpose:** The purpose of this study was to examine potential fibrinolytic adaptations in healthy men following four and eight weeks of HIIT. **Methods:** Healthy, sedentary men participated in a HIIT program three days/week for eight weeks. Training bouts were modeled after the traditional Wingate test, consisting of repeated, 30-second bouts of maximal intensity cycling separated by 4.5 minute rest intervals. Training began with three bouts per day and an additional bout/day was added to the regimen every two weeks, progressing up to six bouts per day in the final two weeks. Plasma concentrations of total tissue plasminogen activator (tPA) and plasminogen activator inhibitor-1 (PAI-1) were assessed at baseline, after four weeks (4w), and after eight weeks (8w). Statistical comparisons across the three time points were done using repeated measures ANOVA. Significance was set to $p < 0.05$. **Results:** 21 men (age: 25 ± 5 yrs, BMI: 26.7 ± 6.2 kg/m²) completed the study. No significant changes were observed for tPA during training (baseline: 9.8 ± 3.1 , 4w: 9.7 ± 2.9 , 8w: 8.9 ± 2.7 ng/ml, $p > 0.05$). Likewise, PAI-1 did not change with training (baseline: 17.7 ± 16.8 , 4w: 18.8 ± 16.1 , 8w: 18.0 ± 16.8 ng/ml, $p > 0.05$). **Conclusion:** Though it has been suggested that HIIT may be superior to traditional, aerobic training for the purpose of enhancing one's cardiovascular health, results of the present study do not indicate HIIT influences fibrinolytic potential in healthy young men. Future research should explore the benefits of HIIT in populations that may be characterized by diminished fibrinolytic potential.

1035 Board #214 May 31 3:30 PM - 5:00 PM Acute Exercise-induced Angiogenic T Cell Redistribution Is Attenuated in Older Men

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Circulating CD31⁺ T cells (T_{ANG}) possess significant pro-angiogenic capabilities, contribute to maintenance of endothelial function, and are reduced in those with vascular-related diseases. Therefore, maintaining high levels of these cells may be important for vascular health benefits. Acute bouts of exercise stimulate an increase in circulating T-cells, including T_{ANG} cells. Ageing is associated with a chronic reduction in T_{ANG} cells. **PURPOSE:** To determine the influence of age on the exercise-induced increases in circulating T_{ANG} cells. **METHODS:** Eight young (18-25yrs) and eight older (60-75yrs) men underwent a 30-minute cycling bout at 75% of their pre-determined maximum oxygen uptake (VO₂max). Peripheral blood samples were taken pre-, immediately post-, and 1 hour post-exercise. Blood samples were used to quantify circulating T_{ANG} cells by flow cytometry. T_{ANG} were defined as peripheral blood mononuclear cells expressing CD3 and CD31. In addition, these cells were further characterised using antibodies against CD4 and CD8. Mixed model repeated measures analyses of variance (ANOVA) were performed to examine the effect of age, time and interactions of such (age x time) on changes in circulating T_{ANG} cells. **RESULTS:** Acute exercise stimulated an increase in circulating T_{ANG} cells in both groups, with a

significant time x age interaction found for total T_{ANG} cells ($p=0.049$), with older age group displaying reduced circulating cell response to the exercise bout ($95.62 \pm 7.71\%$ vs. $78.09 \pm 7.25\%$, young vs. older individuals respectively). CD4⁺ T_{ANG} cells were also significantly affected by acute exercise, including a time x age interaction ($p=0.0014$, $107.09 \pm 10.56\%$ vs. $79.88 \pm 10.04\%$ increase). Despite CD8⁺ T_{ANG} cells significantly increasing in response to exercise (time, $p=0.002$, $71.44 \pm 7.30\%$ pooled increase), no such effect of age was apparent (age x time, $p=0.384$). **CONCLUSIONS:** Exercise significantly increases the number of circulating T_{ANG} cells, however ageing attenuates the increase in total T_{ANG} and CD4⁺ T_{ANG} cells, but not CD8⁺ T_{ANG} subsets. Acute increases in circulating T_{ANG} cells may contribute to the improvements in vascular function observed with exercise, yet strategies to augment the T_{ANG} cell increase to exercise in older individuals may be required to promote vascular benefits of exercise.

1036 Board #215 May 31 3:30 PM - 5:00 PM Serum Angiogenic Capacity and Circulating MicroRNAs in Trained and Inactive Young, Healthy Individuals

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Angiogenesis is induced by endurance exercise training and improves cardiovascular function. Exercise training also influences blood-borne factors, such as circulating microRNAs (ci-miRNAs), which can affect endothelial cell functions. **PURPOSE:** To determine differences in the angiogenic response of human umbilical vein endothelial cells (HUVECs) to serum of young individuals with no risk factors for cardiovascular disease (CVD), who differ only by habitual aerobic exercise level. In addition, ci-miRNAs were compared as potential candidates responsible for differences in HUVEC responses. **METHODS:** Serum was isolated from fasted, peripheral blood of endurance trained ($n=10$) and inactive ($n=10$) men and women aged 20-39. Exercise habits and VO₂max were determined, and groups were matched by age, BMI, and blood chemistry. Serum was applied to HUVECs in a radius well migration assay, fluorometric proliferation assay, and tube angiogenesis assay at concentrations of 10%, 20%, and 7.5%, respectively. Ci-miRNA was isolated from serum and reverse transcribed. Using real-time quantitative PCR (qPCR), a subset of three samples per group were first compared for an array of 84 CVD-related miRNAs. Targets showing at least a 4-fold difference, as well as a priori chosen miRNAs, were validated using qPCR and compared for all subjects. **RESULTS:** HUVECs exposed to serum from trained subjects migrated 8% more in the first 4 hours ($p < 0.05$) and 13% more after 8 hours ($p=0.058$) compared to those exposed to serum from inactive subjects. Following 12 and 24 hours, migration was 20% ($p=0.055$) and 21% ($p=0.08$) greater respectively, with serum of trained subjects. Following 36 hours, serum of trained individuals resulted in greater proliferation of HUVECs compared to serum of inactive individuals ($P=0.04$). There were no differences in tube length or complexity between the groups. PCR array data indicated nine ci-miRNAs with ≥ 4 -fold difference. One ci-miRNA was more highly expressed in the trained sample, while eight were higher in the inactive sample. Of the ci-miRNAs chosen for validation, none exhibited different expression between groups. **CONCLUSION:** Serum of endurance trained individuals induces faster migration and greater proliferation compared to serum of inactive men and women, even in a young, healthy population.

1037 Board #216 May 31 3:30 PM - 5:00 PM Both Exercise And Calorie Restriction Increase Mitochondrial Membrane Potential Of Myocardium In Aging SD Rats

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Exercise and calorie restriction have function to relieve the increase of oxidative damage in the myocardium. Mitochondria are the main cellular location to produce the reactive oxygen species (ROS). It is still unknown whether exercise or calorie restriction reduce the production of reactive oxygen in myocardial mitochondria. **Purpose:** The purpose of this study is to explore the positive effects from exercise and calorie restriction on the membrane potential of myocardial mitochondria, the ROS level in mitochondria, the relief of myocardial oxidative damage and the improvement of the myocardial function. **Method:** Twenty-one months-old male SD rats were divided into four groups: control aged group (CA), calorie aged with calorie restriction group (CRA, 60% calorie of CA group), aged exercise group (EA, running on treadmill with the speed of 15m/

min,5%,at 64% VO₂ max for 60 min/day, 5 days a week for 12 weeks) and exercise combined calorie restriction group (CREA). In addition, 20 of 9 months-old SD male rats were set as the young control group (YC).

Result: The pulse pressure(blood pressure in left ventricle) was significantly higher in CREA (12.08±2.9) than in CRA (9.39±1.0, P<0.05) and EA (9.30±1.2, P<0.05). The membrane potential(fluorescence image) was significantly higher in CREA than in CRA (P<0.01) and EA (P<0.05). The level of ROS(fluorescence image) was significantly lower in CREA (28.92±2.6) than in CRA (39.54±8.7,P<0.05), EA (32.94±3.2, P<0.05) and CA (33.63±5.6,p<0.01). The level of MDA(kit) in CA (5.79±1.9) was extremely significantly higher than that in YC (2.37±0.3,p<0.01), CRA (2.37±0.3,p<0.01), CRE (3.06±0.7,p<0.01) and CREA (2.94±0.7,p<0.01).

Conclusion: Exercise training and calorie restriction increased the membrane potential of aged myocardium, they reduced the production of ROS and the level of oxidative damage in the mitochondria,and,improved the myocsrdisl ctrnscstle function.(This report is supported by NSFC 31271275,Corresponding author:wenli34@hotmail.com)

1038 Board #217 May 31 3:30 PM - 5:00 PM
Plasma Metabolomics in Response to an Acute Bout of Exercise in Adolescents Boys and Girls

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(No relationships reported)

Technological advances now permit the simultaneous detection of previously unattainable numbers of small molecule metabolic products (the metabolome) in blood. Metabolomics facilitates analysis of dynamic, interacting physiologic systems and unravelling the role of physical activity during the process of growth in disease prevention across the lifespan. **PURPOSE:** To evaluate the effect of an acute intense bout of exercise on plasma metabolomics in a group of healthy adolescents, and explore sex-related patterns. **Methods:** 29 normal weight healthy adolescents (14-17 y/o, 16 girls) performed 10, 2-min bouts of cycle ergometer exercise interspersed with 1-min rest at a constant work equivalent to ~75% of their peak VO₂. Blood was collected at baseline and immediately after the exercise. Untargeted profiling of primary metabolism was performed using automatic liner exchange / cold injection GC-TOF mass spectrometry at the UC Davis WCM Center. An acute exercise effect was assessed using paired t test (FDR ≤0.05). Two- way repeated measure ANOVA followed by paired t test was carried out to evaluate sex differences. Pathway analysis was performed using MetaboAnalyst 3 (FDR≤0.05). **Results:** Exercise caused a significant shift in plasma metabolites associated with major bioenergetics, aerobic, anaerobic and amino acid metabolism. 48 annotated metabolites (36↑12↓) were classified into 11 metabolism pathways (e.g., citrate cycle, alanine, aspartate and glutamate metabolism, valine, leucine and isoleucine biosynthesis, glycine, serine and threonine metabolism, arginine and proline metabolism and aminoacyl-tRNA biosynthesis). 11 metabolites had different response to exercise in boys compared to girls. 4 of them were enriched (FDR=0.01) in the arginine and proline metabolism pathway, which plays a role in maintenance of vascular tone and hemodynamics, and acts in muscle metabolism. **CONCLUSION:** The rapidly emerging field of metabolomics enables us to identify interacting networks of cellular metabolites activated by exercise. Our exploratory data revealed that exercise induced a shift in the metabolic profile indicating global cellular metabolic/energetic stress and sex dimorphism not previously observed. Supported by NIH Grant P01HD-048721 and PERC System Biology Fund

1039 Board #218 May 31 3:30 PM - 5:00 PM
Microparticles Are Linked to Post-Prandial Hyperglycemia and Cardiovascular Disease Risk in Adults with Prediabetes

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PURPOSE: Microparticles (MPs) have been implicated in type 2 diabetes and cardiovascular disease (CVD). However, no study has assessed MPs from fresh samples with advanced imaging flow cytometry in order to understand the relation of MPs to CVD risk. We tested the hypothesis that MPs would correlate with hyperglycemia and CVD risk in adults with prediabetes. **METHODS:** In this cross-sectional study, 12 subjects (Age: 61.25±7.03y, BMI: 34.2±5.5kg/m²) were screened for prediabetes using American Diabetes Association criteria (75g OGTT and HbA_{1c}). Post-prandial early (0-30min) and late phase (60-180min) glucose tolerance (75g OGTT) was calculated by incremental area under the curve (AUC). CVD risk was assessed by body composition (BIA) and waist circumference, fitness (VO₂max and rate pressure product (RPP)), as well as systolic (SBP) and diastolic blood pressure (DBP). Arterial stiffness (augmentation index; AI) was calculated using total AUC.

Total MPs and endothelial MPs (EMPs; CD105, CD31⁺/CD41⁻) were analyzed from fresh plasma via imaging flow cytometry. **RESULTS:** Elevated total MPs were associated with early phase glucose intolerance (r=0.77, P=0.009) and VO₂max (trend: r=0.52, P=0.08). CD31⁺/CD41⁻ EMPS were correlated with higher body weight (r=0.59, P=0.04), waist circumference (r=0.66, P=0.03), RPP (r=-0.66, P=0.02) and late phase glucose intolerance (r=0.64, P=0.02). CD105 EMPS were inversely related to total AI (r=-0.61, P=0.04). **CONCLUSION:** MPs are significantly linked to post-prandial hyperglycemia and markers of increased CVD risk in adults with prediabetes.

1040 Board #219 May 31 3:30 PM - 5:00 PM
In Vitro Exercise, Laminar Shear Stress, Attenuates Basal Mmp-2 Dysfunction In Cultured African American Endothelial Cells

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Matrix metalloproteinase (MMP)-2, an enzyme that is integral in regulating vascular structure and vascular homeostasis, is constitutively expressed in endothelial cells (EC). MMP-2 has been associated with arterial stiffness and hypertension in African Americans (AA). While exercise improves biomarkers of vascular dysfunction in AA with pre-hypertension and hypertension, the mechanism(s) related to exercise-induced improvements in EC health and MMP-2 activity is unknown.

PURPOSE: To determine the extent of EC dysfunction of MMP-2 activity, and its responsiveness to a physiological exercise mimetic, laminar shear stress (LSS), in human umbilical vein endothelial cells (HUVEC) isolated from Caucasian (CA) and AA donors.

METHODS: The present work evaluated expression and activity of MMP-2 and related peptides in 4 AA and 4 CA HUVEC with gender split under basal conditions with LSS (20 dynes/cm²).

RESULTS: In AA HUVEC, we report that basal MMP-2 gene expression was significantly higher (2.13-fold increase, $t_{2,8,12}$; p=0.01) while relative MMP-2 activity was significantly lower (CA: 0.7758 ± 0.1944; AA: 0.1324 ± 0.1135 n=4, $t_{2,8,6}$; p=0.02), compared to CA HUVEC. Importantly, LSS normalized relative basal MMP-2 expression and activity ($F_{3,15}$ = 3.92; p=0.03) by increasing the relative expression in AA HUVEC.

CONCLUSIONS: These *in vitro* data highlight an inherited endothelial dysfunction in AA HUVEC and imply that MMP-2 dysfunction likely contributes to early vascular dysfunction and subsequent hypertension risk in AA. Further, exercise (e.g., LSS) normalized this dysfunction, *in vitro*, and highlights a potential mechanism by which exercise improves endothelial and vascular function in AA, *in vivo*.

1041 Board #220 May 31 3:30 PM - 5:00 PM
Diabetes Impairs the Ability of Skeletal Muscle Pericytes to Augment Postischemic Neovascularization in Mice

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(No relationships reported)

Peripheral artery disease is an atherosclerotic disease that causes limb ischemia and has few effective treatments. Stem cell therapy is a promising treatment option, but concomitant diabetes may limit its effectiveness. **PURPOSE:** To evaluate the therapeutic potential of skeletal muscle pericytes to augment postischemic neovascularization following the induction of limb ischemia in wild type (WT) and type 2 diabetic (T2DM) mice. **METHODS:** Pericytes were isolated via fluorescence activated cell sorting for CD45⁺CD34⁺CD146⁺ cells, and pericyte phenotype was confirmed via surface marker expression, gene expression, and *in vitro* differentiation potential. WT C57BL/6 (n=10) and db/db T2DM (n=8) mice underwent unilateral femoral artery ligation to induce limb ischemia. 24 hrs post-ligation, pericytes or vehicle control were transplanted into the muscles of the ischemic hindlimbs. Postischemic neovascularization was assessed via foot blood flow at pre-surgery, post-surgery, and postoperative days 3, 7, 14, 21, and 28 using laser Doppler perfusion imaging. Differences in gene expression were determined using t-tests; differences in blood flow were determined using linear mixed models. **RESULTS:** CD45⁺CD34⁺CD146⁺ pericytes were positive for mesenchymal stem cell markers CD90 (74%) and CD105 (65%) and weakly positive for the pericyte marker PDGFRβ (42%) and the endothelial cell marker CD144 (36%). Pericytes transdifferentiated into skeletal myocytes, adipocytes, osteocytes, and endothelial cells. Pericytes had significantly (p<0.05) upregulated *Scal1* (4.0-fold) gene expression, downregulated *CD31* (0.2-fold) gene expression, and no difference in *MyoD* (1.0-fold), *Pax3* (1.3-fold), or *Pax7* (1.0-fold) expression. Blood flow recovery in WT mice was significantly higher after pericyte transplantation than after vehicle control (p=0.03; 81.1±6% vs.

64.7±9% at postoperative day 28). Blood flow recovery in T2DM mice after pericyte transplantation was not different than after vehicle control ($p=0.44$; $50.1±4\%$ vs. $53.5±4\%$ at postoperative day 28). **CONCLUSION:** T2DM negates the capacity of pericytes to augment neovascularization after limb ischemia. Further study is required to determine the mechanism by which T2DM impairs this pericyte function. Support: AAUW American Dissertation Fellowship

B-70 Free Communication/Poster - Cold/Dive/Space Physiology

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1042 Board #221 May 31 3:30 PM - 5:00 PM Differences in Energy Expenditure Between Genders in Ultra-Endurance Nordic Skiing

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(No relationships reported)

PURPOSE: Given the new reclassification options for women serving in the, the purpose of this study was to evaluate sex differences in energy expenditure and body composition data collected during the Alaska Mountain Wilderness Ski Classic. **METHODS:** Fifteen race participants (8 males and 7 females, aged 31-54) were recruited for the study. Participants completed pre- and post-race body composition scans via dual energy x-ray absorptiometry (DEXA). Participants wore ActiGraph activity monitors around their wrists for the entire duration of their participation in the race. Pack weights were measured prior to the race. **RESULTS:** There was no difference in time to completion between men and women (ie., $125±20.1$ hours and $119.3±18.0$ hours, respectively, $p=0.6$). Pack weights relative to body mass were significantly lower in men ($20.7±2.0\%$) compared to women ($25.9±5.4\%$). Pre- and post-percent fat mass was significantly lower in men ($14.8±4.0$ and $12.8±3.5$) compared to women ($19.8±2.7$ and $18.0±2.5$), respectively. Calculated total energy expenditure for the duration of the race was higher in men ($42,679$ and $30,861$ kcal, men and women, respectively, $p=0.002$). Energy expended in order to complete the race was proportionate to total weight (body and pack) regardless of gender ($R^2=0.84$). **CONCLUSION:** Despite the challenge of carrying a heavier pack weight relative to their body mass, the women were able to complete the race in the same amount of time as the men. Previous studies suggest that at extreme distances women may possess a metabolic advantage over men. Further research is warranted to better understand the unique physiological advantages women in the military may offer under similar conditions.

1043 Board #222 May 31 3:30 PM - 5:00 PM A Thermochromic Leuco Dye Coated Glove for the Prevention of Frostbite in Cold Environments

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(No relationships reported)

Background: We have developed a prototype of a thermochromic leuco dye coated latex glove designed for the early prevention of frostbite in cold environments. The thermochromic leuco dye was calibrated to detect contact temperature and change color accordingly at temperatures of 8°C and below. **Purpose:** The purpose of this study was to evaluate the reliability and efficacy of the glove as a potential tool for the early detection of frostbite and adverse outcomes secondary to cold environments. **Methods:** Two trials were conducted in a constant environmental temperature set at 24°C and 6°C using an environmental chamber. Using a water bath, water was cooled to temperatures between 5°C and 15°C in 1°C increments. The thermochromic dye coated latex glove and was placed into the same temperature thermochromic dye coated latex glove five times at each temperature set point, in each trial. Visual findings were recorded and all data was analyzed using paired samples t-tests. **Results:** Color change was noted in 20/100 individual trials at all internal contact temperatures of 8°C and below. Mean internal contact temperature measurements were $8.54 (\pm) 0.05^{\circ}\text{C}$ in Trial 1 (24°C ambient) and $8.48 (\pm) 0.04^{\circ}\text{C}$ in Trial 2 (6°C ambient). It was concluded that there was no significant difference ($p=0.208$) between threshold mean internal water temperature between the two trials at the targeted color change of red. **Conclusion:** The glove demonstrated a consistent color change at a threshold temperature of 8°C and below with all of the 100 individual trials at 2 different external environmental temperature set points, therefore, proving that ambient temperature has minimal influence on the necessary contact temperature required to elicit a color change. The results of this proof of concept supports the use

of a thermochromic dye coated latex glove as a visual, real time diagnostic tool for the prevention of cutaneous frostbite. Future work may therefore focus on developing this material for the military or outdoorsman for the early detection of cold injury in the field.

1044 Board #223 May 31 3:30 PM - 5:00 PM Evaluation of Three Rewarming Techniques Following Cold Water Immersion in Military Personnel.

Kaitlyn A. Rostomily, Douglas M. Jones, Christina K. Cooper, Dale S. Bergquist-Turori, Carina M. Pautz, Jay H. Heaney. *Naval Health Research Center, San Diego, CA.*
(No relationships reported)

The Marine Corps Mountain Warfare Training Center (MCMWTC) conducts a Cold Weather Medicine course to educate students about first aid and treatment for cold injuries and illnesses. Students participate in a "hypothermia lab," consisting of immersion in cold water followed by rewarming. Currently, no body temperature values have been analyzed to support a rewarming technique that is most physiologically or perceptually effective. **PURPOSE:** To determine the impact of three rewarming techniques following cold water immersion, and to identify the most beneficial technique for rewarming warfighters in the field. **METHODS:** Thirty-eight military personnel participated in the MCMWTC hypothermia lab (mean \pm SD age: 26 ± 5 yrs; height: 1.8 ± 0.09 m; weight: 83.2 ± 10.9 kg). Students fully immersed their bodies in cold water (0.3°C) and remained at neck-high level for 10 min. Post-immersion, students changed into a dry set of clothing and rewarmed for 60 min by either donning a sleeping bag ($n = 13$), donning a sleeping bag while drinking 1 liter of warm liquids (SBWL, $n = 13$), or completing a set exercise program ($n = 12$). Core (T_{core}) and mean skin temperature (T_{MSK}), thermal sensation (TS, -4 very cold to $+4$ very hot), and shivering sensation (SS, 0 no shivering to 3 vigorous shivering) were recorded. **RESULTS:** No physiological or perceptual differences were seen between the three techniques.

		Sleeping bag	SBWL	Exercise	p value
Tcore	Pre	$35.8 \pm 1.4^{\circ}\text{C}$	$36.2 \pm 0.5^{\circ}\text{C}$	$36.0 \pm 1.3^{\circ}\text{C}$	0.666
	Post	$36.8 \pm 0.4^{\circ}\text{C}$	$36.7 \pm 1.0^{\circ}\text{C}$	$37.0 \pm 0.8^{\circ}\text{C}$	
TMSK	Pre	$16.7 \pm 1.7^{\circ}\text{C}$	$17.6 \pm 2.2^{\circ}\text{C}$	$17.3 \pm 1.3^{\circ}\text{C}$	0.111
	Post	$27.7 \pm 1.4^{\circ}\text{C}$	$28.5 \pm 1.4^{\circ}\text{C}$	$27.2 \pm 0.9^{\circ}\text{C}$	
TS	Pre	-3.0 ± -1.1	-3.2 ± -1.5	-2.8 ± -1.3	0.137
	Post	0.0 ± 1.4	0.0 ± 1.6	1.1 ± 1.6	
SS	Pre	2.2 ± 0.6	2.5 ± 0.7	1.9 ± 1.0	0.128
	Post	0.1 ± 0.0	0.4 ± 1.0	0.0 ± 0.0	

CONCLUSION: The three rewarming techniques were not physiologically or perceptually different after the 60-min rewarming period. Within the limitations of this study (participants, environment, and equipment), any of these three techniques would appear to be suitable for rewarming in the field.

1045 Board #224 May 31 3:30 PM - 5:00 PM Performance of Intravenous Insertion is Impaired Following Cold Water Immersion in Military Medical Providers

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Accidental cold water immersion or unprepared exposure to extreme cold temperatures can negatively impact warfighter performance and mission outcomes by hindering hands and feet use due to numbness. Skin or extremity temperature has been identified as a relevant variable that predicts impairment in manual dexterity and tactile sensitivity, yet no data have been presented showing performance of medically-specific tasks, such as intravenous (IV) insertion following a cold water immersion. **PURPOSE:** To determine the influence of cold water immersion and rewarming on IV insertion performance among military medical providers. **METHODS:** Thirty-eight military personnel (mean \pm SD age: 25.8 ± 5.4 yrs; height: 179.5 ± 9.9 cm; weight: 83.2 ± 10.9 kg), trained in the technique of IV insertion, participated in a Cold Weather Medicine course. During the training exercise, students completed six stations: baseline in a classroom (5 min, 23°C), pre-immersion (pre) outdoors (5 min, -4.6°C), immersion in cold water (10 min, 0.2°C), post-immersion (post) (5 min, wet clothing, -4.6°C), transition (5 min, change into dry clothing), and rewarming (60 min, using various techniques). An IV insertion task was performed upon arrival at baseline, pre- and post-immersion, and after rewarming. The IV insertion task required students to insert an IV using a manikin arm. Students were assessed for time to insert IV and success of administering fluid. **RESULTS:** Assessment revealed a significant increase in IV insertion time ($p<0.001$) and a decrease in IV insertion success rate following cold water immersion. IV insertion times (seconds) for each station were: baseline

82 ± 17, pre 70 ± 12, post 168 ± 45, and rewarm 73 ± 14. IV insertion success rates were similar among baseline (76%), pre (71%), and rewarm (84%) stations; however, post-immersion, IV success trended downward (47%). **CONCLUSION:** Results were consistent with the expected loss of manual dexterity following cold water immersion. When given one hour of rewarming, performance returned to baseline. It is essential that military personnel are educated and trained on the effects of accidental cold exposure, the impact it may have on their performance as medical providers, and appropriate extremity rewarming techniques.

1046 Board #225 May 31 3:30 PM - 5:00 PM

BMI Of San Francisco Cold-water Swimmers: Comparisons To North American And International Masters Athletes

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(No relationships reported)

Recreational swimming in cold, open-water without a wetsuit continues to grow in popularity, attracting individuals with a wide variety of athletic backgrounds. Different than a polar bear plunge, cold-water swimming involves consistent swimming throughout the winter months. **PURPOSE:** To determine if cold-water swimmers have substantial differences in body mass index (BMI) vs. North American and International masters pool swimmers and International masters athletes from different sports. It is postulated that a higher BMI might have a protective benefit against heat loss and hypothermia during cold, open-water swims without wetsuits. **METHODS:** BMI was measured in a group of 103 open-water swimmers (mean age: 54 years; 76 men, 27 women), who swam consistently throughout the winter months in the San Francisco Bay, without wetsuits (median water temperature: 11°C [52°F]). Swimmers' values were compared to data from North American Masters pool swimmers (mean age: 57 years), International masters pool swimmers (mean age: 54 years), and International athletes from different sports (age range: 42-57 years). **RESULTS:** The average BMI values for cold-water swimmers in our study (25.9 kg/m²) were not significantly different than the average BMI of North American Masters pool swimmers (25.1 kg/m²; p=0.17) or International masters pool swimmers (25.3 kg/m²; p=0.16). On average, San Francisco cold-water swimmers had slightly higher BMI (kg/m²) (p<.05) than ultramarathon runners (23.0), track and field athletes (24.1), soccer players (24.5), and volleyball players (24.9), and lower (p<.05) BMI (kg/m²) than softball players (27.3). **CONCLUSIONS:** The BMI of cold-water swimmers is similar to North American and International Masters pool swimmers; and in general, is slightly higher than masters athletes from different sports. It appears that cold-water swimming abilities cannot be attributed to unique body composition; other factors such as acclimatization, heat production while swimming, and limiting time in cold water may be keys to preventing hypothermia.

1047 Board #226 May 31 3:30 PM - 5:00 PM

BMI Of San Francisco Cold-water Swimmers: Comparisons To U.S. And Regional Populations

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Higher body mass contributes to protection from hypothermia and one might assume that swimmers who swim consistently in cold water have more adipose tissue than average individuals. **PURPOSE:** To determine if cold-water swimmers have substantial differences in body mass index (BMI) which might have a protective effect against heat loss during swims in cold water without wetsuits. **METHODS:** BMI was measured in a group of 103 open-water swimmers (mean age: 54 years; 76 men, 27 women), who swam consistently throughout the winter months, in the San Francisco Bay, without wetsuits (median water temperature: 11°C [52°F]). Swimmers' values were compared to U.S., California, and San Francisco values, which were obtained through the National Health and Nutrition Examination Survey (NHANES) and the California Health Information Survey (CHIS). **RESULTS:** Average BMI values for cold-water swimmers in our study (25.9 kg/m²; range = 19 - 39) were significantly lower than U.S. (28.7 kg/m²) and California state BMI (27.3 kg/m²) averages (P<.001

for both comparisons). When comparing unadjusted averages, cold-water swimmers had a slightly higher BMI (25.9 kg/m²) than San Franciscans (25.1 kg/m²) (P=.02); however, after appropriately matching for age and sex, the adjusted average BMI of cold-water swimmers (25.9 kg/m²) was lower than the adjusted San Francisco average BMI (26.6 kg/m²) (P=.047). 10.7% of the cold-water swimmers were classified as obese (BMI > 30 kg/m²) vs. 35.7%, 24.8% and 11.3% in the U.S., California, and San Francisco populations, respectively; and 53.4% as overweight/obese (BMI > 25 kg/m²) vs. 68.8%, 59.8%, and 41.8% in the U.S., California, and San Francisco populations, respectively. **CONCLUSIONS:** The BMI of cold-water swimmers is lower or similar to the BMI of U.S., California, and San Francisco general populations. Protection from hypothermia in cold-water swimmers is likely related to other factors such as acclimatization, heat production while swimming, and limiting time in cold water.

1048 Board #227 May 31 3:30 PM - 5:00 PM

Lipolysis, Substrate Metabolism, & Time Trial Performance In Cold Versus Thermo-neutral Environments In Trained Cyclists

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(No relationships reported)

The degree to which temperature affects endurance performance and exercise metabolism in trained athletes is not fully known. **PURPOSE:** In the present study, we investigated the impact of cold and neutral environmental temperatures on subcutaneous abdominal adipose tissue (SCAAT) lipolysis and whole-body substrate oxidation during submaximal steady-state cycling in trained cyclists. Additionally, we assessed subsequent time trial (TT) performance. **METHODS:** Ten trained male cyclists (age = 22.80 ± 2.76 yr; height = 178.58 ± 5.65 cm; mass = 74.02 ± 10.95 kg; body fat = 18.35 ± 3.37%; peak oxygen consumption (VO_{2peak}) = 60.60 ± 4.67 ml·kg⁻¹·min⁻¹; power output in Watts (W) at lactate threshold (LT) = 234.00 ± 35.00 W) participated in a randomized, crossover designed study that consisted of baseline testing to determine LT and VO_{2peak}, two familiarization trials, and two experimental trials. The experimental trials consisted of 25 min of cycling at 70% LT, followed immediately by 25 min at 90% LT in either cold (3.06±1.78°C; 41.63±5.60%RH) or thermoneutral (19.43±0.98°C; 38.97±2.23%RH) conditions. Following a 15-min break, subjects then completed a 20km thermoneutral room. SCAAT interstitial glycerol concentrations were measured *in situ* throughout the trial via the microdialysis technique. Two-way (group x time) repeated measures analysis of variance tests and student t-tests (where appropriate) were used to identify differences between measured variables with significance set at p ≤ 0.05. **RESULTS:** A significant time effect was observed for HR (p < 0.001), core temperature (p < 0.001), interstitial glycerol (p < 0.001), blood lactate (p < 0.028), carbohydrate oxidation (p < 0.0001), fat oxidation (p < 0.0001), and VO₂ (p < 0.001). No significant differences were observed between conditions for any measured variable including TT performance (cold, 189.9±24.6 v. neutral, 187.5±27.4 W, p=0.858). **CONCLUSION:** SCAAT lipolysis increases during steady state exercise. However, metabolism and performance are not impacted by cold ambient conditions. This study was funded by the National Strength and Conditioning Association and Florida State University.

1049 Board #228 May 31 3:30 PM - 5:00 PM

Leptin, Adiponectin, And Ghrelin Responses To Different Temperature Conditions With Endurance Exercise

Morgan Busboom, Terence Laursen, Robert Shute, Rokhsana Zak, Matthew Heesch, Nicholas Dinan, Matthew Bubak, D. Taylor La Salle, Dustin Slivka, FACSM. University of Nebraska at Omaha, Omaha, NE. (Sponsor: Dr. Dustin Slivka, FACSM)

(No relationships reported)

Obesity can result from a lack of energy expenditure or excessive energy intake. The appetite-regulating hormones leptin, adiponectin, and ghrelin may help decrease energy intake by affecting appetite. Exercise and exposure to extreme temperatures can independently affect these hormones. However, less is known on how exercise and temperature interact to affect appetite.

Purpose: To determine the effect of exercise in different temperatures on the circulating concentrations of leptin, adiponectin, ghrelin, and acylated ghrelin. **Methods:** Eleven recreationally-trained male participants completed three separate 1 h cycling bouts at 60% W_{max} in different environmental temperatures (Hot 33 °C, Cold 7 °C, Room Temperature 20 °C), followed by 3 h recovery at room temperature. Blood was drawn pre-exercise, post-exercise, and 3 h post-exercise from the antecubital vein. Hematocrit and hemoglobin were measured to account for changes in plasma volume. **Results:** Leptin concentrations were lower at post and 3 h post-exercise compared to pre-exercise, with and without correcting for plasma volume shifts, regardless of

temperature ($p < 0.05$). Adiponectin was higher post-exercise than pre-exercise ($p = 0.021$) and then returned to pre-exercise levels by 3 h post-exercise ($p = 0.084$) without correction for plasma volume shifts. However, adiponectin concentrations were not different at any time point when plasma volume shifts were accounted for ($p > 0.05$). Ghrelin and acylated ghrelin concentrations were not affected at post and 3 h post-exercise compared to pre-exercise, with and without correcting for plasma volume shifts, regardless of temperature ($p > 0.05$). No differences in leptin, adiponectin, ghrelin or acylated ghrelin were found between trials ($p > 0.05$). **Conclusion:** Temperature does not effect the circulating concentrations of leptin, adiponectin, or ghrelin during an acute bout of endurance exercise. Supported by the University of Nebraska-Omaha University Committee on Research and Creative Activity and the National Institute for General Medical Science (5P20GM103427).

1050 Board #229 May 31 3:30 PM - 5:00 PM
Plasma Interleukin-6 Response to Environmental Temperature with Endurance Exercise

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 (No relationships reported)

An effective method to treat and prevent a multitude of low-grade inflammatory diseases is to reduce inflammation through regular exercise. The anti-inflammatory effect of exercise is predominantly influenced by the production of Interleukin-6 (IL-6) from the active skeletal musculature. The pro-inflammatory effects of IL-6 production derived from adipose tissue is reduced during exercise. However, the effect of IL-6 when exercising in different environmental conditions is currently unknown. **PURPOSE:** Determine the effects of exercise in hot, cold, and room temperature environments on plasma IL-6. **METHODS:** Eleven recreationally trained males (age = 25 ± 4 y, height = 178 ± 5 cm, weight = 79.4 ± 13.5 kg, 14.7 ± 3.6 % body fat, $VO_{2\text{peak}} = 4.29 \pm 0.86$ L · min⁻¹, $W_{\text{max}} = 277 \pm 41$ W) performed a 1 h cycling bout in hot (H), cold (C), and room temperature (RT) environments (33 °C, 7 °C, 20 °C, respectively) followed by 3 h of supine recovery at room temperature. Expired gases were measured every 15 minutes during exercise and once every hour during recovery. Heart rate (HR) was continuously measured throughout trial. Blood samples were obtained from the antecubital vein pre-exercise, immediately post-exercise, and 3 h post-exercise. Blood samples were analyzed for plasma concentrations of IL-6 using a commercial ELISA kit. **RESULTS:** Plasma IL-6 concentrations were higher immediately post-exercise (14.8 ± 1.6 pg · ml⁻¹, $p = 0.008$) and 3 h post-exercise (14.8 ± 0.9 pg · ml⁻¹, $p = 0.018$) compared to pre-exercise (11.4 ± 2.4 pg · ml⁻¹) regardless of trial. There were no differences in plasma IL-6 concentrations ($p = 0.207$) between H, C, and RT. VO_2 and HR were higher and RER was lower in the hot compared to other conditions ($p < 0.05$). **CONCLUSION:** These data indicate that temperature does not affect the acute exercise response of IL-6, despite differences in metabolic state. Funded by UCRCA Grant and NIGMS # 5P20GM103427

1051 Board #230 May 31 3:30 PM - 5:00 PM
Irisin and Fibronectin Type III Domain-Containing 5 Responses to Exercise in Different Environmental Conditions

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 (No relationships reported)

Fibronectin type III domain-containing 5 (FNDC5) is a skeletal muscle membrane-bound precursor to the myokine irisin. Irisin is involved in stimulating adipose tissue to become more metabolically active in order to produce heat. It is unknown how exercising in different temperature environments affects the response of FNDC5 gene expression and blood irisin concentration. **PURPOSE:** To determine the effects of exercise in a hot (33 °C), cold (7 °C), and room temperature (RT, 20 °C) environment on the skeletal muscle gene expression of FNDC5 and the blood concentrations of irisin. **METHODS:** Twelve recreationally trained males completed three separate, 1 h cycling bouts at 60% of W_{max} in a hot, cold, and RT environment followed by three hours of recovery at room temperature. Blood samples were taken from the antecubital vein and muscle biopsies were taken from the vastus lateralis pre-, post-, and 3 h post-exercise. **RESULTS:** Plasma concentrations of irisin did not change from pre- (9.23 ± 2.68 pg · mL⁻¹) to post-exercise (9.6 ± 0.2 pg · mL⁻¹, $p = 0.068$), but decreased from post-exercise to 3 h post-exercise (8.9 ± 0.5 pg · mL⁻¹, $p = 0.047$), regardless of temperature. However, when plasma volume shifts were considered, no differences were found in irisin at pre-, post-, or 3 h post-exercise ($p = 0.086$). There were no differences between trials for irisin plasma concentrations

($p = 0.984$). No differences in FNDC5 mRNA were observed between the hot, cold, and RT trials or between pre-, post-, and 3 h post-exercise time points ($p > 0.05$). **CONCLUSION:** These data indicate that the temperature in which exercise takes place does not influence FNDC5 skeletal muscle transcription or circulating irisin in a human model. Funding provided by the University of Nebraska at Omaha Graduate Research and Creative Activity Grant and the National Institute for General Medical Science (NIGMS, 5P20GM103427).

1052 Board #231 May 31 3:30 PM - 5:00 PM
Occupational Specific Strength Testing Enhances the Prediction of Astronaut Related Task Performance

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 (No relationships reported)

Future space missions beyond low earth orbit will require deconditioned astronauts to perform occupationally relevant tasks while confined within a spacesuit of significant mass. The prediction of task performance times under these conditions will be critical for crew safety, autonomous operations, and mission success. **PURPOSE:** Determine if the addition of task specific upper body strength testing to current National Aeronautics and Space Administration's (NASA) standard lower body testing would enhance the prediction of time-to-completion in a test battery designed to simulate astronaut related occupational tasks. **METHODS:** Eight, healthy participants of astronaut age (34.9 ± 3.7 years) completed six occupationally relevant tasks while wearing a 48-kg weighted suit designed to emulate the weight distribution of the NDX-2 planetary spacesuit. The six tasks performed were: hatch opening, hand drilling, construction wrenching, half-mile walk, collecting weighted samples, and dragging an unresponsive crewmember to safety. The time-to-complete each task was recorded and summed to obtain a total time for the test battery. In addition to the standard knee extensor-flexor strength and endurance tests employed at the NASA Johnson Space Center for crew health testing, task specific isometric strength was collected prior to each task for hatch opening, hand drilling, and wrenching. Linear regression was used to predict the dependent variable of total time-to-completion with two independent variable models 1): NASA upper leg standard measures alone and 2): NASA upper leg standard measures + task specific isometric testing for wrenching and hand drilling. **RESULTS:** Total time-to-completion of the test battery ranged from 20.2-44.5 minutes. NASA upper leg standard measures alone accounted for 61.5% of the variability in time-to-completion ($p = 0.15$). The addition of hand drilling and wrenching testing to NASA upper leg standard measures accounted for 99.6% of the variability in time-to-completion ($p = 0.047$). **CONCLUSION:** Adding occupational specific strength tests (hand drilling and wrenching) to NASA's standard lower extremity tests successfully predicted time-to-completion of a performance test battery within a weighted suit in 1G. **Supported by ND NASA ESPCoR**

1053 Board #232 May 31 3:30 PM - 5:00 PM
Acute Effects of Blood Flow Restriction Resistance Exercise in a Head-down Tilt Position on Growth Hormone and Insulin-like Growth Factor-I Release

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Muscular atrophy is common among astronauts while in spaceflight. Growth Hormone (GH) and IGF-I are key hormones with regards to the preservation and growth of skeletal muscle tissue. Low intensity blood flow restriction (BFR) resistance exercise is a newer training modality employed to various populations to enhance muscle growth, yet has not been thoroughly explored in the astronaut population. **PURPOSE:** To determine the effects of low intensity BFR in a head-down tilt position on the acute release of GH and IGF-I. **METHODS:** Twelve college-aged males with resistance exercise experience were included in the study. The first of three sessions consisted of informed consent, demographic measurements, and 3RM testing. The two experimental sessions consisted of subjects resting in a -6 deg head-down tilt position for 2 hr. Upon rest completion, while tilted, subjects performed the exercise protocol at 30% of estimated 1RM for the following exercises: close-grip bench press, dumbbell bicep curls, and dumbbell triceps extensions. Exercises were performed with or without BFR (160 mmHg) to the upper arms in a counterbalanced order. Venus blood draws (15 mL) occurred 10 min prior to tilt, 10-15 min post exercise protocol, and 24 hr post exercise protocol and were assayed in duplicate. Two 2 x 2 Factorial ANOVAs with repeated measures were utilized for statistical analysis of the dependent

variables (GH, IGF-I). Alpha levels were set at $p < 0.05$. **RESULTS:** A significant interaction was found between exercise condition and time for GH ($p < .05$). No significant interaction was found between exercise condition and time for IGF-I ($p > .05$). No significant mean difference was observed between BFR and no BFR for IGF-I ($p > .05$). A significant mean difference was observed pre to post exercise protocol for IGF-I ($p < .05$). **CONCLUSION:** A low intensity BFR exercise protocol in a head-down tilt position elicited a large increase in systemic GH concentrations from pre to post exercise. Post exercise GH levels were elevated to a much greater extent with BFR compared to no BFR. A low intensity BFR modality may be beneficial to employ to astronauts while in spaceflight or post spaceflight to help promote muscular tissue growth.

1054 Board #233 May 31 3:30 PM - 5:00 PM
Peripheral Chemosensitivity is Not Blunted during Head Out Water Immersion

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 (No relationships reported)

Carbon dioxide (CO₂) retention occurs during water immersion. The peripheral chemoreceptors contribute to ventilatory control and the rise in ventilation (V_E) during hypercapnia. However, it is unclear if peripheral chemoreceptor control of V_E is altered during water immersion.

PURPOSE: We tested the hypothesis that peripheral chemosensitivity (PCS) is blunted during head out water immersion (HOWI).

METHODS: We assessed PCS to hypoxia (PCS_{O₂}) and hypercapnia (PCS_{CO₂}) in 6 participants (age: 23 ± 3 y, BMI: 27 ± 2 kg/m², 3 women) during two randomized trials: a time-control dry trial (DRY) and a thermoneutral (35 ± 0°C) HOWI trial. PCS_{O₂} and PCS_{CO₂} were assessed at baseline, and at 10, 60, and 120 min of DRY or HOWI. V_E, arterial oxygen saturation (%SaO₂), and the partial pressure of end tidal CO₂ (PETCO₂) were recorded continuously. For the PCS_{O₂} test, participants inhaled 2-6 breaths of 100% N₂, followed by 3 min of room air breathing, 4 separate times. For the PCS_{CO₂} test, participants inhaled 1 breath of 13% CO₂, 21% O₂, and 66% N₂, followed by 3 min of room air breathing, 4 separate times. We determined the mean of the three highest consecutive V_E values, the lowest %SaO₂, and the peak PETCO₂ within 2 min following each hypoxic or hypercapnic administration. The PCS_{O₂} and PCS_{CO₂} data are reported as the slope of the linear regression line of V_E vs. %SaO₂ or PETCO₂, respectively.

RESULTS: V_E was not different between HOWI and DRY (condition main effect: $p = 0.12$). PETCO₂ was higher during HOWI vs. DRY at 10 (45.9 ± 2.2 vs. 43.9 ± 1.7 mmHg, $p = 0.01$), 60 (46.0 ± 2.6 vs. 43.7 ± 1.8 mmHg, $p = 0.005$), and 120 min (45.9 ± 2.5 vs. 44.0 ± 2.4 mmHg, $p = 0.01$). PCS_{O₂} was not different between HOWI and DRY (baseline: 0.41 ± 0.34 vs. 0.69 ± 0.44; 10 min: 0.40 ± 0.46 vs. 0.71 ± 0.57; 60 min: 0.33 ± 0.17 vs. 0.57 ± 0.59; and 120 min: 0.57 ± 0.29 vs. 0.73 ± 0.70 L/min/%SaO₂; respectively, condition main effect: $p = 0.20$). PCS_{CO₂} was not different between HOWI and DRY (baseline: 0.07 ± 0.04 vs. 0.06 ± 0.03; 10 min: 0.06 ± 0.03 vs. 0.06 ± 0.01; 60 min: 0.08 ± 0.04 vs. 0.06 ± 0.03; and 120 min: 0.08 ± 0.02 vs. 0.07 ± 0.02 L/min/mmHg; respectively, condition main effect: $p = 0.63$).

CONCLUSION: These data indicate that PCS_{O₂} and PCS_{CO₂} are not blunted during thermoneutral HOWI while breathing room air. Therefore, CO₂ retention during HOWI does not appear to be due to alterations in PCS.

1055 Board #234 May 31 3:30 PM - 5:00 PM
Effects of Consecutive, Long-Duration Water Immersions on Skeletal Muscle Performance in Well Trained, Male Divers

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PURPOSE: Diving operations may require personnel to be immersed for extended periods while breathing compressed air. The objective of this study was to examine the effects of resting, consecutive long-duration water immersion (WIs) at 1.35 atmospheres absolute (ATA) on neuromuscular performance in multiple muscle groups. We hypothesized a decrease in neuromuscular performance will occur following five days of consecutive, resting, long-duration WIs. **METHODS:** Fifteen healthy, active male divers completed five consecutive 6-hour resting dives with 18-hour surface intervals while breathing compressed air at 1.35 ATA. Skeletal muscle performance was assessed immediately before and after each WI, and 24 and 72 hours after the final WI. Assessments included maximum voluntary isometric contractions (MVIC), maximal isokinetic (IK) contractions, maximum handgrip (MHG), and surface electromyography (sEMG) of the vastus lateralis, rectus femoris, vastus medialis, biceps brachii, and brachioradialis. **RESULTS:** MVIC knee extension peak

torque decreased by 6% ($p=0.001$) with an associated 7% increase in rectus femoris activation ($p=0.048$) by day 3. IK knee extension peak torque increased by 11% and 5% post-WI compared to pre-WI on days 3 and 5 ($p<0.001$), respectively, with increased quadriceps sEMG activation ($p<0.001$). However, an overall 3% decrease in torque production occurred on day 5 ($p=0.015$). MVIC elbow flexion peak torque decreased by 2% ($p=0.014$) on day 3 with an associated 12% decrease in biceps brachii sEMG activation ($p=0.001$); both metrics fully recovered by day 5. Biceps brachii sEMG activation increased 3% and 9% during IK elbow flexion on days 3 and 5 ($p<0.001$), respectively, with no change in torque production. MHG force output decreased 5% and 2% on days 3 and 5 ($p<0.001$). Brachioradialis sEMG activation increased by 5% on day 3 ($p=0.005$) and remained elevated through 72-hr post-WI ($p<0.001$). All muscle performance metrics equaled or exceeded baseline levels by 72-hr post-WI. **CONCLUSION:** Consecutive, resting, long-duration WIs cause small, but noticeable decrements to neuromuscular activation and performance after three days of WI with an adaptation towards recovery by the end of the WI 5. Further analyses are required to determine the mechanisms involved.

1056 Board #235 May 31 3:30 PM - 5:00 PM
Regional Heat Exchange During a Dry Suit Glove Failure in Cold Water Immersive Diving

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Dry suit failures causing wet hands during cold-water diving can limit manual dexterity, affect comfort, or result in cold injury or hypothermia. While dry suit leaks are a known problem in the field, it is rarely captured and measured in controlled lab settings. **PURPOSE:** We quantified regional heat exchange with a glove leak while diving in cold water with thermal protective equipment in the form of a water-perfused tube suit (WPT). **METHODS:** A healthy male subject was immersed supine, just below the surface of the water (1.3±0.01 °C), for 115 min while wearing a WPT supplied with 37.8°C water and standard passive insulation under a dry suit. There was a slow leak at both wrists, resulting in wet gloves against the skin that was sensed by the subject within 7 min of immersion. The WPT was instrumented to measure 48 water temperatures for regional thermal exchange. Skin temperature (T_s) in 13 regions and rectal temperature (T_r) were measured via thermistors. All data were analyzed after T_s stabilized 30 min into immersion. **RESULTS:** The WPT delivered a linear increase of heat energy (619±26 W). This maintained T_r, which only decreased by ~0.24 °C, and mean T_s, which was stable at 33.3±0.1 °C. T_s including foot, calf, leg, abdomen, chest, upper and lower back, arm, and head remained stable, but forearm, hand, thumb and pinky T_s decreased over time; however, all T_s remained well above tissue injury level with the coldest being the pinky, which was ~22.3 °C at the end of the immersion. The WPT delivered the following mean proportions of heat (all ±1%): head=10%, chest=8%, back=14%, arms=12%, forearms=9%, hands=12%, anterior leg/lower leg=8/5%, posterior leg/lower leg=10/5%, and feet=6%. The leak caused 12% of heating resources to be devoted to hands, which made up only 3% of body surface area. **CONCLUSION:** For the first time, regional heat exchange was quantified with a specially designed WPT during a common cold-water diving scenario in which there is a leak wetting the hands. T_r and T_s remained in safe limits and/or unchanged as a result of heat delivery supplied by the WPT. Importantly, the forearm, hand and finger regions were successfully kept warm by the WPT despite the leak. However, there was a 2.7-fold larger amount of heat required per unit surface area to the wet hands than to the dry extremities - the feet. Supported by NAVSEA N0002416WX02277

1057 Board #236 May 31 3:30 PM - 5:00 PM
Rear Suspension Decreases Vibration and Impact Transmission in Manual Tilt-in-Space Wheelchairs

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Vibration and impact experienced by wheelchair users is a detriment to both comfort and health. However, manufacturers of manual tilt-in-space wheelchairs do not provide chairs with suspension. A rear-wheel aftermarket suspension system is now available for these chairs. **PURPOSE:** The goal of this study was to examine the vibration and impact reducing characteristics of rear suspension on manual tilt-in-space wheelchairs. **METHODS:** Four manual tilt-in-space wheelchair users with chairs equipped with rear suspension volunteered for the study (3 with cerebral palsy, 1 with quadriplegia; age = 27.7±7.0 yrs; height = 162±24 cm; mass = 50.2±17 kg (mean±SD)). Subjects were pushed by a trained caregiver over four different surfaces in both their suspended chair and a similar rigid chair. Surfaces included a 1) building exit door with elevated threshold followed by new concrete sidewalk with regularly spaced expansion seams, 2) section of fractured asphalt, 3) road crossing with bubbled transition ramp from sidewalk, and 4) pea gravel. Rigid chair trials were completed

first. Three acceptable trials were collected in each condition. Suspension chair trials needed to be within 0.5 sec (on average) of the matched rigid chair trials. A tri-axial accelerometer was mounted to the rear of the wheelchair seatpan with signals sampled at 2k Hz. Peak resultant accelerations were analyzed from surface 1, root mean square (RMS) resultant accelerations were analyzed from surfaces 2-4. **RESULTS:** Peak accelerations when the rear wheel traversed the door threshold and expansion seams of section 1 were significantly reduced from 47-79% in the suspended chair ($p < 0.011$). Peak accelerations at the front wheel were also reduced with rear suspension, but not to the same extent (p not consistently < 0.050). RMS accelerations were significantly reduced by 50% over surfaces 2 & 3 ($p = 0.013$ and $p = 0.050$, respectively), and 56% over surface 4 ($p = 0.002$) with rear suspension. **CONCLUSION:** Aftermarket rear suspension significantly reduces vibration and impact transmission of rough surface conditions to the users of manual tilt-in-space wheelchairs. The reduced accelerations most likely improve both comfort and health outcomes of users (e.g., low-back pain, neck pain, muscle ache and fatigue).

1058 Board #237 May 31 3:30 PM - 5:00 PM

Long-duration Spaceflight And Latent Viral Reactivation Alter Plasma Antimicrobial Protein Concentrations.

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Long duration spaceflights have been associated with profound dysregulation of the immune system and latent viral reactivations, which could jeopardize crew safety and mission success. The dearth of information on the impact of long duration spaceflight on innate immunity raises concerns on crewmembers' ability to fight infections during a mission. **Purpose:** To determine the effects of spaceflight on plasma antimicrobial proteins (AMPs) and reactivation of latent herpesviruses. **Methods:** Plasma, saliva and urine samples were obtained from 23 crewmembers who spent 6-months on the International Space Station (ISS). Samples were collected before flight, during (Early flight, Late Flight), immediately upon return to Earth (R+0) and 30 days following return (Recovery). Plasma Albumin, LL-37, HNP 1-3 and lysozyme concentrations were determined by ELISA. Saliva Epstein-Barr virus (EBV), varicella zoster virus (VZV) and urine cytomegalovirus (CMV) DNA levels were quantified by Real-Time PCR. Maximum likelihood linear mixed models (LMM) were used to determine main effects of time, and viral shedding status on the concentration of each AMPs. **Results:** The levels of viral EBV DNA were significantly higher during flight than at baseline, and VZV DNA concentrations increased during and after flight when compared to pre-flight level. CMV DNA level did not change during flight, but significant increased upon return on earth and during recovery, compared to baseline and in-flight viral concentrations. The magnitude of CMV reactivation after return was associated with reductions in plasma LL-37 concentrations, while EBV and VZV reactivations during the early stages of the missions preceded HNP1-3 and Lysozyme increases during Late flight. Following return on Earth and during recovery, HNP1-3 and Lysozyme concentrations were associated with EBV and VZV viral DNA levels, reducing the magnitude of viral reactivation. **Conclusion:** Innate immunity appeared to be partially restored after 6-months in space and the release of plasma HNP1-3 and Lysozyme enabled the reduction of EBV and VZV reactivation rate and magnitude. However, the landing-associated decline in plasma LL-37 is likely to enhance the rate of CMV reactivation in Astronauts following spaceflight, potentially compromising crewmember health after landing.

1059 Board #238 May 31 3:30 PM - 5:00 PM

Facilitation of Paraspinal Muscles with Kinesio® Tape During Exercise Countermeasures

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Declines in skeletal muscle function and physiological deconditioning during spaceflight have been well documented, giving way to exercise countermeasures such as the Advanced Resistive Exercise Device (ARED). Because of the high loads placed on the spine, a pitfall to using ARED is the possibility of paraspinal muscle overload leading to injury. Enhancing the force production capability of the paraspinal muscles during exercise may help mitigate concern and maintain exercise form.

PURPOSE: To examine Kinesio® Tape as an intervention to facilitate the paraspinal muscles during back squat.

METHODS: Thirty-two healthy subjects (age = 34.4 ± 7.9 yrs) completed a maximal voluntary isometric contraction (MVC) for back squat (control). Subjects completed

two sets of eight repetitions at 70% of their MVC. To examine the effect Kinesio® Tape during exercise while controlling for fatigue, subjects were randomized to two conditions: tape applied during the first set (N=16) or second set (N=16). Prior to each set, an additional MVC was obtained to explore peak force and rate of force development (RFD) with tape. Joint markers were placed on subjects to analyze hip and knee angles. For MVC, a repeated measures ANOVA was completed with Bonferroni adjustment to examine differences between conditions. Paired t -tests were completed to examine differences in RFD and joint kinematics between the two conditions.

RESULTS: Significant decreases in MVC were observed with and without the application of tape when compared with the control (tape = 92.84 ± 98.88 kg, no tape = 92.68 ± 38.44 kg, control = 96.43 ± 39.97 kg, $p = 0.01$ and $p = 0.02$, respectively). However, no significant differences were observed between conditions in RFD ($p = 0.280$). During the last repetition (i.e. most fatiguing), joint kinematics of the hip (tape = $83.02 \pm 11.98^\circ$, no tape = $84.90 \pm 11.81^\circ$, $p = 0.140$) and knee (tape = $90.90 \pm 10.16^\circ$, no tape = $91.35 \pm 9.24^\circ$, $p = 0.678$) were not significantly different at the lowest point of the squat.

CONCLUSION: The application of Kinesio® Tape to the paraspinal muscles during back squat does not enhance peak force, rate of force production, or alter exercise form. However, future studies in deconditioned participants may warrant further investigation especially for application in long-duration spaceflight.

Support ND Space Grant Consortium

1060 Board #239 May 31 3:30 PM - 5:00 PM

Submaximal Exercise Responses Before and During Long Duration Space Flight

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PURPOSE: To document the cardiopulmonary responses to submaximal exercise during long-duration International Space Station (ISS) missions. **METHODS:** Astronauts ($n = 14$) assigned to ISS missions (range: 91-192 d) performed cycle exercise testing ~90 d before launch, ~15 d after launch and every ~30 d thereafter. Peak oxygen consumption (VO_{2pk}) data were previously reported (Moore, et al, 2014). Heart rate (HR, ECG), and oxygen consumption (VO_2 , Portable Pulmonary Function System, DAC, Denmark) were measured at rest and during 5-min work rates prescribed to elicit 25, 50, and 75% of preflight VO_{2pk} . Cardiac output (Q, Freon 22/SF6 technique) was measured at rest and the 25 and 50% stages. Stroke volume (SV) and arterial-venous oxygen difference ($a-v O_2d$) were calculated. Inflight outcomes were compared to preflight values using mixed-model linear regression with preflight body weight as a covariate. To account for multiplicity, significance thresholds for P values were adjusted (Hochberg procedure). No time trend during flight was evident, thus inflight data are reported as a single outcome. **RESULTS:** During spaceflight, neither resting VO_2 (Pre: 0.41 ± 0.12 , In: 0.33 ± 0.07 L/min; Mean \pm SD) nor HR (Pre: 71 ± 10 , In: 69 ± 11 bpm) differed from preflight, but resting Q (Pre: 5.8 ± 0.9 ; In: 7.6 ± 0.9 L/min) and SV (Pre: 83 ± 19 , In: 112 ± 21 ml/beat) were higher while resting $a-v O_2d$ was lower (Pre: 7.0 ± 2.0 , In: 4.4 ± 0.8 ml O_2 /100 mL). During exercise, VO_2 was lower at the 25% stage during flight (Pre: 0.95 ± 0.19 , In: 0.81 ± 0.14 L/min), but did not differ from preflight during any other exercise stage. Inflight HR did not differ from preflight in the 25% stage (Pre: 88 ± 11 , In: 89 ± 14 bpm), but HR was elevated during the 50% stage (Pre: 113 ± 15 , In: 122 ± 16 bpm) and the 75% stage (Pre: 147 ± 16 , In: 158 ± 16 bpm). In contrast to rest, exercise Q and SV did not differ from pre-flight, although $a-v O_2d$ was reduced during both the 25% stage (Pre: 9.8 ± 0.8 , In: 7.7 ± 0.5 ml O_2 /100 mL) and the 50% stage (Pre: 12.8 ± 0.9 , In: 10.2 ± 0.8 ml O_2 /100 mL). **CONCLUSION:** Lower VO_2 during the 25% stage on ISS may result from reduced metabolic cost of pedal upstroke. Maintained exercise Q and SV during flight suggest central cardiovascular factors did not limit submaximal exercise at these levels. Lower $a-v O_2d$ during flight may be related to altered blood flow distribution in space.

1061 Board #240 May 31 3:30 PM - 5:00 PM

Metabolic and Cardiovascular Indicators of Intensity and Performance during Astronaut Related Test Battery

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The deconditioning of astronauts from weightlessness exposure in space may limit their ability to complete a variety of occupational relevant tasks efficiently upon landing, especially when confined within a space suit of additional mass. The tradeoff between task specificity and intensity will be important to predict the potential completion times of these tasks. **PURPOSE:** Compare task specific metabolism

and determine if a simple cardiovascular indicator (i.e., resting heart rate, HR) can be used to predict total time-to-completion during an astronaut related test array. **METHODS:** Eight, healthy participants wore a 48-kg weight suit and completed six occupationally relevant tasks. Tasks included hatch opening (HO), hand drilling (HD), construction wrenching (CW), a half-mile walk (HM), sample collection (SC), and dragging a crewmember to safety (DC). Total completion time for the array was calculated by summing each task's completion time. The metabolic demands of each task were recorded using a metabolic cart. One-way ANOVAS were used to identify differences in VO_2 , VCO_2 , RER, VE, and RR between HO, HD, CW, and HM, as well as differences in post HR between all tasks. Tukey Post-Hoc tests were used to distinguish specific task differences. Linear regression was used, with an enter method, to predict total time-to-completion from resting HR values. **RESULTS:** The peak VO_2 of HD was significantly lower than both CW ($p = .002$) and HM ($p = .001$). The peak VCO_2 of HD was significantly lower than HO ($p = .025$), CW ($p = .029$), and HM ($p = .004$). Mean RER for HO was significantly higher than both CW ($p = .024$) and HM ($p = .022$). No significant differences were observed for VE ($p = .082$) and RR ($p = .941$), and post HR ($p = .087$). Resting HR was a significant predictor ($p = .027$) of total time-to-completion. **CONCLUSIONS:** Occupational tasks in a weighted suit showed a variety of metabolic characteristics and alterations in fuel sources. The resting HR of subjects significantly predicted the total time-to-completion of an astronaut relevant test array performed within a weighted suit in 1G. Resting HR can be easily monitored in novel environments and may be a useful tool for determining an astronaut's physical activity readiness for space relevant tasks.

Supported by ND NASA ESPCoR

1062 Board #241 May 31 3:30 PM - 5:00 PM
Heart Rate and Blood Pressure Regulation before and after 60 Days of Bed Rest

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PURPOSE: To test the hypothesis that the regulation of heart rate (HR) and mean blood pressure (mBP) in response to moderate work rate (WR) changes differs before and after 60 days of bed rest. **METHODS:** Twenty-two male subjects (mean \pm SD): 29 \pm 6 years, 181 \pm 6 cm, 77 \pm 7 kg) were tested using a moderate WR protocol with pseudo-random binary sequences (PRBS) between 30W and 80W on an upright cycle ergometer before and after 60 days of 6° head down tilt (HDT) bedrest. Eleven of the twenty-two subjects participated in a near-daily reactive jump training intervention during bed rest, using a horizontal sledge jump system (TRAIN). The other 11 subjects served as a control group (CTRL). The test was performed 9 days before the HDT period (BDC-9) and 2 days after (R+2) reambulation. HR and mBP were measured beat-to-beat during the cycle ergometer test and kinetics responses were calculated via time-series analysis. Higher maxima of the cross correlation function between WR and the respective parameter (CCF_{max}) indicate faster kinetics responses. ANOVA with the factors 'group' and 'point in time' combined with LSD post hoc tests were applied to calculate differences in kinetics between sessions as well as absolute values of HR and mBP during the PRBS. **RESULTS:** Significant effects were identified for point in time for the parameters CCF_{max} (HR) (BDC-9: 0.328 \pm 0.093, R+2: 0.273 \pm 0.062; $P = 0.020$) and CCF_{max} (mBP) (BDC-9: 0.237 \pm 0.069, R+2: 0.338 \pm 0.134; $P = 0.009$), but not for point in time x group or group. Absolute values of HR during the PRBS (point in time: $P = 0.001$, point in time x group: $P = 0.002$, group: n.s.) were significantly higher at R+2 compared with BDC-9 (101 \pm 12 min^{-1} vs. 115 \pm 12 min^{-1} , $P < 0.001$), but only in the CTRL group. For the absolute mBP values a significant effect for 'point in time' (100 \pm 12 mmHg, $P = 0.029$) but not for point in time x group or group was found. **CONCLUSION:** 60 days of bed rest affected the kinetics response to moderate WR changes during upright cycling, but differently for HR and mBP kinetics. As indicated by the higher absolute HR values during the PRBS, sympathetic nervous system activity might have increased after bed rest. This could have slowed HR kinetics and, as a result of the baroreceptor reflex, accelerated mBP kinetics.

1063 Board #242 May 31 3:30 PM - 5:00 PM
Baroreceptor Unloading Attenuates the Increase in Blood Pressure Elicited by Prolonged Face Cooling

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Purpose: We tested the hypothesis that baroreceptor unloading does not interfere with the magnitude of blood pressure elevation elicited by prolonged face cooling. **Methods:** Ten healthy subjects (age: 22 \pm 2 y, 6 females) completed two trials in which a 2.5 L bag of ice water (0 \pm 0°C) was placed over their cheeks, eyes, and

forehead for 15 min. On separate days, face cooling was carried out in the absence of (REST) and during 30 mmHg lower body negative pressure (LBNP). In REST, face cooling began after 10 min of supine rest, while in LBNP face cooling began following 6 min of lower body negative pressure. Blood pressure (Finometer), heart rate (ECG), stroke volume (Modellflow), cardiac output, total peripheral and cutaneous vascular resistances, and forehead temperature were measured. Data are presented as 1 min averages prior to face cooling and during the final minute of face cooling.

Results: During face cooling, reductions in forehead temperature did not differ between REST (-21.2 \pm 3.7°C) and LBNP (-22.8 \pm 2.0°C, $P = 0.17$). Mean arterial pressure before face cooling was lower in LBNP (78 \pm 11 mmHg) compared to REST (83 \pm 9 mmHg, $P = 0.02$). The magnitude of increase in mean arterial pressure with face cooling was attenuated in LBNP (+12 \pm 14 mmHg vs. +22 \pm 10 mmHg, $P = 0.03$). Heart rate was higher and stroke volume was lower before face cooling in LBNP (85 \pm 23 bpm, 77 \pm 18 mL) compared to REST (62 \pm 13 bpm, 97 \pm 18 mL, $P < 0.01$). During face cooling, stroke volume remained lower in LBNP (90 \pm 27 mL vs. 107 \pm 23 mL, $P = 0.02$), but heart rate was not different (LBNP: 67 \pm 10 bpm, REST: 64 \pm 12 bpm, $P = 0.68$). Cardiac output did not differ between trials before face cooling (REST: 5.9 \pm 1.4 L/min, LBNP: 6.3 \pm 1.4 L/min, $P = 0.39$) but was lower in LBNP during face cooling (5.8 \pm 1.4 L/min vs. 6.7 \pm 1.7 L/min, $P = 0.04$). Total peripheral (REST: 14.8 \pm 4.0 mmHg/L/min, LBNP: 13.0 \pm 3.7 mmHg/L/min, $P = 0.24$) and cutaneous vascular (REST: 2.7 \pm 1.4 mmHg/PU, LBNP: 3.1 \pm 1.7 mmHg/PU, $P = 0.93$) resistances before face cooling were not different between trials and increases in resistance during face cooling did not differ between REST (+2.1 \pm 3.7 mmHg/L/min, +1.4 \pm 1.6 mmHg/PU) and LBNP (+3.3 \pm 3.8 mmHg/L/min, +0.2 \pm 0.9 mmHg/PU, $P < 0.11$).

Conclusion: Baroreceptor unloading, induced by LBNP, attenuates increases in blood pressure elicited by prolonged face cooling. Supported by a UB IMPACT award

B-71 Free Communication/Poster - Ergogenic Aids II
 Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
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1064 Board #243 May 31 3:30 PM - 5:00 PM

Short Bouts Of Resistance Training Reduces Lipid Metabolism Disparities In T2d Offspring In 6 Weeks

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Having a family history of diabetes (FH+) increases type 2 diabetes (T2D) risk, and is associated with metabolic flexibility, and mitochondrial dysfunction. However, the mechanisms underlying these differences remain elusive. Exercise has a protective effect on metabolic health and mitochondrial function, and we have shown resistance training (RT) can improve fasting glucose in FH+ and those with no family history of T2D (FH-) similarly. However, little is known about the impact of RT on lipid metabolism in the FH+ population.

Purpose: To evaluate markers of lipid metabolism in FH+ and FH- before and after 6 weeks of RT.

Methods: 10 healthy FH- and 13 healthy FH+ age and gender matched men and women participated in 6 weeks of RT, ~10 min/session, 5 days/week, including full-body, plyometric and core exercises on alternate days. Fasting plasma samples were collected prior to, and after 6 weeks of RT for triglycerides (TG), non-esterified fatty acids (NEFA) and acylcarnitine (AC) determination, followed by an oral glucose challenge (OGC, 50g glucose).

Results: No baseline differences in strength, fasting glucose, OGC area under the curve (AUC), body weight, or circulating TG and insulin were noted between groups. Though, FH+ displayed lower circulating NEFA (276 \pm 37 vs 412 \pm 44 mM for FH+/-, $p < 0.04$), and had lower medium chain (C8-1, C10:1, C14-2, C14-1; $p < 0.04$) and higher long-chain AC (C16:2, C18-2, C18-1 (μM , $p < 0.05$) compared to FH- prior to RT. NEFA and fasting glucose declined (32.1 and 6.8% respectively) overall with RT ($p < 0.05$) with no difference in changes between groups ($p = 0.33$ and 0.55 respectively). Though AC did not change differently between groups with RT, only C18-1 remained different between FH+ and FH- post-RT. Changes in AC were positively correlated with change in NEFA in FH+ (C8:1-OH/C9, C3-DC/C8-OH, C10-OH/C5-DC, C12/C6:1-DC, C12:1-OH, C14-2, C14-1, C18:2-OH; $r > 0.6$, $p < 0.04$), but not in FH-.

Conclusions: Healthy young FH+ display a fasting AC profile different than FH-, suggesting alterations in fat metabolism that may contribute to increased T2D risk. These disparities in AC profiles were diminished after RT, suggesting that 6 weeks of short RT bouts normalizes lipid metabolism in FH+. RT may protect against impaired lipid metabolism in FH+, thereby protecting against T2D.

1065 Board #244 May 31 3:30 PM - 5:00 PM

Caffeine and Sprint Cycling Performance: The Influence of Torque Factor and Sprint Duration

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PURPOSE: The aim of this study was to investigate the effects of caffeine supplementation on sprint cycling performance and how those effects are influenced by torque factor and sprint duration. **METHODS:** 13 recreationally active men (age: 20 ± 2 years; height: 1.78 ± 0.06 m; body mass: 75.3 ± 7.6 kg) completed nine trials on an electromagnetically-braked cycle ergometer. In Trial 1, participants completed a series of 6 s sprints (separated by 5 min passive recovery periods) at progressively increasing torque factors (0.4 - 1.25 N·m·kg⁻¹), to determine the torque factor (for each individual) which elicited the highest peak power output (T_{OPTIMAL}). The remaining trials followed a counterbalanced randomised design in which torque factor (0.8 N·m·kg⁻¹ versus T_{OPTIMAL}), sprint duration (10 s versus 30 s), and supplementation (caffeine versus placebo) were manipulated such that all possible combinations of conditions were experienced by each participant. One hour before trials 2 - 9, participants ingested a gelatine capsule containing 5 mg·kg⁻¹ of either caffeine or placebo (maltodextrin). **RESULTS:** There was a significant effect of torque factor on peak power output (PPO) ($F_{(1,12)} = 188.3; p < 0.001$), with higher values at T_{OPTIMAL} (mean difference: 168 W; 95% likely range: 142 - 195 W). There was also a significant effect of sprint duration on PPO ($F_{(1,12)} = 11.4; p = 0.006$), with values being higher in 10 s sprints (mean difference: 52 W; 95% likely range: 18 - 86 W). However, there was no effect of supplementation on PPO ($F_{(1,12)} = 4.5; p = 0.056$). Nevertheless, there was a significant torque factor × sprint duration × supplement interaction ($F_{(1,12)} = 5.5; p = 0.036$), with *post hoc* tests revealing that caffeine produced a significantly greater PPO (mean difference: 76 ± 75 W; 95% likely range: 19 - 133 W) only when the sprint duration was 10 s and the torque factor was T_{OPTIMAL}. **CONCLUSIONS:** The results of this study confirm previous reports of significant effects of torque factor and sprint duration on PPO. Moreover, when torque factor and sprint duration are optimised to allow participants to express their highest PPO there is a clear effect of caffeine on sprinting performance.

1066 Board #245 May 31 3:30 PM - 5:00 PM

Caffeine's Effects on an Upper Body Resistance Exercise Strength Workout

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Purpose: The purpose of this study was to examine the effects of caffeine on an upper body resistance training strength workout using the barbell bench press.

Methods: Fifteen men ($M \pm SD$, age: 23.1 ± 1.9 years; body mass: 89.1 ± 13.9 kg; height: 175 ± 6.1 cm), volunteered for three laboratory visits. During visit one, 1RM values were determined. For visit two, subjects consumed either 800 mg caffeine, or a placebo. Subjects then completed three sets of the barbell bench press to failure at 80% 1RM. Visit three was the same as visit two; however, participants consumed the opposite treatment as visit two.

Results: Participants completed significantly more average repetitions per set for the barbell bench press in the caffeine condition ($M \pm SD = 4.80 \pm 2.66$ repetitions) compared to the placebo condition ($M \pm SD = 4.42 \pm 2.56$ repetitions).

Conclusions: These results suggest that caffeine has a positive ergogenic effect on upper body strength workout performance.

1067 Board #246 May 31 3:30 PM - 5:00 PM
The Effect of Coffee or Advocate's Spark on Anaerobic Performance and Isometric Strength

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PURPOSE: The purpose of this study was to determine if caffeine in the form of coffee or Advocate's Spark would increase performance in anaerobic exercise and isometric strength.

METHODS: Subjects (N = 16) completed three testing sessions on non-concurrent days. Each trial consisted of a standard warm up followed by a 600 yard shuttle run, a maximal grip strength test, and an isometric front plank to exhaustion. The first trial was a control trial where caffeine was absent and served as a baseline. A cross over design was used, and subjects completed two additional trials: one with coffee and the other with Advocate's Spark. The amount of caffeine given to each participant was 4 mg/kg body weight.

RESULTS: A MANOVA was run to determine if significant differences existed in isometric strength or anaerobic exercise with the use of Advocate's Spark or coffee. The use of coffee or Advocate's Spark showed no significant ($p > .05$) effect on 600 yard shuttle time when compared to the control trial ($F = 1.256$). ($M = 123.65 \text{ s} \pm 42.43 \text{ s}$; $M = 121.73 \text{ s} \pm 38.92 \text{ s}$; $M = 123.64 \text{ s} \pm 37.49 \text{ s}$ respectively) The use of coffee or Advocate's Spark showed no significant ($p > .05$) effect on plank time to exhaustion when compared to the control trial ($F = 2.347$). ($128.89 \text{ s} \pm 60.30 \text{ s}$; $M = 120.44 \text{ s} \pm 53.54 \text{ s}$; $M = 111.10 \text{ s} \pm 48.97 \text{ s}$, respectively) The use of coffee or Advocate's Spark showed no significant effect on grip strength when compared to the control trial ($F = 1.289$). ($M = 45.44 \text{ kg} \pm 12.90 \text{ kg}$; $M = 45.44 \text{ kg} \pm 13.30 \text{ kg}$; $M = 43.81 \text{ kg} \pm 14.02 \text{ kg}$, respectively)

CONCLUSIONS: The use of caffeine did not significantly increase performance in either anaerobic exercise or isometric strength. While many studies have shown that caffeine will have a positive effect on exercise performance, the present study may not have provided a great enough dose of caffeine to elicit a positive response. Caffeine consumption greater than 4mg/kg may be necessary to elicit improvements in anaerobic performance & isometric strength.

1068 Board #247 May 31 3:30 PM - 5:00 PM

Caffeine Mouth Rinse Does Not Affect Sweating Rate And Performance In Runners

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Caffeine plays ergogenic effects improving the physical performance. On the other hand, caffeine supplements and foods can affect sweating rate impairing the performance. **PURPOSE:** To examine the effects of caffeine mouth rinses on sweating rate and performance in runners.

METHODS: Ten runners completed two experimental trials performed in acute 10 km test in a double-blind, crossover and placebo controlled design. All subjects are > 18 years old (30.1 ± 6.4 y) and according to DEXA, the fat mass percentage is 19.3. Treatments were placebo or caffeine anhydrous power, separated by a washout time 7d. Athletes were instructed to maintain physical activity and normal diet restricted in caffeine for two days before experimental trial. The running was immediately started after 10 seconds of mouth rinses either caffeine or placebo. The measurement of the sweating rate and performance were evaluated by formula and time record, respectively. Student's t test was applied to evaluate probable difference between placebo and caffeine.

RESULTS: Sweating rate (mL/min) was not different among placebo (16.1 ± 9.6) and caffeine (12.9 ± 6.8) groups ($p = 0.399$). Moreover, time running (min) also does not shown statistical difference, 46.8 ± 5.2 in placebo and 47.0 ± 6.3 in caffeine group ($p = 0.939$).

CONCLUSIONS: Caffeine mouth rinse does not alter sweating rate and time running in 10 km trial test.

Supported by grant FAPEG, Brazil.

1069 Board #248 May 31 3:30 PM - 5:00 PM
The Effect Of The Cyp1a2 -163 c>A Polymorphism On The Metabolism Of Caffeine And Effect On Performance
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Prior studies suggest that the -163 C > A polymorphism of the Cytochrome P450 (CYP1A2) gene influences the ergogenic effect of caffeine. Although this polymorphism has been known to influence the inducibility of hepatic CYP1A2 and the rate of caffeine metabolism, levels of caffeine and/or metabolites were not reported. Thus, a mechanistic link between the polymorphism and the ergogenic effect of caffeine is lacking. **Purpose:** The purpose of the present study was to determine if the CYP1A2 polymorphism (AA homozygotes and C allele carriers) affected caffeine metabolism and subsequent performance. **Methods:** Twenty subjects participated in two 3-km cycling time trials with placebo (all-purpose flour) and caffeine (6mg/kg body weight anhydrous caffeine) supplementation. 'Slow metabolizers' were characterized as possessing a 'C' allele (grouped AC heterozygotes, and CC homozygotes), and 'fast metabolizers' were homozygous for the A allele. **Results:** C allele carriers had significantly higher serum caffeine after one hour (C allele carriers = 14.2 ± 1.8 ppm, AA homozygotes = 11.7 ± 1.7 ppm). While there was a main effect for caffeine ingestion on time trial performance, there was no caffeine x genotype interaction (C allele carriers: Placebo = 297 ± 20 sec, Caffeine = 292 ± 20 sec; AA homozygotes: Placebo = 318 ± 35 sec; Caffeine = 308 ± 22 sec). **Conclusions:** Results from this study suggest that C allele carriers have higher serum caffeine after one hour than AA homozygotes, consistent with the assertion that C allele carriers exhibit slower caffeine metabolism. These findings do not support a genetic influence on the ergogenic effect of caffeine in a 3km cycling trial.

1070 Board #249 May 31 3:30 PM - 5:00 PM
Expression of Strength and Power Relative to Lean Body Mass Impacts Results of Caffeine Intervention
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 (No relationships reported)

Differences in performance tests for strength or power could be attributed to the amount of lean body mass (LBM). So it may be important to report results of such tests not only relative to weight, but also relative to LBM. Depending on their proposed ergogenic mechanism(s), discerning between absolute and relative strength may be even more important in dietary supplement research. **Purpose:** Previously, our lab examined effects of caffeine withdrawal and acute caffeine ingestion, while this current investigation aims to elucidate if the prior results are dependent upon whether strength and power variables are expressed in absolute values or relative to body mass / LBM. **Methods:** Subjects were strength trained, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg). Subjects abstained from caffeine for 4 days, consumed 5mg·kg⁻¹ for 3 days and finally ingested 6mg·kg⁻¹ caffeine or placebo one hour before final testing. Groups were assigned in matched pairs. Isokinetic peak torque (PT), total work, average power, and average PT were tested in the subjects' dominant leg at 60°·s⁻¹, 180°·s⁻¹, and 300°·s⁻¹. Endurance was assessed by 30 reps at 180°·s⁻¹. Isometric PT was measured at 30° and 90° flexion of the non-dominant leg. Absolute performance measures were converted to relative measures by dividing by the subject's body mass, LBM, or LBM of the exercising limb. Data were analyzed with independent or paired t-tests and an alpha of 0.05. **Results:** Caffeine yielded many significant increases in strength and power. However, 5 of these measures were statistically significant in absolute terms, but no longer significant when divided by body mass. Isometric PT at 30° yielded significant results for caffeine supplementation in absolute PT (p=0.042) and relative units (p=0.032), but not when divided by the LBM of the exercising leg (p=0.059). **Conclusion:** This analysis demonstrates that the significant results of a study looking at the effects of acute caffeine ingestion are overestimated when strength variables are reported in absolute units as opposed to relative. Moreover, strength relative to LBM is important to examine changes independent of subjects' %BF. These relative values would then be more associated with differences in neuromuscular stimulation or fatigue irrespective of muscle size.

1071 Board #250 May 31 3:30 PM - 5:00 PM
Effects Of Energy Drink On Power Performance: Meta-analysis
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Energy drinks have been consumed often in the field of sports to enhance power performance. However, the effects of energy drinks are inconsistent in previous studies. **Purpose:** To assess the effects of energy drinks on power performance using meta-analysis. **Methods:** Published English language studies were located from computerized searches of following databases: Academic Search Complete, Education Source, ERIC, MEDLINE, PsycINFO, SPORTDiscus, and Google Scholar. Studies meeting inclusion criteria were: 1) included caffeine containing energy drinks, 2) reported a quantitative measure of power, 3) reported on supplement intervention, 4) published in peer reviewed journals and/or forms of thesis and dissertation from January 2000 to May 2016. Keywords included 'energy drink or red bull or caffeine drink' and 'power or performance'. Two investigators independently collected data from the search engines and coded data for verification. The studies were coded for methodological, participant and study characteristics. The Comprehensive Meta-Analysis version-3 software was used to compute effect sizes (ES) and 95% confidence interval (CI) using a random effects model. ESs were computed based on a comparison of change scores between pre- and post- intervention. Subgroup analyses were conducted to identify moderators (gender, subject type, and dosage of caffeine). **Results:** A total of 30 ESs were derived from the 10 selected studies for meta-analysis. The overall mean ES was small, but significant (Cohen's d (ES) = 0.163, 95% CI = 0.04, 0.29). Subgroup analyses showed that ESs were not affected by any moderator variables. **Conclusion:** Results of the present analysis indicated that the consumption of energy drink slightly improves the power performance. Other moderating variables should be considered so that the effects of energy drink intake can be explored further.

1072 Board #251 May 31 3:30 PM - 5:00 PM
Combined Carbohydrate and Caffeine Mouth Rinsing Enhance Anaerobic Power Output in a Reduced Glycogen State
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Purpose: The aim of this study was to determine the effects of mouth rinsing with carbohydrate and/or caffeine solutions on peak anaerobic power output during sprint cycling under glycogen reduced conditions. **Methods:** In a counterbalanced, double-blind cross over design, eight trained males (age 21.7±0.7 years, weight 70.8±4.2 kg, height 175.6±7.0 cm, percentage body fat 12.1±3.4%) participated in four experimental mouth rinsing trials after signing an IRB-Approved informed consent where they were informed about the risks and benefits associated with the experiment: (1) Mixed carbohydrate and caffeine solution composed of 7.5% sucrose and 2% caffeine (MR-CCAF), (2) Carbohydrate solution (7.5% sucrose) (MR-CHO), (3) Caffeine solution (2% caffeine) (MR-CAF), (4) No rinse (NR). Each trial was performed in the morning, following an overnight fasting, and performed Wingate test (30 seconds, resistance set at 7.5% of body weight). Circulating glucose and lactate levels were measured at the end of each test. **Results:** Blood lactate and glucose were not significantly different between trials. Peak Power was significantly higher in MR-CCAF in comparison with NR (11.12 ± 0.57 Wt/Kg versus 9.12 ± 1.01 Wt/Kg, p=0.043). MR-CAF and MR-CHO were not significantly different from each other or MR-CCAF. MR-CAF tended to be higher than NR (p=0.053), but lower than MR-CCAF (p=0.182) and MR-CHO (p=0.398). **Conclusion:** Combining carbohydrate and caffeine in a mouth rinsing solution improves power output under reduced endogenous carbohydrate conditions.

1073 Board #252 May 31 3:30 PM - 5:00 PM
Caffeine Supplementation Increases Blood Lactate But Not Muscle Endurance - A Balanced Placebo Design Study

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Caffeine (CAFF) is the most consumed psychoactive substance in the world. About 74% of athletes during international competitions use CAFF to improve performance. However, its effect on muscle endurance (ME) is still controversial. Placebo (PLA) effect may also increase performance and interact with CAFF.

PURPOSE: To analyze the physiological and placebo effect of CAFF supplementation on ME using a balanced placebo design (BPD)

METHODS: 16 young men, age 21.4±2.9 yrs, body fat 17.2±4.0%, underwent six exercise sessions: one for familiarization, one as control and four experimental (BPD). At the first session, they were submitted to anthropometric measurements, CAFF consumption questionnaire and one repetition maximum test (1RM) in the parallel squat. At the second session they performed the ME test - 3 sets until exhaustion with 3 min interval between sets using 60%1RM. The last four sessions were: Session C/C: Subject told CAFF and given CAFF; Session C/P: Subject told CAFF but given PLA; Session P/C: Subject told PLA but given CAFF; Session P/P: Subject told PLA and given PLA. Subjects waited 1h20min to execute the ME test after receiving CAFF (5 mg/kg of body weight) or PLA. Work was considered as a product of the weight lifted and repetitions performed. Blood samples were collected for lactate (LA) analysis - at rest, 2, 4 and 6 min after the last set. ANOVA (told x given) was performed with a Bonferroni post-hoc - 5% level of significance.

RESULTS: CAFF consumption was 93.9 ± 88.2 mg/day, 1RM was 134.7 ± 24.1 kg. CAFF did not increase the number of repetitions or total work (p>0.05) - table 1, nor a particular set or work performed during a set. Use of CAFF and expectation of CAFF increased LA (p<0.05).

Session	Sum of repetitions	Total work (kg)	LA 2 nd min (mmol/L)	LA 4 th min (mmol/L)	LA 6 th min (mmol/L)
C/C	36.5±7.8	2998±881.4	10.9±1.5	11.7±1.7	11.8±1.9
P/C	36.6±7.8	2949±741.2	9.9±1.9 §	11.1±2.1	11.3±1.9
C/P	37.3±8.3	3025±847.1	9.7±1.8 §	10.9±1.6	10.6±1.9
P/P	35.0±7.7	2836±795.0	8.9±1.4 §#	9.9±1.7 §	9.6±1.7 §#

LA: Lactate; §: Lower than C/C; Lower than P/P.

CONCLUSION: CAFF did not increase ME in men. LA was affected by both the use of CAFF and the expectation of it. This finding reinforces the need of the BPD when studying CAFF, even when examining physiological variables, because they may be affected by expectation (PLA effect).

1074 Board #253 May 31 3:30 PM - 5:00 PM
Caffeine Withdrawal and Acute Consumption Effects on Reaction Time and Muscular Strength, Power, and Endurance

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(No relationships reported)

Studies on the benefits of caffeine to anaerobic exercise have varied designs and equivocal results. Previous work in our lab has demonstrated positive effects of caffeine using laboratory-based tests. **PURPOSE:** To study the effects of caffeine withdrawal and caffeine supplementation on field tests of power output, muscular strength, endurance, and reaction time. **METHODS:** Physically active, habitual caffeine consumers (n=50; 40 female, 10 male; age: 22±3; mass: 63.9±10.0 kg; average caffeine: 258±128mg) participated in a placebo-controlled intervention. All subjects abstained from caffeine for 4 days prior to withdrawal testing (T1), supplemented with 5mg·kg of caffeine for 3 days and on the final testing day (T2) consumed 6mg·kg of caffeine or placebo (insoluble fiber) one hour before testing. Power was assessed using peak vertical jump height, while muscular strength and endurance were assessed using a handgrip dynamometer. Subjects performed three handgrip trials to determine their maximal voluntary contraction (MVC). They then performed an isometric hold to volitional failure at 40% of their respective MVC. Reaction time was measured using a commercial application for a tablet computer. Data are presented as means ± standard deviation and were analyzed with SPSS 22.0 using either independent or paired t-tests with an alpha of 0.05. **RESULTS:** Following four days of caffeine withdrawal, peak vertical jump height decreased from 17.49±3.70in to 17.00±3.58in (p<0.001). There was a trend for an increase in power output (calculated from vertical jump) in caffeine:

3583.6±893.0W vs placebo: 3120±691W (p=0.065). Following caffeine withdrawal, there was also a trend for reaction time to slow by 0.01415±0.05414 sec (p=0.083). There was no significant difference in handgrip strength or muscular endurance following caffeine withdrawal or acute supplementation. **CONCLUSION:** This study demonstrates that caffeine withdrawal may be detrimental to performance and supplementation provides limited benefit using these chosen field tests. However, our previous findings using an isokinetic dynamometer to assess muscular strength and power provide more conclusive results indicating that caffeine withdrawal can hinder muscular strength and power and that supplementation may provide an acute ergogenic effect.

1075 Board #254 May 31 3:30 PM - 5:00 PM
The Effects of Caffeine and Pre workout Supplementation on Exercise Repetition during Sets and Muscular Endurance

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(No relationships reported)

Previous research has suggested that both caffeine and pre-workout supplementation prior to resistance training may be able to lead to increases in muscular endurance and repetition number. Popular pre-workout supplements can be fairly costly whereas caffeine is an inexpensive supplement found in many natural plant sources. **PURPOSE:** The aim of this study was to compare the effectiveness of caffeine and pre-workout supplementation on resistance exercise performance. **METHODS:** Eighteen healthy young adults (12 males and 6 females, 22.4±1.7 years) were recruited to participate in four separate exercise sessions in which they performed the same workout which consisted of 4 exercises: leg press, chest press, row, and lat pull downs. On day 1 all participants performed a 1-repetition max (1-RM) test for that movement. On days 2-4 each subject was randomly given a placebo, caffeine (260mg) or pre-workout (N.O.-Xplode, BSN, Boca Raton, FL, United States). During each of these sessions participants were asked to perform one set of each movement at 80% of their 1-RM as many times as they could. Participants were given a minimum of 72 hours between each trial session. Significant differences were determined by using repeated measures ANOVA. **RESULTS:** There was no significant difference found between the lat pull downs (Placebo 14.62±5.8, Caffeine 17.1±5.7, Pre-Workout 17.6±5.6 Reps) and chest press (Placebo 9.5±3.0, Caffeine 11.2±3.6, Pre-Workout 10.2±3.2 Reps) trials, however Caffeine and Pre-workout showed a significant (p≤0.05) increase (43% for caffeine & 35% for pre-workout) in the number of repetitions performed in the leg press (Placebo 11.6±6.8, Caffeine 20.25±7.1, Pre-Workout 17.6±6.7 Reps) and row (27% for caffeine & 28% for pre-workout) (Placebo 14.5±5.2, Caffeine 19.75±6.7, Pre-Workout 20.0±7.0 Reps) trials. There was not a significant difference found between caffeine and pre-workout trials. **CONCLUSION:** This data suggests that both caffeine and pre-workout may have a positive effect on exercise performance in multiple muscle group movements, but was less effective in increasing muscular endurance in lat pull downs and chest press.

1076 Board #255 May 31 3:30 PM - 5:00 PM
Caffeine Alters RPE-Based Intensity Production

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(No relationships reported)

This study examined effects of caffeine (CAF) on power output (PO) selection and associated physiological responses during cycling at moderate and high intensities prescribed by RPE (0-10 scale). Participants (n = 9) (VO_{2peak} : 55.4 ± 6.32 mL · kg⁻¹ · min⁻¹) cycled for 20 min at RPE₄ and 20 min at RPE₇, separated by 10 min recovery following caffeine (CAF) (6 mg · kg⁻¹) and placebo (PLA) ingestion. PO, HR, serum lactate [La], VO_2 , V_E , and RER were recorded every 5 min. Session RPE (S-RPE) was recorded following 10 min recovery. Repeated-measures ANOVA's, 2 (trial) x 4 (time pt), showed significantly greater PO during RPE₄ for CAF (130 ± 23 W) vs PLA (112 ± 26 W) and during RPE₇ (CAF: 165 ± 37 vs PLA: 143 ± 41 W). Overall HR, VO_2 , and V_E were significantly greater for CAF vs PLA during RPE₄, RER for RPE₄ and RPE₇ were not significantly different (CAF vs PLA). Overall [La] was significantly greater for CAF during RPE₄ (CAF: 2.32 ± 0.94 vs PLA: 1.73 ± 1.09) and RPE₇ (CAF: 3.22 ± 1.44 vs PLA: 2.22 ± 1.49). Paired T-tests for S-RPE revealed no significant difference for RPE₄ (CAF: 4.0 ± 0.5 vs PLA: 3.7 ± 0.5) or RPE₇ (CAF: 7.1 ± 0.3 vs PLA: 6.9 ± 0.6) despite greater PO for CAF. Although individual responses varied, the current study indicates caffeine ingestion results in elevated self-selected PO with significant systematic changes in associated physiological responses particularly at a higher intensity (RPE₇).

1077 Board #256 May 31 3:30 PM - 5:00 PM
Effects Of Individualised NaHCO₃ Ingestion On Peak Alkalosis
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PURPOSE: Recently it has been suggested, that an individualised sodium bicarbonate (NaHCO₃) ingestion strategy might be the most appropriate method to elicit a state of peak alkalosis. Such a strategy can then be used to "marry up" time to peak alkalosis with the performance required. However, such ingestion strategies have displayed large inter-individual variation (range 10-180 min). Hence, if such a strategy is to be practically applied, the blood analyte response needs to be reproducible. This study aimed therefore, to evaluate the reproducibility of blood pH, HCO₃⁻ and Na⁺ following acute NaHCO₃ ingestion on more than one occasion. **METHODS:** Fifteen team sports players completed six randomised trials entailing ingestion of 0.2 g.kg⁻¹ BM NaHCO₃ twice (SBC2A and B), 0.3 g.kg⁻¹ BM NaHCO₃ twice (SBC3A and B), or two control trials (CON1A and B) on separate days. Blood analysis included pH, HCO₃⁻ and Na⁺ prior to and at regular time points following NaHCO₃ ingestion over a three hour period. **RESULTS:** Compared to pH, a greater relationship for HCO₃⁻ in both time to peak (HCO₃⁻ SBC2 = 0.772, P = 0.003, SBC3 = 0.942, P < 0.001; pH SBC2 = 0.618, P = 0.044 SBC3 = 0.712, P = 0.016) and absolute change (HCO₃⁻ SBC2 = 0.890, P < 0.001, SBC3 = 0.755, P = 0.008; pH SBC2 = 0.842, P = 0.001, SBC3 = 0.624, P = 0.041) was observed. **CONCLUSIONS:** The results indicate that both time to peak and absolute change in HCO₃⁻ are more reliable when compared to time to peak pH. Future work should utilise an individualised NaHCO₃ ingestion strategy based on HCO₃⁻ responses and evaluate the effects on exercise performance.

1078 Board #257 May 31 3:30 PM - 5:00 PM
Impact of Aspartate and Sodium Bicarbonate Supplementation Upon Muscle Contractile Properties within Trained Men
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PURPOSE: To examine the effects of ammonia accumulation and changes in muscle contractile properties in trained men following Aspartate and NaHCO₃ supplementation. **METHODS:** Twelve men (21.9±1.5 yr) ingested 4 conditions all separated by 1 week and included: placebo (PL), L-Aspartate (12.5 mg)(LA), NaHCO₃ (0.3g.kg⁻¹)(SB), or combination of LA and SB (CB). For each day of testing, participants performed one high-intensity exercise session along with a pre- and post-exercise (pre-/post-ex) isometric mid-thigh pull test to measure peak force production (PF) and rate of force development (RFD). Blood was collected for all testing sessions before/after the high-intensity exercise to determine ammonia accumulation (AMM). Exercise sessions consisted of 4 exercises: barbell thrusters, squat jumps, lunge jumps, and forward jumps, with total amount of work being equated for all 4 exercises across all 4 testing sessions. **RESULTS:** Treatments did not differ (p>0.05) for AMM when pooled across pre-/post-exercise (PL=101±89, LA=62±17, SB=45±26, CB=87±86 mmol.L⁻¹), but when pooled across treatments AMM was higher post-ex (86±46 mmol.L⁻¹) than pre-ex (60±51 mmol.L⁻¹) (p=0.004). There was also a trend towards a significant treatment x time interaction (p=0.067) where AMM in PL seemed to rise at a faster rate than in the treatments. There was a trend (p=0.064) for PF when pooled across pre-/post-ex where PL appeared to be greater than LA and CB (PL=3332±664, LA=3143±583, SB=3237±600, CB=3136±571 N), but PF did not differ when pooled across treatments from pre- (3269±655 N) to post-ex (3156±525 N) nor was there a treatment x time interaction (p>0.05). The treatments for RFD did not differ (p>0.05) for RFD when pooled across pre-/post-ex (PL=5527±1648, LA=5019±1249, SB=5327±1505, CB=5092±1238 N.s⁻¹), or between pre-/post-ex when pooled across treatments (pre-ex=5155±1311, post-ex=5328±1389 N.s⁻¹). However, there was significant treatment x time interaction (p=0.019) where the RFD increased in SB and CB, decreased in PL, and did not change in LA. **CONCLUSIONS:** RFD increases with SB supplementation. Additionally, both LA and SB have the potential to reduce post-ex AMM, as does SB in reducing exercise related decline in PF.

1079 Board #258 May 31 3:30 PM - 5:00 PM
The Influence of Alkalosis on Muscle Force and Power in the Triceps Surae and Brachii
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 (No relationships reported)

The effect of metabolic alkalosis on fibre-specific maximal force production and rates of force development (RFD) has been previously investigated in animal models, with evidence suggesting an improved capacity to rapidly develop force in fast- compared to slow-twitch muscle. To date, the fibre-type dependent findings related to pH and rapid force generation have not been replicated in the exercising human. **PURPOSE:** To model *in vivo* the fatigue profile of voluntary and involuntary maximal force and rate of force development in the triceps' surae and brachii after sodium bicarbonate (NaHCO₃) ingestion. **METHODS:** In a double-blind, 3-way repeated measures design participants (n=10) ingested either 0.3 g.kg⁻¹ NaHCO₃ (ALK) or equivalent calcium carbonate (PLA) prior to 2-min of continuous (1Hz) supramaximal stimulation (300ms at 40Hz) of the triceps' surae or brachii, with maximal voluntary efforts (MVT) coupled with direct muscle stimulation also measured at baseline, 1-min and 2-min. **RESULTS:** Metabolic alkalosis was achieved in both ALK trials but was not different between muscle groups. Regardless of condition, involuntary torque declined nearly 60% in the triceps brachii (p < 0.001) and ~ 30% in the triceps surae (p < 0.001). In all trials there was a significant decline in normalised involuntary RFD (p < 0.05). MVT declined nearly 28% but was not different between conditions (p < 0.01), and although declining nearly 21% in voluntary RFD (p < 0.05) there was no difference between PLA and ALK in either muscle group (p = 0.93). **CONCLUSION:** NaHCO₃ exhibited no effect on the fatigue observed between representative fibre-type muscle groups on maximal voluntary and involuntary torque or rates of torque development during and after 2-min of tetanic stimulation.

1080 Board #259 May 31 3:30 PM - 5:00 PM
L-Citrulline Supplementation Did Not Improve Time Trial or Sprint Repeat Performance in Trained Endurance Cyclists
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 (No relationships reported)

L-Citrulline (CIT) is an amino acid that has been shown to act as a nitric oxide donor when ingested, making it appealing to athletes as a dietary supplement. However, there is currently no evidence to suggest that CIT conveys any performance benefit to endurance athletes. **PURPOSE:** To determine whether 7 days of CIT supplementation would improve cycling performance in a time trial (TT) or sprint repeat task (SRT) compared to placebo. **METHODS:** Ten competitive male cyclists (24 ± 4 yr; 181 ± 7 cm; 76 ± 13 kg; 4.09 ± 0.56 L/min VO₂ max) consented to participate in this randomized, double-blind, crossover study design. Baseline evaluation included dual-energy X-ray absorptiometry (DEXA) scans, a maximal oxygen uptake (VO₂ max) protocol on a cycle ergometer, and an SRT familiarization session (6x1-min sprints at 120% max wattage from VO₂ max protocol). Supplementation consisted of 6g/day (three 2g doses) of either CIT or maltodextrin (PLAC) capsules for 6 days. The final 6g dose was given in the lab 2 hours prior to the experimental protocol, which consisted of a 40-km TT on a cycle ergometer, followed 2.5 mins later by the SRT. After a minimum washout period of 7 days, supplementation with the opposite treatment began. The main variables of interest were TT time and the average and maximal pedal force moments (PFM) sustained during the SRT. Other variables measured included heart rate (HR), mean arterial pressure (MAP; TT only), VO₂ (TT only), RPM, and RPE (Borg scale). Statistical comparisons were made using a 2x2 (Trial Number X Supplement) ANOVA, with an alpha level of 0.05. **RESULTS:** There were no significant main effects of supplement, trial, or their interaction for TT time or maximal PFM during the SRT. There was a significant interaction for average PFM during the SRT (P=0.0018) such that subjects taking PLAC for Trial 2 had significantly lower average PFM than those taking either supplement during Trial 1. There was also a significant main effect of supplement on %HR max sustained during the TT, with those taking CIT having significantly higher %HR max than PLAC (P=0.0469). No other variables had significant main effects or interactions. **CONCLUSIONS:** CIT supplementation provided no clear advantage over PLAC for measures of endurance cycling performance or physiological variables.

B-72 Exercise is Medicine®/Poster - EIM - Health Professionals and Vital Signs

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1081 Board #260 May 31 2:00 PM - 3:30 PM

Evaluation Of Exercise is Medicine From The Perspective Of Fitness Professionals

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PURPOSE: Exercise is Medicine (EIM) promotes physicians prescribing exercise and referring patients to fitness professionals (FP). Early focus in research has been on improving the knowledge of physicians on how to prescribe exercise and encouraging physicians to refer patients to FPs, however the receiving end of the referral procedure has not been examined. This mixed method pilot study aimed to identify level of awareness for FPs regarding EIM initiatives and whether a brief educational session enhanced that level of awareness. The second aim was to engage FPs in dialogue to indicate barriers to and enablers of the exercise prescription and referral procedure. **METHODS:** Twelve certified personal trainers employed at a university campus recreation facility with an active EIM on campus group, were recruited to participate in an EIM information session and focus group. Personal trainers completed a pre-information session questionnaire on EIM goals, mission, and contents of the exercise prescription pad. A 15 minute EIM information session was provided and then the same questionnaire was completed again. Immediately after the information session personal trainers participated in a focus group to indicate if problems exist and discuss solutions regarding the EIM goal of engaging FPs and physicians to implement exercise prescription and referrals in the health care system. **RESULTS:** Average score on the pre-information questionnaire (7 questions) was 30% which significantly improved to 82% ($p < 0.05$) after the information session. Thematic analysis of the focus group identified four suggestions: increase communication opportunities between physicians and FPs, increase promotion of EIM to both physicians and FPs, add progression and follow-up details to the EIM prescription pad and increase educational opportunities about EIM for all staff employed at a recreational facility. **CONCLUSION:** EIM should consider increasing opportunities to educate FPs about the EIM initiative so they are better prepared to receive patients referred to exercise and can engage with physicians to promote EIM. Furthermore, by incorporating the suggestions of FPs to enhance the exercise prescription and referral procedure, the effectiveness of EIM for increasing physical activity levels in all populations can improve.

1082 Board #261 May 31 2:00 PM - 3:30 PM
Physical Activity Levels and Counseling Practices of Physicians & Patients in a Chilean Sports Medicine Clinic

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PURPOSE: Promoting physical activity (PA) among physicians and patients is one of the main pillars of Exercise is Medicine® (EIM). The purpose of this study was to evaluate the PA levels of physicians and their patients in a private sports medicine clinic in Santiago, Chile, in which a printed PA prescription and a small box recommending PA as a "medicine", are delivered to all patients. **METHODS:** This study examined responses from 65 physicians (75% orthopedic surgeons) and 2,688 patients. Physicians answered the short IPAQ and questions regarding how often, and how, they recommend PA to their patients. Patients (59.5% men; 40.5% women; between 25-65 years of age) answered an online survey with questions regarding the frequency and duration of their weekly PA levels. **RESULTS:** A small percentage of patients (26.5%) reported practicing PA five or more days per week with 86.7% reporting 30-90 minutes per day. Results from the physicians showed that just 26.1% reached the recommendation of at least 150 min/week of PA, and 55% reported not performing any resistance exercise. The median time sitting and attending patients was 6.1 hours per day. Median frequency of moderate and vigorous PA was 2 days/week for a duration of 45 minutes and 2 days/week and 30 minutes/day, respectively. In regards to their PA counseling attitudes and practices, 66% of the physicians considered it their responsibility to help their patients become physically active, 55% agreed that if they were physically active themselves they will have better capacity to counselling PA, and 40% of the physicians evaluating

the PA levels of their patients and always recommending PA for them. Although 89% of the physicians in the clinic agreed to use PA prescription with their patients, just 50% delivered a written PA prescription.

CONCLUSIONS: From this study, we conclude that physicians who are regularly involved with patients in a sports medicine clinic are aware of the importance of evaluating the PA levels of their patients, but that they need to improve their regular practice of prescribing PA to their patients.

1083 Board #262 May 31 2:00 PM - 3:30 PM

Physician Assistant Students' Perceptions of the Fitness Industry and Lifestyle Medicine

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INTRODUCTION: With nearly two-thirds of all chronic disease having a lifestyle cause, there is spurred interest in curricular changes for Physician Assistants (PA) and other medical providers to learn Lifestyle Medicine (LM) - the therapeutic use of lifestyle changes to prevent, treat and reverse disease. A key competency in LM practice involves an interdisciplinary approach, including aid from fitness professionals. Yet, perceptions of the fitness industry might hinder such a relationship. **PURPOSE:** To assess PA students' knowledge of LM and perceptions of the fitness industry, to guide curriculum implementation efforts. **METHODS:** An online survey was advertised to all PA students at Baylor College of Medicine. Students' competence in assessing and prescribing physical activity and diet, knowledge of LM, current curriculum time spent on LM, and desire to learn more about LM were assessed. Students were also asked to share their attitude of both health clubs and personal trainers, alongside referral perceptions. **RESULTS:** 76 (84%) of students (25.57 ± 4.86 years; 22.77 ± 4.20 kg/m²) completed the survey, self-reporting moderate competence (range: 1-6) in conducting a physical exam to approve an exercise program (4.22 ± 1.22), determining caloric and nutritional needs (3.80 ± 1.34), and designing an exercise prescription (3.57 ± 1.35). However, only 18%, 6%, and 6% self-rated full competence in each, respectively. 31% of students had heard of the discipline of LM, with 43% self-reporting inadequate or poor knowledge. 0% felt they spent enough time on LM in their program, and 78% rated their time spent on LM was either poor or inadequate. Yet, 100% wanted to learn more. Perceptions of health clubs and personal trainers were positive (8.16 ± 1.68 ; range: 1-10), with them being appropriate exercise venues for patients (7.78 ± 1.76). However, only 6% - 16% believed that health clubs and personal trainers were fully qualified, effective, smart, and concerned about patient health. **CONCLUSIONS:** Despite the role of lifestyle on chronic disease, PA students had limited competence and knowledge in LM, but held a unanimous desire for more in their educational training. Perceptions of the fitness industry were generally positive; yet educational efforts might be needed to encourage a team-approach to chronic disease care.

1084 Board #263 May 31 2:00 PM - 3:30 PM

Effectiveness of the Exercise is Medicine Canada Training Workshops on Physician Counselling and Prescription Practice

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PURPOSE: Comparing perceptions and practices around physical activity counselling and exercise prescription in physicians initially and three-months following Exercise is Medicine Canada training. **METHODS:** Initially, physicians (n=113) from 7 provinces completed self-reflection questionnaires. Of that sample, (n=46) physicians completed questionnaires again at three months following the workshop. **RESULTS:** At baseline, physicians reported low confidence (46%) and rated the impact of primary barriers that prevent physical activity and exercise (PAE) counselling and prescription as (scale out of 4): patient interest (2.77), resources (2.65), and time (2.62). The majority of physicians (85%) provided a written prescription for exercise in <10% of appointments. At follow-up, the workshop increased physicians' confidence (% score) to: assess patient physical activity/exercise (PAE) (44 to 69; $p = 0.005$); provide PAE information to patients (55 to 79; $p < 0.001$), answer patient PAE questions (54 to 78; $p < 0.001$), provide PAE advice (43 to 71; $p < 0.001$), and appropriately refer to qualified professionals (52 to 77; $p = 0.002$). Confidence composite score increased from 251 ± 119 to 376 ± 66 ($p < 0.001$) out of 500. At follow-up, physicians self-perceived barriers' impact decreased, including: patient interest (2.75 to 2.25 out of 4; $p < 0.001$), lack of resources (2.59 to 2.00 out of 4; $p < 0.001$), and lack of time (2.41 to 2.14 out of 4; $p = 0.017$). Initially, the vast majority (n=98/113; 86.7%) of physicians proposed at

least one change to practice (205 change statements) and 71% proposed two or more changes to practice (155 change statements). Physicians who completed baseline and follow-up questionnaires (n=46) generated 93 statements regarding proposed changes to practice, including prescribe exercise (27%) and discuss PAE in more depth (26%). At follow-up, (n=46) physicians provided 88 statements regarding actual changes to practice. 46% of statements were reflective of at least one of the proposed changes and 40% reflecting changes that were different than originally proposed. **CONCLUSION:** Providing a comprehensive workshop improves confidence and supports for counselling, reduces impact of barriers and effectively changes physician's practices. Support provided by the Lawson Foundation

1085 Board #264 May 31 2:00 PM - 3:30 PM
The Effects of Physician Discussion/Recommendation on Physical Activity Behaviors During Pregnancy
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Little is known about physical activity (PA) behavior during pregnancy following PA discussions and recommendations from a prenatal health care provider (HCP). **PURPOSE:** To investigate 1) patient perceived value of prenatal HCP advice and 2) the differences in PA behavior between patients that did and did not a) discuss current PA behaviors with their prenatal HCP and b) receive PA recommendations from their prenatal HCP. **METHODS:** Participants (n=25) included pregnant women enrolled in a pilot nutrition and PA intervention. A baseline survey assessed 1) demographics, 2) participants' perceived value of prenatal HCP opinions (5-point likert scale; 1=do not value, 5=highly value), and whether 3) participants' current PA habits were discussed with a prenatal HCP, and 4) prenatal HCPs recommended participation in PA. An accelerometer was used to assess participant PA. Means±SD and frequencies were calculated and independent samples t-tests were used to assess differences in PA between participants that did and did not 1) discuss current PA habits with their prenatal HCP, and 2) receive PA recommendations from their prenatal HCP. **RESULTS:** On average, participants were 27.5±4.4 years of age. A majority of the sample was Caucasian (79.2%), married (80.0%), and had some college education (80.0%). Less than half of participants (43.5%) discussed current PA habits with their prenatal HCP and received a PA recommendation from their prenatal HCP (43.5%). Participants valued their prenatal HCP's advice, mean±SD=4.68±0.6. No differences in moderate and vigorous PA per day were found between participants that did (n=13, 12.4±10.6 min/day) discuss current PA behaviors with their prenatal HCP and those that did not (n=10, 13.1±10.7 min/day), (t(21)=0.17, p=0.87). Similarly, no PA differences were found between participants that did (n=10; 12.5±10.8 min/day) receive a PA recommendation from their prenatal HCP and those that did not (n=13; 13.0±10.4 min/day), (t(21)=0.11, p=0.91). **CONCLUSION:** Participants valued prenatal HCP opinions. However, PA discussions and recommendations with prenatal HCPs do not appear to impact PA behavior of pregnant women. Future research should explore the extent of PA discussions and recommendations between prenatal HCPs and patients to better understand the impact of discussions.

1086 Board #265 May 31 2:00 PM - 3:30 PM
Exercise Is Medicine In Traditional Chinese Medicine
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PURPOSE: The exercise therapy used for prevention, treatment, health care and rehabilitation were called the exercise prescription of Traditional Chinese Medicine (TCME_xR). We made a systematic combing of its historical evolution to know how Exercise is Medicine (EIM) developed in Traditional Chinese Medicine (TCM). **METHODS:** We checked the documents of TCM, and sorted out the related content of exercise prescription. **RESULTS:** There were 7 stages of the development. It originated from the primitive society. Around 2300 BC, people made a "big dance" to cure joint disease, which is the earliest record of TCME_xR. The formation was from the Spring and Autumn Periods. Exercise was combined with breathing, and was used for treatment and prevention. It was proposed that exercise can make us live longer and reduce disease, and should comply with the natural environment. Excessive exercise could do harm to organs. *Inner Canon of Huangdi* recorded a prescription of kidney disease including time choose, types, frequency, duration and position, which was very similar to the modern ones. Theories developed since Qin Dynasties. Doctors and Taoisms made great contributions. TCME_xR was based on the meridian circulation and syndrome differentiation, which was used to treat various diseases. Large number of documents and pictures were found. Complete sets like *Wuqinxi* had been invented. Taoism, Buddhism and Confucianism developed since Northern and Southern Dynasties.

The theory was enriched and grew systematically. Types increased and application range expanded. *General Treatise on the Cause and Symptoms of Diseases* gave 278 kinds of ExR. Dr. Sun advised that exercise should control volume. The balance of diet, sleep, breathing, physical and mental was proposed. Along with the invention of papermaking and printing, TCME_xR went to flourish. Numerous types were created. Doctors had good application of TCME_xR, possessing their own experiences. Tai Chi was born from the combining of martial arts and medical concepts. Research stayed still since the Opium War but developed again after the founding of new China. **CONCLUSIONS:** The use of exercise in TCM had long history. Until now, doctors and sports experts worked together to make it perfectly, and to jointly promote the project of EIM. Supported by MOST-China(2016YFC1300202)

1087 Board #266 May 31 2:00 PM - 3:30 PM
Validation Of A Multi-staged Step Test For Measuring Fitness As A Clinical Vital Sign
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The Exercise is Medicine™ initiative utilizes three questions that subjectively indicate how many minutes per week an individual engages in physical activity. The reported amount of activity is subsequently classified as a vital sign based on the association between the amount of physical activity and morbidity and mortality. However, there is little research examining how to objectively measure cardiorespiratory fitness within a clinical setting. Limitations exist with current valid tests regarding 2 major barriers to practice settings: administration time and fixed step heights and step rates unable to accommodate various fitness levels and musculoskeletal limitations. **PURPOSE:** To determine the validity of a brief, submaximal, variable height, step test used to predict VO₂max. **METHODS:** Healthy participants aged 18-65 were recruited to perform a 4 minute step test that consisted of stepping for 1 minute successively on steps that were 6, 8, 10, and 12 inches in height. Following each minute, the heart rate of the participants was recorded. The participants then performed a VO₂max test on a treadmill. Multivariable regression analysis was used to develop a predictive model of VO₂max from the step test. The variables included in the multivariable regression equation were gender, BMI, steps/min, and avg. HR for the 4 steps. **RESULTS:** A total of 113 participants were included in this study .67 men (age = 24.3±5.93 yr, BMI = 25.7±4.00, VO₂max = 44.69±7.82) and 46 women (age = 24.7±7.62 yr, BMI = 23.5±3.02, VO₂max = 36.63±5.57). The model explained 55% of the variance in VO₂max (R = 0.74, p = 0.0001). **CONCLUSION:** The model was an accurate predictor of VO₂max for this sample. Further investigation will aim to enhance the generalizability of the test through targeting older age groups.

1088 Board #267 May 31 2:00 PM - 3:30 PM
Exercise Vital Sign Correlates With New Diagnosis of Depression
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 (No relationships reported)

Kaiser Permanente in Southern California (KPSC) has pioneered use of an exercise vital sign (EVS) to record minutes per week of PA at every visit. Given the established connection between regular PA and depression, it stands to reason that patients who report doing recommended amounts may be less likely to suffer from a new diagnosis of depression than those who report being sedentary. **PURPOSE:** To evaluate the correlation between self-reported PA level (using EVS) and the likelihood of being diagnosed with clinical depression. **METHODS:** Data were abstracted from electronic medical records of adult KPSC members (N=1,077,140) in a cohort study to investigate use of an EVS in predicting a new diagnosis of depression. The cohort consisted of all adult patients (>18 yr.) with minimum of 3 EVS measurements spanning a year from January 1, 2009 to December 31, 2011, that did not have a prior diagnosis of depression on or before the date of their last EVS measurement. Patients were classified into 1 of 3 distinct categories for EVS; Consistently Sedentary (CS) EVS=0 min/wk for every measure, Insufficiently Active (IA) EVS 10-149 min/wk and Consistently Active (CA) EVS>150 min/wk for every measure. Estimates were adjusted for age, gender, race, marital status, education level and Charlson comorbidity score. Results are presented as odds ratios (OR) with corresponding 95% confidence intervals (CI). **RESULTS:** Patients who were CA were 20% less likely to be diagnosed with depression compared to CS patients (OR (CI) = 0.80 (0.86, 0.90)), while IA patients were found to be 12% less likely (OR = 0.88 (0.78, 0.82)). In addition to low EVS, other risk factors for depression were female gender, race (Hispanic>White>Black>Asian), Unmarried status, lower education level and higher Charlson comorbidity score.

CONCLUSIONS: We conclude that self-reported PA is strongly correlated with the likelihood of suffering a new diagnosis of depression. For this reason, any patient presenting with symptoms suspicious for depression should be asked about their exercise habits and a low EVS should add to the clinical suspicion for depression.

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Exercise Vital Sign and Health Care Utilization

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Background: It is well established that >150 minutes of weekly physical activity significantly improves health and Kaiser Permanente Southern California (KPSC) has pioneered the use of an Exercise Vital Sign (EVS) to record Physical Activity (PA). However, there is less data on exercise and impact on healthcare utilization. **Purpose:** To evaluate the correlation of EVS and healthcare utilization, in our SCKP patient population. Specifically, do those patients who report consistent exercise for >150 minutes per week have reduce utilization of the health care system. **Methods:** KPSC Electronic Health Record data was abstracted to determine 3 cohorts of adults (18-65yrs) (N=2,534,895) who were Consistently Sedentary (CS) (EVS=0min/wk consistently), Insufficiently Active (IA) (EVS=1-149min/wk), or Consistently Active (CA) (EVS>150min/wk consistently), meeting the World Health Organization recommendations. Each cohort had at least 3 encounters and self reported EVS that were consistent. Each cohort was then compared to their health care utilization over a 1, 3 and 5 year period. Because KPSC is a closed system we were able to accurately capture utilization of pharmacy, hospital, radiology, laboratory and outpatient departments. Data was adjusted for age, gender and ethnicity. **Results:** Compared to CS patients, CA patients have consistently lower use of the KPSC health care system. This relationships held true across the 1, 3 and 5 year analysis. Of note patients who were CA were 75% less likely to be hospitalized (OR 0.23-0.26), 43% less likely to use the ER (OR 0.55-0.58) and 45% less Urgent Care services (OR 0.54-0.56), 25% less laboratory blood draws (OR 0.73-0.74), and 27% less pharmaceuticals fills (OR 0.71-0.74). Other factors that were associated with lower health system utilization were female gender, caucasian ethnicity and **Conclusion:** Based on EVS data, and analysis of health utilization we conclude that CA individuals have significantly lower utilization of the health care system than those who are CS.

B-73 Free Communication/Poster - Exercise Psychology - Cognition and Emotion

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1090 Board #269 May 31 2:00 PM - 3:30 PM

Correlates Among Physical Activity, Physical Function, and Cognitive Function in Older Adults

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Current adverse components of aging include the increase in both cognitive impairment and the incidence of dementia. Previous studies have shown positive associations between physical activity and the prevention and treatment of cognitive impairment and dementia. **The PURPOSE** of the present study was to identify correlates among physical activity, physical function, and cognition in independent older adults. **METHODS:** In 77 older adults (77±7.8 years), self-reported physical activity (Community Healthy Physical Activities Model Program for Seniors, CHAMPS), cognitive function (Addenbrooke's Cognitive Examination-Revised, ACE-R), and physical function (Six Minute Walk Test, 6MWT; Short Physical Performance Battery, SPPB; and Grip Strength) were measured. Partial correlations were run between the variables while controlling for age and sex. Significance was set to $p < 0.05$. **RESULTS:** The mean values±standard error (SE) for the physical function variables were: CHAMPS: 1202±130 kcal·wk⁻¹ of moderate-to-vigorous physical activity; 6MWT (distance): 417±14 m; and grip strength: 27.0±1.1 kg. The average score on the ACE-R was 91.6±0.5 out of 100 (≤88 = 94% specificity for dementia). Age was correlated with ACE-R ($r = -0.59$, $p < 0.05$). When controlling for age and sex, ACE-R was correlated with SPPB performance ($r = 0.39$, $p < 0.05$), 6MWT performance ($r = 0.33$, $p < 0.05$), and grip strength ($r = 0.25$, $p < 0.03$). ACE-R was not correlated with self-reported physical activity ($r = 0.14$, $p > 0.05$). **CONCLUSIONS:** Although previous research has shown positive associations between physical activity

and cognitive function, our preliminary data do not support these previous findings. However, indices of physical function, as measured by three standard clinical tests, were associated with cognitive function in this population of independent older adults.

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Psychological Factors Of Burnout In Former/retired Elite-level Race Walkers In The United States

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PURPOSE: The study aims to determine and extrapolate the causation of psychological factors of burnout in former/retired female and male elite-level race walkers (N=75) in the United States (U.S.). The results of this project will assist in identifying influential factors of burnout, hence improving the future of the sport of race walking in the U.S. **METHODS:** Seven factors of burnout were derived and analyzed based on the subjects' responses to a validated anonymous online survey. This research was analyzed through exploratory analysis with an eigenvalue set at 1.00 using varimax rotations. These seven factors retained 75.99% of total variance which were accounted for and explained by the factors success (1), accomplishment (2), fatigue (3), apathy (4), awareness (5), appreciation (6), and lack of marketing (7). An independent t-test and a one-way ANOVA were conducted to determine a significant difference in responses between genders. **RESULTS:** Profile analysis/one way repeated measures analysis of variance of the seven factors indicate statistical significance and efficacy based on the Partial eta² of 0.489 using the Lower-bound being 49% of the total variance explaining the differences among the seven factors. Across all factors, factors 5 and 7 scored the highest means, which indicated the most significant impact of burnout while factors 1 and 2 demonstrated the least impact. Both the independent t-test and the one-way ANOVA found no significant ($p < 0.05$) differences in responses to factors 1 (.615), 2 (.611), 3 (.820), 4 (.633), 5 (.760), 6 (.854), and 7 (.369) between genders. **CONCLUSIONS:** Based on the profile analysis, the common underlying factors in this research investigation narrowed down to "Awareness" and "Lack of Marketing" in U.S. race walking. This represents crucial components to the declining state of elite-level race walking as well as the most significant impact of burnout in former/retired female and male elite-level race walkers in the U.S. The results of this project will assist in identifying influential factors of burnout, hence improving the future of the sport in the U.S. The continuation of research on elite-level race walking burnout is imperative for the growth of the sport and the well-being of these athletes.

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The Effects of Caffeine on Selective Attention after Exercise in Older Adults: A Pilot Study

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(No relationships reported)

PURPOSE: The purpose of the present study was to determine if caffeine influenced selective attention following a bout of cycling in older adults. **METHODS:** Five older (60 ± 7 years), adults (3 males, 2 females) participated in three separate laboratory sessions. During the first visit, subjects underwent a submaximal cycling task (YMCA) to predict maximal oxygen consumption (VO_{2max}) and were allotted time to practice the Stroop Color Word Task (SCWT). For the next two visits, subjects reported to the Laboratory in the post-absorptive state. Upon arrival subjects rested for 5 min then completed the SCWT. Two pieces of chewing gum (CAFF vs. PLA) were then administered in a counterbalanced, double blind manner. Following gum administration subjects rested for 10 min, performed a standard warm-up, and then cycled for 30 min at constant wattage (workload corresponding to 60% predicted VO_{2max}). Subjects rested for 5 min then completed the SCWT. **RESULTS:** Stroop Color Word Task Interference Scores (SCWT-INF) were calculated and used as an indicator of selective attention. A preliminary analysis of variance (ANOVA) demonstrated that SCWT-INF remained unchanged from baseline to post exercise (2.7 ± 2.8 vs. 3.4 ± 2.5 respectively, $p = 0.759$). Further, SCWT-INF were similar across treatments (caffeine versus placebo, 6.3 ± 3.2 vs. -0.2 ± 3.2 respectively, $P = 0.196$) and no treatment by time interaction was evident ($p = 0.703$). **CONCLUSIONS:** These data demonstrated that a low dose of caffeine and moderate exercise had no impact on selective attention.

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Acute Effect of Exercise on Cognitive Function Changes by Exercise ModeShinji Takahashi, *Tohoku Gakuin University, Sendai, Japan.*
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(No relationships reported)**PURPOSE:** To assess the differences of influence of acute bouts of aerobic, resistance and badminton on the cognitive control measured by Stroop task.**METHODS:** Twenty-five men (age: 20.8 +/- 1.0 yrs, height: 173.8 +/- 3.9 cm, weight: 73.8 +/- 11.7 kg) and 20 women (age: 20.3 +/- 1.0 yrs, height: 156.6 +/- 4.0 cm, weight: 50.1 +/- 6.0 kg) performed an incremental treadmill running test to determine peak oxygen consumption (VO₂peak). On subsequent days, the participants underwent four counterbalanced an intervention consisting of 10 min of either walking, resistance exercise, badminton and seated rest control. A matching type Color-Word Stroop test (writing) consisting of a neutral condition and an incongruent condition was completed before and 8 min after each session. Oxygen consumption (VO₂) was measured during 4 sessions. Stroop task performance (scores) in both of the neutral and the incongruent condition were compared by 2-way ANOVA model in mixed model, two factors were sessions (4 levels) and time (2 levels), respectively.**RESULTS:** Intensities of walking, resistance exercise, badminton and seated rest control were 45+/-10%, 41+/-7%, 74+/-11% and 9.7+/-1.7%VO₂peak, respectively. For the neutral condition scores, the interaction was not significant (P = 1.08) although the main effect of time was significant (P < 0.001). For the incongruent scores, ANOVA model indicated significance in the main effect of time (P < 0.001) and the interaction (P = 0.012), badminton significantly improved scores larger than seated rest control (P = 0.021). Differences between walking, resistance exercise and seated rest control were not significant (P ≥ 0.477).**CONCLUSIONS:** These results indicate that complex and high-intensity exercise such as badminton appear to improve cognitive function relative to low-intensity simple aerobic exercise and anaerobic exercise.

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The Effects Of Long-term Open- And Closed-skill Exercise Interventions On A Task-switching Paradigm In The ElderlyChia-Liang Tsai¹, Chien-Yu Pan², Fu-Chen Chen³, Chun-Hao Wang¹. ¹National Cheng Kung University, Tainan, Taiwan. ²National Kaohsiung Normal University, Kaohsiung, Taiwan. ³National Pingtung University of Science and Technology, Pingtung, Taiwan.
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(No relationships reported)Although previous studies have demonstrated that regular participation in open- and closed-skill exercise could produce distinct benefits on neurocognitive performances in the elderly, these cross-sectional studies cannot establish causality and obviate the participants' inherent executive-control capacities. **PURPOSE:** To investigate the effects of long-term open- and closed-skill exercise intervention on the neurocognitive performances in the elderly. **METHODS:** Fifty-seven healthy elderly males were randomly assigned to either an open-skill (n=19), closed-skill (n=19), and control (n=19) group and assessed behavioral and electrophysiological measures when performing the task-switching paradigm at baseline and after either a 24-week exercise intervention or control period. All independent variables were separately analyzed with a repeated-measures ANOVA. **RESULTS:** Both the exercise groups exhibited significantly larger P3 amplitudes after the exercise intervention relative to baseline when performing the task-switching paradigm (open-skill: 3.93±2.19 vs. 5.97±2.55 μV, p<.05; close-skill: 3.82±1.61 vs. 5.30±1.68 μV, p<.05). Although two exercise groups relative to the control group showed significantly faster reaction times (RTs) in the switch trials after the exercise intervention, only the open-skill group showed RTs facilitation in the non-switch (pre vs. post: 1183.41±144.36 vs. 1026.19±126.18 ms, p=.001) and switch (pre vs. post: 1396.99±301.51 vs. 1159.11±190.46 ms, p=.001) trials after an exercise intervention when performing the cognitive task. **CONCLUSION:** Regularly participation in open- or closed-skill exercise could facilitate overall neurophysiological effects and produce distinctive neuropsychological performance in the elderly.

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Taekwondo Practice Improves Working Memory in Sedentary ChildrenSonia Montero-Briceño, Isaura Castillo-Hernández. *University of Costa Rica, San José, Costa Rica.* (Sponsor: Luis Fernando Aragon-Vargas, FACSM)
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(No relationships reported)Martial Arts training have a favorable effect on cognitive variables; however, there is a lack of evidence comparing the effects of practicing one of the taekwondo modalities (i.e., fighting and *poomsae*) on working memory (WM) in children. **PURPOSE:** To determine the chronic effect of *poomsae* taekwondo routines and fighting training programs on WM variables in Costa Rican sedentary schoolchildren.**METHODS:** Forty-eight children (25 males and 23 females, mean age 11.0 ± 0.9 yr.) were paired by gender and randomly allocated to either a fighting (60-min taekwondo fighting exercises including a 10-min aerobic warm up, 40-min of technical and tactical fighting exercises and 10-min cool down stretching exercises per session), a *poomsae* (60-min taekwondo *poomsae* including a 10-min aerobic warm up, 40-min of the first and second progressive *poomsae taeguk* standardized routine and 10-min cool down stretching exercises per session), or a control (no practice of taekwondo) group. Participants in the experimental fighting and *poomsae* groups performed two training sessions per week during six weeks. In both groups the exercises were taught by a black-belt taekwondo expert. WM was determined using the Words Backward (WBT), Digits Forward (DFT) and Digits Backward Tests (DBT) at the beginning (pre-test) and six weeks after (post-test) training.**RESULTS:** Two-way analysis of variance with repeated measures on one factor (time) revealed a statistically significant between-group interaction on WM measured by WBT (p = 0.009). A significant interaction was found between fighting and control groups over time (p = 0.024), and *poomsae* and control groups over time (p = 0.005). Follow-up simple effects tests revealed differences for time in the fighting (pre-test = 24.20 ± 6.27 vs. post-test = 26.53 ± 5.07) and *poomsae* (pre-test = 22.53 ± 4.72 vs. post-test = 26.47 ± 2.75) groups. No differences were observed in the control group (pre-test = 23.11 ± 6.51 vs. post-test = 22.67 ± 6.74). Cohen's *d* effect size was considered high in *poomsae* (Δ = 0.83) and moderate in the fighting (Δ = 0.48) group. No between-group interactions were found on DFT (p = 0.674) and DBT (p = 0.206) scores.**CONCLUSIONS:** Taekwondo training improves working memory in sedentary Costa Rican children; *poomsae* has higher positive effect than fighting exercises.

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Effects of An 8-Week Moderate-Intensity Aerobic Exercise Intervention on Episodic Memory and Cognitive ControlAnthony J. Bocchine¹, Ryan L. Olson², Christopher J. Brush¹, Peter J. Ehmann¹, Brandon L. Alderman¹. ¹Rutgers, The State University of New Jersey, New Brunswick, NJ. ²University of North Texas, Denton, TX.
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(No relationships reported)Although the effects of exercise on global cognitive function are well documented, there have been few randomized trials of aerobic exercise that focus specifically on select aspects of cognition, including episodic memory and cognitive control processes. Understanding these cognitive processes may be particularly important for individuals with major depressive disorder (MDD), as deficits in both memory and cognitive control are well recognized in MDD. **PURPOSE:** The primary aim was to assess the effects of an aerobic exercise intervention on episodic memory and cognitive control in individuals with and without MDD. **METHODS:** 48 participants (24 healthy, 24 MDD) were randomly assigned to either 8-weeks of aerobic exercise (AE) or a control group of time-matched light stretching. AE and stretching groups consisted of three weekly 30-45-min sessions per week. Depressive symptoms (BDI), peak aerobic fitness (VO₂ peak), episodic memory, and cognitive control were assessed at baseline and follow-up. Episodic memory and cognitive control were assessed using behavioral and event-related brain potential (ERP) measures during old/new and modified flanker tasks. **RESULTS:** After 8-weeks of AE, there were significant reductions in depressive symptoms, despite no change in aerobic fitness. No significant behavioral findings were observed for the old/new task; however, ERP analyses indicated significant increases in the parietal late positive component (LPC) from pre- to post-intervention, p < .05. Improvements were observed for reaction time during the flanker task, F(1,17)=16.89, p < .001, but not accuracy. Significant increases in flanker N2 and P3 component amplitudes were observed, ps < .05. **CONCLUSION:** These findings suggest that 8-weeks of moderate-intensity AE has a significant influence on both episodic (recognition) memory and cognitive control processes, particularly among individuals with MDD. However, the effects were larger for cognitive control relative to recognition memory. The 8-week AE program improved select aspects

of cognitive function, in addition to reducing depressive symptoms. These benefits occurred without a change in fitness, suggesting other psychobiological mechanisms of action.

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Effects of Two Types of Acute Exercise on Young Adults' Psychomotor Learning

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(No relationships reported)

Physical arousal coinciding with periods of memory consolidation facilitates long-term memory storage. Unknown is the role of exercise type on long-term memory.

PURPOSE:

To evaluate the effects of two types of acute exercise on young adults' immediate and delayed psychomotor learning.

METHODS:

30 young adults (22.9 yrs, F=73.3%) were randomly assigned to one of three conditions: Control, Simple Step Dance, or Complex Step Dance. Participants practiced a manual pursuit-rotor tracking task for 5 blocks of 10 trials and then engaged in 10-min of either seated rest, a simple Dance-Dance Revolution (DDR) type exercise, or a complex DDR exercise. Psychomotor learning was assessed in a single block of 10 trials administered immediately, 24 hours, and 7-days following exercise or rest. Exercise intensity was measured by the Borg Perceived Exertion Scale, administered at minute 3, 5, 7 and 10.

RESULTS:

For each participant, difference scores were calculated based on average time-on-target during the last block of training and during each retention test. A 3 (Group: Rest, Simple DDR, Complex DDR) X 3 (Time: Immediate, 24-hr, 7-day) analysis of variance revealed a significant Group X Time interaction ($F(2,54) = 3.11, p = 0.02$). Planned contrasts revealed that at 24-hr, both exercise types significantly increased time-on-target performance (Simple DDR = 2.62 sec; Complex DDR = 2.84 sec), compared to rest (2.03 sec); at 7 days, performance improved for those in the complex DDR condition (4.60 sec) compared to the simple DDR condition (2.30 sec) and rest condition (1.67 sec). Ratings of perceived exertion differed between the exercise groups only at the end of exercise.

CONCLUSION:

The results support prior research showing that psychomotor memory is enhanced when practice is followed by acute exercise and suggest that physical arousal enhances memory consolidation. The results add to the research findings by showing that the type of exercise differentially affects memory consolidation, with exercise involving complex cognitively-demanding movements producing greatest benefits.

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Comparison of Whey Protein and Alpha-lactalbumin in Muscle Pain, Pressure Pain Threshold and Mood States following Strenuous Prolonged Running

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PURPOSE: To compare the effect of whey protein and alpha-lactalbumin ingestion on muscle pain, pressure pain threshold (PPT) and mood state following prolonged strenuous running.

METHODS: 12 apparently healthy, active male subjects (age: 30.4 ± 2.8 yr., height: 172.7 ± 5.6 cm, weight: 66.7 ± 6.5 kg, VO_{2max} : 58.0 ± 6.9 ml·kg⁻¹·min⁻¹) participated in the double-blind counterbalance crossover study. During the main trial, two treatments were applied CHO + Whey PRO or CA: CHO + Alpha-lactalbumin. Participants ran at 70% VO_{2max} on a standardized treadmill and recovered for 4 hours. Treatments were ingested every 30 minutes during the first two hours of the recovery period, with the amount of 0.66g/kg/h CHO and 0.34g/kg/h PRO. PPT and pain intensity at the biceps femoris muscle and mood state (evaluated by Brunel Mood Scale, BRUMS-C) were evaluated before exercise (Ex 0), 90 min during exercise (Ex- 90) and at 120 min (Re-120) and 240 min (Re-240) post recovery.

RESULTS: Compared with Ex-0, muscle pain was significantly higher at Ex-90 in both trials (CA: 4.79 ± 0.72 vs. 0.46 ± 0.22 , $P < 0.01$; CW: 4.58 ± 0.67 vs. 0.45 ± 0.16 , $P < 0.01$). No treatment effect was found in the rating of muscle pain ($P > 0.05$). Compared with CW, PPT was significantly higher at Re-120 min in CA trial (CA vs. CW: 31.55 ± 3.09 vs. 26.99 ± 2.32 N/cm²; $F = 5.223$, $P = 0.033$). Vigor was slightly higher following CA ingestion than CW ingestion. (CA vs. CW: 4.08 ± 0.47 vs. 3.16 ± 0.47 ; $F = 4.382$, $P = 0.066$).

CONCLUSIONS: Strenuous prolonged running increases muscle pain. Compared with whey protein, alpha-lactalbumin elevates PPT in muscle and potentially enhances the feeling of vigor during short term exercise recovery.

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Visceral Adipose Tissue Is Negatively And Selectively Associated With Cognition Among Obese Children

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Purpose: Although obesity later in life is a recognized risk factor for cognitive dysfunction, the relation of excess adiposity on childhood cognition remains controversial. In particular, visceral adipose tissue is metabolically active pathogenic tissue that is mechanistically implicated in inflammation, insulin resistance, and dyslipidemia. However, the influence of visceral adipose tissue on children's cognition remains understudied. Thus, the aim of the present investigation was to evaluate the differential impact of adiposity, particularly visceral adipose tissue, on cognitive function among obese and healthy weight children.

Methods: Obese (BMI $\geq 95^{\text{th}}$ %tile) children (ages 7-9 years old, N= 64, 37 females) completed tests from the Woodcock Johnson Tests of Cognitive Abilities. A group of healthy weight children (BMI: 5^{th} - 85^{th} %tile) were matched to the obese children on demographic characteristics (age, sex, SES) and aerobic fitness. Adiposity (i.e., whole body percent fat (%Fat), subcutaneous adipose tissue (SAAT), and visceral adipose tissue (VAT)) was assessed using dual energy X-ray absorptiometry.

Results: Bivariate correlational analyses revealed that %Fat and SAAT were not related to cognitive function in obese children. However, among obese children, VAT was a significant negative predictor of cognitive function, such that increased VAT was associated with poorer intellectual abilities, $r's \geq -0.26, p's \leq 0.04$; and performance on two out of three cognitive performance clusters: thinking ability, $r = -0.26, p = 0.04$; and cognitive efficiency, $r = -0.26, p = 0.04$. In contrast, among healthy weight children, adiposity measures were not associated with intellectual abilities or any of the cognitive performance clusters.

Conclusion: The results suggest that VAT, rather than SAAT or %Fat, was selectively and negatively related with cognitive function among obese children. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and mental health of children. Along with the dangerous metabolic nature of VAT, its detrimental relationship with obese children's intellectual and cognitive functioning raises additional concerns regarding the public health concerns of childhood obesity.

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The Effects Of Using A Treadmill Workstation On Mental Arithmetic Performance

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(No relationships reported)

The effectiveness of using treadmill workstations in work environment to increase daily physical activity is well demonstrated in previous studies. However, there is limited evidence about the effects of using treadmill workstation on cognitive functions. To our knowledge, no previous study examines the effects of using treadmill workstation on mental arithmetic, which is a crucial cognitive skill in our daily life and is highly related to the working memory.

PURPOSE: To assess the impacts of using treadmill workstation on mental arithmetic performance, as well as to evaluate whether the impacts differ in different walking speeds. **METHODS:** Twenty four college students (12 female and 12 male, mean age = 23 ± 1.8 yrs) each performed mental arithmetic test in four workstation conditions: sitting, standing, walking at a self-paced speed (mean = 2.3 km/h), and walking at a faster speed (mean = 3.5 km/h), during four days visits to an office-setting lab. The sequence of the workstation conditions was counterbalanced among participants with Latin Square design. The mental arithmetic test consists of fifty arithmetic problems adapted from the *Kit of Factor-Referenced Cognitive Tests* published by Educational Testing Service. The test was conducted on a computer and the accuracy, as well as speed, was measured by Matlab programs. Repeated measures of ANOVA was employed in data analysis with workstation condition as a within-subjects factor and gender as a between-subjects factor. **RESULTS:** There is no significant main effect for workstation conditions either in accuracy ($F = 0.698, p = 0.562$) or in speed ($F = 0.908, p = 0.442$). In addition, ANOVA revealed no significant interaction effect of workstation conditions with gender either in accuracy ($F = 1.528, p = 0.215$) or in speed ($F = 1.812, p = 0.154$). **CONCLUSIONS:** Performance of mental arithmetic dose not differ across

the four workstation conditions, indicating that working memory may not be impaired when using a treadmill workstation. Given the benefits of using treadmill workstations in increasing daily physical activity, this could be taken as supportive evidence for the feasibility of adopting treadmill workstations as a solution for workplace inactivity. Further research focusing on long-term effects of using treadmill workstations on cognitive functions is suggested.

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Acute Stretching Improves Affective States And Cognitive Function In Physically Inactive People.

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Physical inactivity appears to have negative effects on affective states and cognitive function, whereas acute exercise has beneficial effects on them. Stretching is a common activity used in a physical fitness program. In the present study, we hypothesized that acute stretching is beneficial to affective states and cognitive function in physically inactive people. **PURPOSE:** To test the specific hypothesis that acute stretching improves affective states and cognitive function in physically inactive people. **METHODS:** Nineteen sedentary young subjects participated in the present study. They were randomized to stretching condition (SC) and resting condition (RC) in a cross-over manner. The stretching program was 10-min whole body stretching using yoga techniques and poses. Before and after stretching or resting, they performed the Stroop task and completed the Short form of Profile of Moods Scale (POMS). Saliva samples were also collected to determine salivary cortisol levels. During the cognitive task, middle cerebral artery mean velocity (MCA V_{mean}) were monitored. **RESULTS:** In the SC, we observed a reduction in depression-dejection score (pre 3.32±/3.53 vs. post 2.05±/3.03, $P = 0.02$) and an increase in vigor score (pre 4.63±/3.58 vs. post 6.68±/4.50, $P = 0.03$). In the RC, we found no changes in depression-dejection score (pre 2.63±/2.93 vs. post 2.58±/3.15) or vigor score (pre 5.21±/4.02 vs. post 5.05±/4.21). The Stroop-interference, which was calculated by subtracting reaction time (RT) in the neutral trials from RT in the incongruent trials, decreased in the SC (pre; 33 ±/ 40 ms, post; -23 ±/ 49 ms, $P < 0.001$). In contrast, the Stroop-interference did not change in the RC (pre; 11 ±/ 38 ms, post; -2 ±/ 43 ms). Stretching did not affect MCA V_{mean} during the cognitive task (SC; pre 52.2±/16.7 cm/s, post 51.2±/15.2 cm/s, RC; pre 50.7±/10.3 cm/s, post 48.2 ±/ 9.4 cm/s) or the salivary cortisol levels (SC; pre: 0.15 ±/ 0.08 µg/dL, post: 0.13 ±/ 0.05 µg/dL, RC; pre: 0.16 ±/ 0.07 µg/dL, post: 0.14 ±/ 0.04 µg/dL). **CONCLUSION:** Acute stretching improved affective states and cognitive function, but did not affect the measured physiological variables. Acute stretching seems to improve cognitive function in physically inactive individuals, possibly via improved affective states.

1102 Board #281 May 31 2:00 PM - 3:30 PM

Vitamin D Status: Associations with Chronic Disease Risk Factors and Cognitive Function

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Vitamin D deficiency has become commonplace in US adults, and has been linked to increased risks of chronic diseases. Decreased cutaneous vitD synthesis, low sun exposure, and other risk factors put older adults at higher risks of vitD deficiency. Identifying and correcting a low vitD status may be an easy way for individuals to improve health and reduce their risks for disease. **PURPOSE:** To investigate the relationship between current vitD status and risk factors for numerous diseases in older men and women. **METHODS:** Seventy-two (72) recreationally active older individuals aged 50-70 years completed medical history, food frequency, sun exposure, and IPAQ questionnaires, and had fasting blood draws and lipid panel, glucose, and vitD values measured. Testing included measures of height, weight, waist circumference, peripheral blood pressure, central blood pressure, arterial stiffness, % body fat, and cognitive function. Two-way ANOVA (PA, gender) was used to determine group difference for all measures based on PA and gender. Pearson correlation coefficient was used to explore relationships between vitD levels and disease risk factors. One-way ANOVA was used to measure differences across three levels of vitD status (deficient, insufficient, sufficient) for each risk factor for disease. Significance was set at $\alpha=0.05$. **RESULTS:** Low vitD status was found to be associated with GLU, TG, %BF, and android/gynoid (A/G) ratio. Males had stronger associations of vitD levels and disease risk factors than females. For males, vitD levels were moderately, negatively correlated with PSP ($r=-0.557$; $p=0.016$), PmeanP ($r=-0.496$; $p=0.036$), CSP ($r=-0.534$; $p=0.022$). For females, weak, negative correlations

found between vitD levels and GLU ($r=-0.386$; $p=0.004$), TG ($r=-0.296$; $p=0.030$), A/G ratio ($r=-0.425$; $p=0.001$). 70% of subjects in low PA group were vitD deficient or insufficient vs. 51.5% and 41.4% for moderate and high PA groups, respectively. A strong association was found between vitD status and the time of year vitD levels are measured ($p=0.036$). **CONCLUSIONS:** Low vitD status is associated with risk factors for disease. Low vitD status is more likely during the winter months due to low sun exposure. Individuals would benefit from sufficient vitD intake in regards to overall health and reduced risks for chronic disease.

1103 Board #282 May 31 2:00 PM - 3:30 PM

The Influence of Hydration on Childhood Cognitive Control

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Converging evidence indicates that health behaviors during childhood impact cognitive control (CC). However, the influence of water intake or hydration on specific aspects of CC remain understudied. This is concerning since recent epidemiological data demonstrates that ~55% of children in the United States are inadequately hydrated. Therefore, experimental studies are needed to delineate the influence of markers of hydration and changes in water intake on childhood CC.

PURPOSE: The current study aimed to: 1) assess the effects of changes in water consumption on modulation of CC among preadolescent children; and 2) elucidate the within condition relationships between urinary markers of hydration and children's CC.

METHODS: A counter-balanced cross-over design was utilized whereby 9-10-year-olds ($N=26$, 11 females) underwent high (HIGH; 2L/d) and low (LOW; 1L/d) water intake conditions for 4d. Following each condition, children completed a modified flanker task to assess attentional inhibition, an important component of CC. Urine osmolality was measured using pooled samples collected during the 24-h period (24-h U_{osm}) preceding cognitive testing.

RESULTS: There was a significant difference ($p<0.01$) in 24-h U_{osm} between the HIGH (393mOsm/kg ± 168) and LOW (787mOsm/kg ± 206) conditions. There were no significant effects of condition on flanker task performance (all p 's > .271). However, within condition analyses revealed that 24-h U_{osm} was correlated with CC. During the HIGH condition, 24-h U_{osm} was associated with congruent ($r = -.441$, $p = .024$) and incongruent ($r = -.468$, $p = .016$) accuracy, indicating that higher 24-h U_{osm} was associated with poorer accuracy.

CONCLUSIONS: Although there were no significant intervention effects on CC, these data link lower urine osmolality (i.e., better hydration) to greater CC among preadolescent children. Ongoing research is examining the effects of water modulation on changes in children's CC while accounting for baseline hydration. Supported by Danone Research

1104 Board #283 May 31 2:00 PM - 3:30 PM

Viewing Television While Walking: Effects on Preference For Exercise, Treadmill Endurance Time and Behavioral Outcomes

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PURPOSE: To determine the effects of television viewing while walking on: 1) preference for exercise and 2) treadmill endurance time. **METHODS:** Twenty-five insufficiently active adults (means±SD; age: 46±12 years; body mass index: 31.2±5.3 (kg/m²) completed this study. Part 1: participants performed three randomized 1/3-mile walking bouts at an intensity equivalent to 70% of their oxygen consumption at ventilatory threshold (VO₂-at-VT). During these exercise bouts, individuals viewed 1) their favorite television program (FavTV), 2) a standardized nature program (NatTV) or 3) no-TV (NoTV). A behavioral choice paradigm approach was used to assess preference for exercising with each television condition. Part 2: participants completed two randomized 60-minute visits where they were asked to walk at 70% of VO₂-at-VT for 10-minutes under FavTV or NoTV conditions. After 10 minutes, participants could choose to continue exercising under the current television condition or stop exercising and watch television while seated. Participants were allowed to switch between exercise and rest as they desired during the remaining time. **RESULTS:** Part 1: in regards to preference for exercise, lower scores indicate greater preference for exercise during specified television condition. FavTV (preference score: 1.1±1.3; $p<0.001$)

and NatTV (preference score: 1.8+1.9; $p=0.002$) were significantly greater than NoTV (preference score: 3.0+2.7). There was no significant difference in preference scores between FavTV and NatTV conditions ($p=0.132$) Part 2: despite this difference in preference for exercise there was no significant difference in treadmill walking time (FavTV vs. NoTV; 50.0+2.6 vs. 44.7+3.2 minutes, respectively; $p=0.102$).
CONCLUSIONS: This study provides empirical evidence that inactive individuals prefer walking with television viewing versus with no television. Further research is needed to determine if active television viewing can translate to observable changes in exercise behaviors.

1105 Board #284 May 31 2:00 PM - 3:30 PM

Complexities of the Body Weight Screening Experience: A Qualitative Analysis

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INTRODUCTION: The U.S. Preventive Services Task Force and NIH emphasize the use of weight-related screenings as a means to increase motivation of overweight/obese individuals to manage body weight. Yet, little is known about individual responses to receiving such screenings, which could inform future research.
PURPOSE: To examine the acute, qualitative responses to a common body weight and composition screening in a sample of women classified as 'overfat' by a validated body fat percentage (BF%) cutoff. **METHODS:** Of 14 volunteers responding to a study assessing personal experience to a weight screening, 10 women (30.21 ± 16.64 years; 39.39% ± 6.60%; 28.25 ± 6.15 kg/m²) were classified as 'overfat'. Following DEXA testing, participants were provided with their weight and composition results, and then given 1-minute to evaluate. Participants were asked a series of questions guided by qualitative description regarding their experience. Interviews were digitally recorded, transcribed, and analyzed with open and axial coding to identify recurring themes. **RESULTS:** Five themes, represented here as internalized questions, emerged to summarize the individual experience: (1) Is this a threat to me? (2) Why is this a threat? (3) How does this make me feel? (4) Am I motivated? (5) What am I motivated to do? Theoretically, the results support a novel confluence of self-regulation and coping theories, where a weight-related discrepancy produced by the screening triggered perceptions of threat to self, including the appraisal of what is at stake during a stressful encounter (self-esteem, survival/health, sex/attractiveness, social status, family, physical functioning), which guided the appraisal process. Subsequently, emotional and motivational responses varied, as did coping choices (physical activity, healthy/unhealthy dietary changes, heightened self-regulation, seeking social support). **CONCLUSIONS:** The findings support the use of screenings to heighten awareness to one's body weight, yet highlight the complexity of individuals' responses and importance of 'appraisal stakes'. This study challenges the belief that screenings always trigger healthy, weight control efforts, while highlighting difficulties and potential bias in recruiting overweight women to volunteer for such screenings.

1106 Board #285 May 31 2:00 PM - 3:30 PM

Acute Effects of Exercise on Attentional Bias in Low and High Anxious Young Adult Females

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 (No relationships reported)

PURPOSE: To examine the effects of an acute bout of exercise on attentional bias, mood, and memory in young adult females who differ in trait anxiety.
METHODS: Sixty-four participants between the ages of 18-34 years provided informed consent and completed two experiments involving tests of attentional bias, mood, and memory before and after a cycling protocol or seated rest condition. Participants were categorized into low-trait anxious ($n = 29$) or high-trait anxious ($n = 35$) groups, and randomly allocated to experimental conditions. For both experiments, participants completed the assessments before and following 20 min of moderate intensity exercise or seated rest. Experiment 1 examined word-based attentional bias, while Experiment 2 examined picture-based attentional bias.
RESULTS: Acute moderate exercise did not alter word-based attentional bias scores, $F(1, 60) = 0.82, p = .37, \eta_p^2 = .01$, nor incongruent response times, $F(1, 60) = 0.97, p = .33, \eta_p^2 = .02$. Exercise decreased picture-based attentional bias, but failed to reach statistical significance for bias scores, $F(1, 59) = 3.03, p = .087, \eta_p^2 = .05$, and incongruent response times, $F(1, 59) = 3.45, p = .07, \eta_p^2 = .06$. Trait anxiety levels did not impact exercise-induced changes in attentional bias. Enhancements in participants' mood post-exercise were observed in both experiments, $F(1, 60) = 14.92, p < .001, \eta_p^2 = .20$ and $F(1, 59) = 16.35, p < .001, \eta_p^2 = .23$, respectively. The effects of exercise on memory were inconsistent.

CONCLUSION: The effects of acute exercise on attentional bias seem to depend on stimulus type. Results suggest that exercise has a greater impact on picture-based attentional bias pre- to post-exercise (Experiment 2) compared to word-based attentional bias (Experiment 1). Moderate intensity exercise improves measures of total mood disturbance, anger, confusion, state anxiety, vigor, and tension. This suggests that exercise may have a greater impact on subjective mood measures compared to the attentional processes associated with anxiety.

1107 Board #286 May 31 2:00 PM - 3:30 PM

Exercise Intensity and Creativity

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It has been shown that poor mental cognition is a risk factor for mortality at all stages in life. Studies have demonstrated that participants who report low levels of weekly physical activity consistently score lower in short-term memory, inductive reasoning, and verbal fluency tests. Intensity of exercise appears to be a critical component in the effectiveness of an exercise program on cognitive function, but little research on exercise's effect on creativity has been conducted. Further research is needed in the areas of both exercise's effect on creativity, and more specifically, various exercise intensity levels on creative function. **Purpose:** The purpose of this study was to investigate the relationship between exercise intensity levels in older adults and the creative component of mental cognition. **Methods:** Participants included 14 females and 10 males aged 55-75 years. Each participant completed three creative functioning assessment tests including the Remote Associations Task (RAT), the Creative Uses Test, and the Torrance Test. Height and weight were measured and BMI was calculated. Each participant wore a physical activity monitor that recorded physical activity for one week. Participants were instructed to go about their daily routine as usual. Data were analyzed by linear regression. **Results:** Average daily steps walked and RAT score were significantly associated ($p < 0.05$). There was no statistical relationship between amount of moderate intensity or vigorous intensity physical activity and scores on any creativity test. Those categorized as obese (BMI > 30) scored significantly lower on the RAT test but higher on the Creative Uses Test for both fluency and flexibility measures. **Conclusion:** Amount, but not intensity, of regular exercise had an influence on creative abilities. Additionally, there was a relationship between fatness and creativity. Obese individuals showed decreased convergent creativity abilities and increased divergent creative abilities. Further research is needed to support and explain this finding.

1108 Board #287 May 31 2:00 PM - 3:30 PM

Using Elisa to Enhance The Biochemistry Laboratory Experience For Exercise Science Students

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Background: Researching the effects of exercise on many health conditions requires the use of biochemistry laboratory techniques such as Enzyme Linked Immunosorbent Assay (ELISA). However, undergraduate Exercise Science programs often do not provide experiences in these kinds of biochemistry laboratory techniques. **Purpose:** This project evaluated undergraduate students' knowledge of, experience with, and confidence in using biochemistry laboratory techniques before and after a laboratory exercise measuring salivary cortisol concentrations via ELISA. **Methods:** As part of the laboratory sessions in an undergraduate Exercise Physiology class the students ($n=113$) provided saliva samples before and after 40 minutes of moderate intensity aerobic or resistance exercise. On another occasion, in groups of 2-4 students, the saliva samples were analyzed for cortisol concentrations using commercially available ELISA kits. Before and after the laboratory experience the students completed a survey regarding their knowledge of, experience with, and confidence in biochemistry laboratory techniques. **Results:** 58% of the students completed the survey before and after the biochemistry laboratory experience. None of the students indicated any previous experience with or knowledge of what ELISA was, how to perform an ELISA, or what could be measured using ELISA. 62% of the students had never used a precision single or multichannel pipette, and 50% had no confidence, 26% had very low confidence, and 24% had moderate confidence in their ability to do so correctly. After the laboratory experience 100% of the students had used a precision single channel and multichannel pipette, and 30% had moderate confidence and 70% had high confidence in their ability to do so correctly. As part of an open ended question the students indicated that they enjoyed the experience and frequently commented that they "felt like a real scientist" as while performing the ELISA. **Conclusion:** While many exercise science students in an undergraduate exercise physiology class had no prior laboratory experiences using precision pipettes or other biochemistry techniques,

a single laboratory exercise enhanced the students' confidence in their ability to correctly use precision pipettes and enhanced their self-identification as exercise scientists.

B-74 Free Communication/Poster - Exercise Psychology - Neuroscience

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1109 Board #288 May 31 2:00 PM - 3:30 PM ERP Evidence of Preparation Strategy Change in Table Tennis Players with Varying Level of Difficulty

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(No relationships reported)

The task-preparation processes usually be affected by different factors, such as attentional demands, and skill levels. Researches in sport and motor field reported that skilled athletes are characterized by intense preparation of stimuli and employ highly developed strategies in the attention and motor domains, to respond to stimuli effectively.

PURPOSE: To investigate the effect of skilled level on the task-preparation strategy with varying level of attentional demands.

METHODS: 50 participants were grouped into Elites group (EG, n = 17), Amateur group (AG, n = 16) and Control group (CG, n = 17) based on the table tennis training years and skilled level. A modified cue-target paradigm was used in current study. It contains both cue stimuli (square means easy task, circle means hard task) and target stimuli (a ping-pang ball, may display on the left, right, up or down of the screen.). In the easy task, participants were asked to press the number key on corresponding position with the target, while in the hard task, the key on the opposite position needs to be pressed. Participants were asked to do a cognitive-motor task (release the "5" key, then press the target key and come back to hold the "5" key again.). Electroencephalograph was recorded during the task.

RESULTS: The accurate result showed the EG (0.99±0.01) performed better than CG (0.97±0.03, $p = .046$), and in both reaction time (ms) and choice time, the EG (RT: 336.22±39.05; CT: 470.01±48.27) was faster than both AG (RT: 391.83±58.71; CT: 543.45±66.17) ($ps < .01$) and CG (RT: 426.47±56.18; CT: 582.85±77.08) ($ps < .001$). In the the contingent negative variation (CNV)(1200-1500 ms, unit:µV), only the easy task elicited larger CNV amplitude on the left hemisphere (1.95±1.67) than right hemisphere (0.59±1.36) ($p < .001$) in the CG, while the AG showed such hemisphere differences on both easy (left: 1.39±1.48; right: 0.05±1.17) ($p = .001$) and hard task (left: 1.26±1.61; right: -0.17±1.53) ($p < .001$), and the EG didn't show any difference on hemisphere in neither of the tasks.

CONCLUSIONS: Different task-preparation strategies were moderated by both the skilled level and task difficulty. It is likely that successful athletes in reactive sports are characterized by employing similar spatial preparation in the motor regions to respond to visual stimulus effectively.

1110 Board #289 May 31 2:00 PM - 3:30 PM Exercise Training Rescues High Fat Diet-induced Neuronal Nitric Oxide Synthase Expression In Hippocampus And Cortex.

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Western high-fat diet (HFD) consumption and being overweight induce hippocampal atrophy and deterioration of function. These alterations are associated with mental disorders, such as depression and anxiety. Exercise is an effective therapeutic treatment to combat obesity and enhance brain health. Numerous studies have demonstrated that neuronal nitric oxide synthase (nNOS) is a key regulator of affective behavior. Increased nNOS expression leads to anxiety, while reduced brain nNOS in an enriched environment that includes running exercise has anxiolytic effects. **PURPOSE:** We investigated whether HFD consumption and exercise training altered nNOS expression in the brain. **METHODS:** Twenty 4-week-old male C57BL/6J mice were used. After 2 weeks of acclimatization, mice were randomly assigned to a standard diet (SD; n = 5) or HFD group (n = 15). After 6 weeks, HFD-fed mice were further divided into either a non-exercise (HFD; n = 7) or a HFD (12 weeks) with exercise group (HFD+Ex; n = 8). The HFD+Ex group was allowed free access to a running wheel. Western blotting was performed to determine nNOS protein expression levels in the hippocampus (Hp), cortex (Cx) and cerebellum (Ce) from SD, HFD and HFD+Ex mice. **RESULTS:**

Body weights were significantly increased in HFD-fed mice (SD: 26.0 ± 0.4 g; HFD: 36.6 ± 1.5 g; HFD+Ex: 29.1 ± 0.5 g; $p < 0.01$). Similarly, mesenteric fat weights were increased in the HFD group, while exercise training mitigated this effect (SD: 0.16 ± 0.04 g; HFD: 0.56 ± 0.10; HFD+Ex: 0.25 ± 0.03; $p < 0.01$). Compared with that of SD mice, Hp and Cx nNOS expression levels increased significantly with HFD feeding (Hp: 1.90 ± 0.28 fold increase, $p < 0.05$; Cx: 1.89 ± 0.49; $p < 0.01$). HFD-induced Hp and Cx nNOS expression was reduced in HFD+Ex mice to levels comparable to those of the SD group, though the difference in the Cx was not significant (Hp: 0.86 ± 0.16 fold increase, Cx: 1.48 ± 0.22; $p = 0.1003$). While Hp and Cx nNOS expression levels were susceptible to HFD consumption and exercise, those in the Ce were unchanged ($p > 0.05$). **CONCLUSION:** We conclude that exercise training restores HFD-induced nNOS expression in the Hp and Cx. Our results indicate that HFD-induced brain dysfunction is regulated by nNOS in the Hp and Cx, and exercise has therapeutic potential for mitigating HFD-induced depression and anxiety via the nNOS/NO pathway.

1111 Board #290 May 31 2:00 PM - 3:30 PM Examining Fear Of Re-injury In High School Athletes With Concussion

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Recent concussion consensus statements advocate for research on emotional sequelae and associated risk factors following sport-related concussion (SRC). Fear of re-injury- a frequent emotional response following orthopedic injuries- is one factor that might influence emotional sequelae following SRC. Researchers report that athletes with SRC demonstrate elevated mood disturbances compared to athletes with musculoskeletal injuries. Maladaptive psychological responses, such as fear of re-injury, may influence the clinical presentation of SRC and associated recovery outcomes such as subjective symptom reporting. The relationship between fear of re-injury throughout SRC recovery and post-concussion symptom reporting are unknown. **PURPOSE:** To examine prospectively the relationship between fear of re-injury and symptom reporting in high school athletes with SRC.

METHODS: High school athletes (ages 14 - 18) with SRC were recruited for study and completed research measures at 3.40 days (SD = 1.60) following injury. Demographic data and total symptom severity scores were obtained from the Post-Concussion Symptom Scale (PCSS) and fear of re-injury was assessed via the Tampa Scale of Kinesiophobia (TSK). The TSK scores were categorized as sub-clinical, mild, moderate, and severe. Fear of re-injury categorizations were calculated for the sample and the relationship between TSK scores and symptom severity scores were examined with a Pearson's product-moment correlation. Statistical significance was set at ($p < .05$).

RESULTS: Sixteen high school athletes ($M = 15.75$, $SD = 1.0$ years) participated in the study. The mean TSK score for the entire sample was 36.88 ($SD = 5.96$), which reflects moderate fear of re-injury. Fear of re-injury scores were above clinical cutoffs for the entire sample. More than half of the sample (56%, 9/16) were moderately fearful of re-injury. Twenty-five percent (4/16) and 19% (3/16) of the sample exhibited mild and severe levels of fear, respectively. The mean total symptom score was 23.94 ($SD = 27.13$). Total symptom scores and TSK scores were positively related ($r = 0.67$, $p \leq 0.05$).

CONCLUSIONS: Fear of re-injury is prevalent in high school athletes with SRC. Moreover, total symptom scores are positively correlated with fear and may influence management of SRC.

1112 Board #291 May 31 2:00 PM - 3:30 PM The Influence of Prior Concussion History and Gender on Post-Concussive Recovery in Young Athletes

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PURPOSE: To determine if female athletes with a prior history of concussion have a longer recovery period when compared with their male counterparts with a similar history of prior concussion. **METHODS:** We reviewed male and female youth, high school, collegiate and professional athletes (10-35 years old) seen by one provider for post-concussive symptoms at an outpatient sports medicine clinic.

RESULTS: When comparing males and females with a prior history of concussion, there were no differences found ($p = 0.4006$) in recovery time following a concussion. Without regard to gender, those with no history of prior concussion are more likely to recover from post-concussive symptoms than those with a prior concussion history, although the difference was not statistically significant ($p = 0.1027$). When assessing

whether gender alone influenced recovery rates, findings suggest that males are more likely to recover at any time point when compared to their female counterparts ($p = 0.0019$).

CONCLUSIONS: History of at least one prior concussion in young athletes results in a higher initial symptom score and extended duration of post-concussive symptoms, thereby prolonging recovery time. According to our study, there are no gender-based differences in recovery time for those who sustain multiple concussions.

1113 Board #292 May 31 2:00 PM - 3:30 PM
Neurotransmitter Concentrations Do Not Predict TMS Measures of Excitability and Inhibition in the Motor Cortex

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 (No relationships reported)

Transcranial magnetic stimulation (TMS) provides measures of motor cortex excitability and inhibition. Pharmacological studies suggest the involvement of the neurotransmitters glutamate and GABA in mediating TMS measures of excitability and inhibition, respectively. **PURPOSE:** The aim of this study was to determine the relationship between TMS measures of excitability and inhibition and proton magnetic resonance spectroscopy (1H-MRS) quantitation of excitatory and inhibitory neurotransmitter concentration in the primary motor cortex. **METHODS:** Thirteen (6 female, aged 20.6±1.0 years) healthy individuals were tested at three time points: Baseline, 2 Weeks, and 2 Months. Amplitude of the motor evoked potential (MEPamp) was calculated as a TMS measure of excitability, and the duration of the cortical silent period (CSP) was determined as a TMS measure of inhibition. Concentrations of glutamate and GABA were obtained at similar time points using 1H-MRS. **RESULTS:** MEPamp ($p=0.30$) and glutamate concentration in the primary motor cortex ($p=0.73$) were both similar across visits. However, glutamate concentration did not significantly predict MEPamp ($R^2=0.0002$, $p=0.93$). CSP duration ($p=0.47$) and GABA concentration within the primary motor cortex ($p=0.42$), were also similar across visits. However, GABA concentration did not predict CSP duration ($R^2=0.0008$, $p=0.87$). **CONCLUSION:** No relationship between TMS measures of cortical excitability or inhibition and 1H-MRS measures of glutamate and GABA were reported. These results suggest that additional factors may be responsible for excitability and inhibition, as assessed by TMS.

1114 Board #293 May 31 2:00 PM - 3:30 PM
The Effects Of An Eight Week Exercise Intervention On Brain Activity In Depressed And Non Depressed Individuals: A Fmri Pilot Study

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 (No relationships reported)

PURPOSE: Memory deficits is the most frequently reported cognitive symptom in people suffering with Major Depressive Disorder (MDD). Supporting clinical findings, neuroimaging studies investigating memory impairment in people with MDD have identified brain areas such as the prefrontal cortex and medial temporal lobe to be dysregulated during both memory encoding and retrieval. Exercise for brain health has been a common research theme for the past several years. Research has found that exercise protects against the development of neurodegenerative diseases, reverses brain volume loss in the elderly, upregulates neurogenesis in rodents and improves learning and memory. The aim of this study is to investigate the effects of an eight week exercise program on brain function during a memory task in people suffering with MDD and young healthy individuals.

METHODS: Eight medicated patients with a clinical diagnosis of MDD based on DSM-IV criteria and eight healthy controls completed an eight week supervised exercise intervention. Participants performed an associative memory fMRI task matching names to faces pre and post the exercise intervention. Region of interest (ROI; anterior hippocampus) and whole-brain analyses were conducted to examine changes in brain function pre and post the exercise intervention.

RESULTS: Following the eight weeks of exercise our ROI analyses revealed no group x time interaction, no main effect of group and a marginal main effect of time that did not reach significance. When examining the whole sample, collapsing across groups, increases in activity were present following the intervention in several regions, such as the basal ganglia, medial frontal and parietal lobe, and posterior cingulate. A regression analysis was conducted to determine if the change in activity pre/post was related to improvement in depression scores. We found those who showed the greatest improvement in depression scores had a reduction in activity in the left occipital and right motor regions. This finding suggests an improvement in sensory and motor processing.

CONCLUSIONS: Our study shows that exercise can modulate brain activity during memory encoding in both healthy controls and those suffering from depression, which may be related to the reduction in symptoms shown in patients.

1115 Board #294 May 31 2:00 PM - 3:30 PM
Effects of the FITKids Randomized Controlled Trial on Cognitive Control and Conflict Monitoring in Children

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PURPOSE: We investigated the influence of a 9-month physical activity intervention (FITKids: NCT01619826, NCT01334359) on cognitive control and conflict monitoring.

METHODS: Three hundred eight preadolescent children (8-9 years old) were randomized into an afterschool physical activity intervention ($n=139$) or a wait-list control group ($n=169$). The FITKids intervention occurred following every school day and provided a sum of 70-minutes of moderate-to-vigorous physical activity per session. All children completed a fitness assessment and a cognitive control task (i.e., flanker task) at pre- and post-test. Event-related brain potentials (ERPs) were recorded during flanker performance to determine neuroelectric underpinnings of frontally mediated changes in conflict monitoring (i.e., error-related negativity or ERN).

RESULTS: Results revealed greater improvements in fitness from pre- to post-test for the intervention group (1.8 mL/kg/min; 5.4% change) compared to the control group (0.6 mL/kg/min; 2.1% change) [$t(306)=2.3$, $p=0.02$]. Further, increased performance was observed for the flanker task, requiring variable amounts of cognitive control, with greater change for the intervention group (9.3% accuracy; -8.5 omission errors, -2.0 omission error runs) compared to the control group (6% accuracy; -4.1 omission errors, -0.7 omission error runs) [$F's(1, 306) \geq 6.1$, $p's \leq 0.02$]. Additionally, results revealed larger ERN amplitude at post-test (-6.3 μV) compared to pre-test (-5.0 μV), only for the wait-list group [$F's(1, 306) \geq 9.6$, $p's \leq 0.01$] with no such change observed for the intervention group (pre-test: -5.7 μV ; post-test: -5.7 μV) [$F's(1, 306) \leq 0.6$, $p's \geq 0.46$], suggesting greater cognitive efficiency in that no additional adjustments in neural indices of performance monitoring were observed to underlie improved performance at post-test. Lastly, a dose-response relation was observed for children in the intervention such that greater improvements in cardiorespiratory fitness were related to greater reductions in ERN amplitude ($r=.20$, $p=0.02$).

CONCLUSIONS: These findings demonstrate that daily physical activity not only serves to improve fitness but also facilitates behavioral and functional neural processes associated with effective conflict monitoring in young children.

1116 Board #295 May 31 2:00 PM - 3:30 PM
Modifying Anterior Cruciate Ligament Injury Risk Factors in Female Athletes Through Real-Time Biofeedback

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With a growing number of females participating in sport activities, the prevention of anterior cruciate ligament (ACL) injuries in female has become increasingly important. Overall, female athletes are more likely to injure the ACL than their male counterparts. Unfortunately, the majority of current preventative training programs face implementation challenges that reduce their widespread adoption as an ACL injury prevention program. The approach used in this study is an effort to overcome prior limitations using a real-time visual feedback training program to reduce biomechanical risk factors associated with ACL injuries.

Purpose: To develop and test effects of within activity response to real-time biofeedback method that targets and improves movement biomechanics associated with ACL injury risk in females.

Methods: Twenty female collegiate athletes [19.7 yrs. ($SD = 1.34$), 1.74 m (0.09), and 72.16 kg (12.45)] participated. The study utilized a two-treatment crossover design. Participants were placed into either a real- or sham-first feedback group. The feedback focused on the technical performance of the unweighted back squat. After half the trials, participants were crossed over to receive the alternative treatment. Each

participant completed 110 squats—40 training squats for each feedback display and 10 squats during each test period. Participants' ability to control the feedback was evaluated by a heat map analysis which consisted of calculating a score that indicated the percentage of time the movement caused the stimulus to occupy a correct value. Heat maps were created for pre- and post-tests and each training set of squats.

Results: During training sets there was a significant difference in the heat map scores between the real and sham feedback sets, $t(19) = 2.94, p < .01$. The heat map score during the real feedback sets [$M = 60.73\%$, (6.47%)] was significantly greater than the score during the sham sets [$M = 56.62\%$, (8.42%)], indicating that the real-time biofeedback promoted the desired response during exercise performance.

Conclusions: The heat map scores of participants were higher during the real feedback training sets than the sham feedback training sets indicating real-time biofeedback as a potential training method for modification of risk factors linked to non-contact ACL injury prevention.

1117 Board #296 May 31 2:00 PM - 3:30 PM
Acute High-intensity Interval Training And Moderate-intensity Continuous Exercises Differentially Facilitate Cognitive Control

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PURPOSE: The present study investigated the effects of a single bout of high-intensity interval training (HIIT) and continuous, moderate aerobic exercise (MAE) on inhibitory control. **METHODS:** The P3 component of an event-related brain potential was collected in 64 young adults during a modified flanker task following 20 minutes of seated rest, 20 minutes of MAE, and 9 minutes of HIIT on separate days in counterbalanced order. **RESULTS:** Shorter overall reaction time was observed following MAE (392.2ms) and HIIT (384.8ms) compared to seated rest (402.6ms), $t's(63) \geq 2.8, p's \leq .007$. Response accuracy selectively improved following HIIT (93.2%) in the task condition requiring greater inhibitory control compared to seated rest (91.1%) and MAE (91.3%), $t's(63) \geq 3.0, p's \leq .004$. P3 amplitude was larger following MAE (14.4µV) compared to seated rest (13.1µV) and HIIT (11.6µV), $t's(63) \geq 2.7, p's \leq .007$. Decreased P3 amplitude and shorter latency were observed following HIIT (11.6µV; 393.6ms) compared to seated rest (13.1µV; 405.4ms), $t's(63) \geq 2.6, p's \leq .012$. **CONCLUSION:** The current results indicated that MAE may facilitate cognitive control via increased neural resource allocation, whereas HIIT may have a larger facilitation on cognitive control beyond MAE via more efficient neural resource allocation. These findings demonstrate that both single bouts of MAE and HIIT may be feasible approaches to enhance cognitive performance, albeit via different mechanisms of neural activation.

1118 Board #297 May 31 2:00 PM - 3:30 PM
Comparing Before-and After-School Neurocognitive Performance in High School Athletes: Implications for Concussion Management

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(No relationships reported)

Sport-related concussion (SRC) requires a multifaceted assessment and management approach that relies on computerized neurocognitive testing (CNT) as an objective complement to subjective symptom reporting. Previous literature has identified several factors that negatively influence CNT performance and may complicate post-injury assessment. One factor that may negatively influence CNT performance is the cognitive fatigue associated with the academic school day. Concussed high school athletes may be required to complete an academic school day following their injury. Oftentimes, sports medicine professionals may have to administer CNT before and/or after school depending on the sports medicine, academic, and athletic schedules. However, administering CNT after an academic school day may not be the optimal time to evaluate neurocognitive performance due to several confounding factors such as cognitive fatigue. **PURPOSE:** To compare before-and after-school CNT performance in non-concussed high school athletes.

METHODS: A randomized crossover design was used for this study. After receiving University IRB approval, 29 high school athletes (15 males, 14 females) completed CNT before-and after-school on separate days. The mean age of the sample was 15.72 ± 1.25 years old. A series of paired samples t-tests were conducted for each CNT outcome score (verbal and visual memory, reaction time, processing speed) for both time points. Statistical significance was set at a Bonferroni-corrected ($p < .01$).

RESULTS: Significant differences for visual memory and reaction time were documented across both time points. Visual memory ($p = .008$) was significantly better

before-school (86.14% ± 11.01) than after-school (81.57% ± 12.14) and reaction time ($p = .001$) was significantly slower before-school (0.60 ± 0.07 sec.) than after-school (0.57 ± 0.06 sec.).

CONCLUSIONS: This study suggests that time of day and the demands of a school day should be considered when determining the optimal timing for CNT assessment. More research is needed to determine the mechanisms for which the time of day and cognitive fatigue may impact CNT assessment scores.

1119 Board #298 May 31 2:00 PM - 3:30 PM
Reliability And Validity Of The Japanese Version Of The Activities-specific Balance Confidence Scale After Stroke

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(No relationships reported)

PURPOSE: To investigate the reliability and validity of the Japanese version of the Activities-specific Balance Confidence Scale (ABC-J) among people > 6 month after stroke.

METHODS: ABC-J was translated with the step according to COSMIN'S CHECKLIST and Principals of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes Measures. In a cross-sectional study design, the sample size of this study was calculated according to psychometric recommendations described by Giraudeau and Mary, and calculated with G*power. A convenience sample of 85 people was included (mean age 66.3 ± 9.5 years, between 0.5 and 20 years after stroke). The ABC-J was administered along with the Timed Up and Go test (TUG-T), the 10-meter walk test (10MWT), the Berg Balance Scale (BBS), the Geriatric Depression Scale (GDS), and the Fall Efficacy Scale-International (FESI). One or two weeks later, the ABC-J was again completed by 69 participants. Reliability was investigated in terms of reproducibility (the intra-class correlation coefficient: ICC, standard error and minimal detectable change) and internal consistency (Cronbach alpha), and one type of validity (criterion-related) were assessed with the Spearman correlation coefficients. **RESULTS:** The mean score for the ABC-J was 58.6±24.0. The ABC-J showed excellent internal consistency (Cronbach's alpha = .96) and substantial test-retest reliability (ICC=.96, 95% CI: .93, .97), with standard error and minimal detectable change values of 2.88 and 7.98, respectively. The ABC-J total score significantly correlated with TUG-T ($r = -.53, 95\%CI: -.67, -.35$), 10MWT ($r = -.53, 95\%CI: -.67, -.35$), BBS ($r = .59, 95\%CI: .65, .72$), GDS ($r = -.29, 95\%CI: -.47, -.08$), and FESI ($r = .76, 95\%CI: .65, .84$) (all $p < .001$).

CONCLUSIONS: ABC-J is a valid and reliable measure for investigating balance confidence among people >6 month after stroke.

1120 Board #299 May 31 2:00 PM - 3:30 PM
Jugular Compression Ameliorates Alteration in fMRI of Working Memory in High School Female Soccer Athletes

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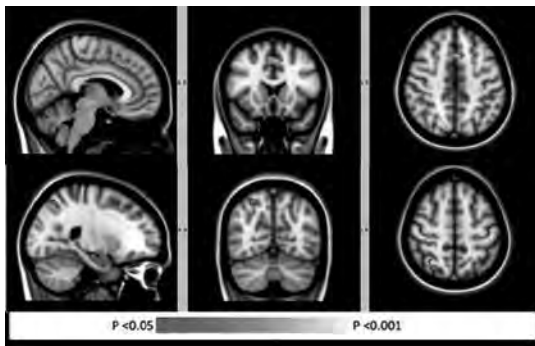
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PURPOSE: We aimed to investigate (1) whether repetitive head impact exposure during a soccer season induced significant functional changes in the brain in female athletes; and (2) whether a neck collar that applies mild jugular vein compression to engorge the cranial reserve volume (to reduce brain slosh during head impact exposure) can ameliorate resultant change in brain functional activation. **METHODS:** Neuroimaging data was acquired prospectively prior to and immediately following a high school soccer season in female athletes. These athletes were assigned to the non-collar group (n=12, age = 15.61±1.00 years) and the collar group (n=8, age = 15.30±1.19 years, $p = 0.53$). Head impact exposures were recorded during all practices and games using X2's X-patch wearable sensor. A standard N-Back task was used to engage working memory during functional MRI at both pre- and post-season. **RESULTS:** On average, the athletes in the two groups experienced a similar number of impacts (145±91 vs. 143±23, $p=0.95$). Increased brain activation of working memory was observed from pre-season to post-season in the non-collar group ($p < .05$, corrected) but not in the collar group. Compared to the non-collar group, significantly lower

alteration in fMRI brain activation ($p < .05$, corrected) was found in the collar group in the cingulate gyrus and the angular gyrus (Figure 1), both of which are known to be associated with memory functions.

CONCLUSIONS: The current study explored the alteration of brain activation in female athletes after experiencing repetitive head impact during a high school soccer season. The significantly increased brain activation from pre- to post-season in the non-collar group suggested that greater effort was required for task completion. The absence of alteration of brain activation in the collar group suggests a potential protective effect, supporting the growing literature of mild jugular compression in brain injury protection in sports.



B-75 Free Communication/Poster - Instrumentation and Assessment Tools

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1121 Board #300 May 31 3:30 PM - 5:00 PM Comparing Motion Capture Systems For Clinical Appropriateness In Lower Extremity Frontal Plane Measurements

Megan Philipp, Kenneth Jenkins, Connor Norman, Harrison Hall, Lauren Beres, Pat Sells, Kevin Robinson. *Belmont University, Nashville, TN.*
(No relationships reported)

Motion capture systems are used with increasing frequency in clinical settings to form treatment and referral decisions. While the systems provide a distinct advantage over visual observations, they are limited by a variety of technological features. Additionally, the systems are not equivalent for all uses, and require further investigation to determine clinical appropriateness.

PURPOSE: The purpose of this study was to compare four independent motion analysis systems for capturing frontal plane hip motion during double limb squat (DLS) and single leg squat (SLS) movements. **METHODS:** 15 females with a mean age of 24.2 ± 1.27 years provided consent and were screened before data collection. Each participant performed three trials of both DLS and SLS which were simultaneously captured on four motion analysis systems (Qualisys, Myomotion, Dartfish, Hudl). Following data collection, frontal plane hip angles were determined at the point of peak knee flexion. **RESULTS:** A one-way ANOVA of frontal plane hip angles between the four motion analysis systems demonstrated significant differences ($p < 0.05$). Tukey post-hoc analyses were conducted to identify statistical significance. No significant difference was found between Qualisys and Myomotion or between Dartfish and Hudl for both right and left lower extremity during both DLS and SLS. A significant difference was found between Qualisys, Dartfish and Hudl during both DLS (7.62 ± 21.71 , -37.57 ± 17.05 , -29.46 ± 15.56) and SLS (-11.52 ± 26.46 , 12.7 ± 6.75 , 12.04 ± 8.09). A significant difference was found between Myomotion, Dartfish and Hudl during both DLS (7.09 ± 8.83 , -37.57 ± 17.05 , -29.46 ± 15.56) and SLS (-20.6 ± 7.88 , 12.7 ± 6.75 , 12.04 ± 8.09). **CONCLUSION:** 2-D and 3-D motion analysis systems demonstrated similarity within their specific domains but cannot be compared due to differences in measurement and calculation methods for hip abduction angles.

1122 Board #301 May 31 3:30 PM - 5:00 PM Relative Strengths and Efficacy of Commonly Used Clinical Motion Capture Systems for Lower Extremity Movements

Kenneth Jenkins, Megan Philipp, Lauren Beres, Connor Norman, Harrison Hall, Patrick Sells, Kevin Robinson. *Belmont University School of Physical Therapy, Nashville, TN.*
(No relationships reported)

Motion capture systems are used with increasing frequency in clinical settings to form treatment and referral decisions. However, these systems offer varying levels of efficacy and comprehensiveness in data capture and clinical appropriateness.

PURPOSE: The purpose of this study was to expand on previous research for a more in-depth comparison between various motion analysis systems including Qualisys and Myomotion as well as Dartfish and Hudl for a variety of joint angles and rotations during functional movements. **METHODS:** 15 females with a mean age of 24.2 ± 1.27 years provided consent and were screened before data collection. Each participant performed three trials of both double limb squat (DLS) and single leg squat (SLS) which were captured on four motion analysis systems simultaneously (Qualisys, Myomotion, Dartfish, Hudl). Multi-plane hip and knee angles were collected at peak knee flexion for each movement performed. **RESULTS:** The comparison between Qualisys and Myomotion demonstrated a significant difference in peak knee flexion ($DLS: 96.83 \pm 12.77$, 105.63 ± 15.31 SLS: 73.68 ± 16.91 , 31.91 ± 15.77) and hip flexion ($DLS: 79.26 \pm 11.39$, 104.01 ± 13.02 SLS: 61.99 ± 18.71 , 78.47 ± 15.57) in right lower extremity. Paired T-tests of the left leg showed no significant difference ($p < 0.05$) between Qualisys and Myomotion for all hip and knee angles collected. Dartfish and Hudl showed no significant difference between knee angles and hip angles at peak knee flexion in the frontal plane bilaterally. **CONCLUSION:** Between the four motion capture systems investigated, comparison of multiple joint angles cannot be made between those using three dimensions (Qualisys and Myomotion) and those using two dimensions (Hudl and Dartfish) as they utilize divergent methods to capture and quantify data. Within their subgroups, Qualisys and Myomotion were found to have no mean differences between hip rotation and abduction, but to differ in peak hip and knee flexion. No significant differences were found between the data captured by Hudl and Dartfish which demonstrates that the two systems are comparable when used in the clinical setting. However, in terms of forming diagnoses, three dimensional systems offer a more complete picture.

1123 Board #302 May 31 3:30 PM - 5:00 PM Mobile, Low Profile, and Inexpensive Knee Joint Angle Sensor

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(No relationships reported)

High-speed videography has been used to collect vast amounts of knee kinematic data, however, this method is generally restricted by a relatively small motion capture volume and is expensive. Consequently, alternative methods should be explored.

PURPOSE: To quantify sagittal-plane knee joint angles, using resistance changes from a high-deflection nanocomposite piezoresistive strain sensor.

METHODS: Nickel coated carbon fiber and nickel nanostrands were cured in a silicone matrix, to create a piezoresistive strain gauge. This gauge was adhered to athletic tape and applied over the patella. The gauge data were collected (1027 Hz), using an RFDuino microcontroller, on one male subject (age = 25 years; height 1.88m, weight 81.6 Kg), while he walked and ran at various speeds (3-7 MPH). Sagittal-plane knee angles were also measured using more traditional methods: VICON high speed cameras and Visual 3-D, and these angles were used to calibrate and evaluate the joint angles obtained from the strain sensor.

RESULTS: Output from the nanocomposite strain gauge appeared to show a one to one relationship between knee angle and change in resistance for angles 20 degrees or more during walking and running (Figure 1). Hysteresis was present in the sensor as it was being loaded and unloaded.

CONCLUSIONS: Through appropriate non-linear models, the strain sensor data could be used to predict knee angles during walking and running, which would facilitate the inexpensive measurement of knee kinematics outside of the traditional biomechanics laboratory setting. Supported by NSF Grant CMMI1538447

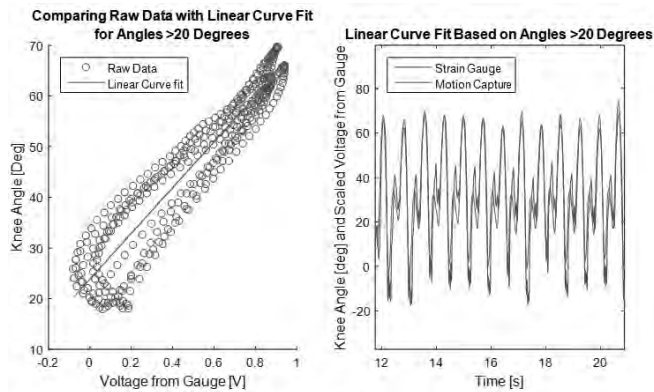


Figure 1 Strain gauge voltage scaled to motion capture angles during a 7MPH run

1124 Board #303 May 31 3:30 PM - 5:00 PM
Reliability Of A Smartphone Application Designed For Postural Control Assessment On Chronic Ankle Instability Subjects

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 (No relationships reported)

Ankle sprain is the most common sports-related injury. With high recurrence rate and residual symptoms, repeated ankle sprain may turn into chronic ankle instability (CAI), which affects sport efficacy and postural control ability. Recently, smartphones had become very popular and powerful devices, and been showed to have good validity and reliability on several clinical usages with built-in sensors. However, there is still not yet a smartphone application designed especially for subjects with CAI to assess their postural control ability.

PURPOSE: The purpose of this study is to evaluate the reliability of a smartphone-based postural control assessment application designed for subjects with CAI. **METHODS:** 10 healthy subjects (1 male, 9 females; age=21.8 ± 1.6 y/o) were recruited in the study. HTC 10 smartphone was used to conduct the assessment by recording the data of built-in accelerometer with an app developed using Android Studio. Subjects were asked to execute a 40-seconds single leg stance test. The smartphone was fixed on the middle of shin with an exercise armband, and the acceleration data was recorded with 50Hz sampling rate. Each subject performed 3 times of the same test (2 tests in day 1 and 1 test in day 2) to evaluate the within- and between-day reliability. Data was analyzed with intra-class correlation (ICC) with SPSS 20, and statistical significance was set as alpha < 0.05. **RESULTS:** ICC of within-day reliability was 0.899, p < 0.001 (acceleration data: test 0.941±1.445 vs retest 0.785±1.252, unit: m/s²). ICC of between-day reliability was 0.655, p = 0.025 (acceleration data: test 0.941±1.445 vs next-day test 1.041±1.513, unit: m/s²). The within-day reliability was good and the between-day reliability was acceptable. **CONCLUSIONS:** The study shows that the smartphone application has good reliability to be a convenient and easy-used tool for assessing postural control ability on CAI.

1125 Board #304 May 31 3:30 PM - 5:00 PM
Leg Power During Simulated Sit-to-Stand Fatigue: Smartphone Measures of Movement Speed

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 (No relationships reported)

Smartphones are inexpensive, portable, user friendly, and contain sensitive gyroscopes. Apps can sample, store, and wirelessly transmit data. The 30s sit-to-stand (STS) is often used to measure leg power and fatigue resistance but provides only a relatively crude count of repetitions. Typically, expensive equipment is required to measure leg power (LP) and changes in LP that would indicate fatigue. **PURPOSE:** Determine the ability of an iPod to detect changes in chair rising speed, compared with an electrogoniometer (eGONI) and force platform. **METHODS:** Young adults (22.9±2.9 yrs, n = 42) performed a series of 20 STS repetitions starting with five at maximal speed, followed by progressive slowing of the remaining reps. Three trials of 20 reps were performed. A 5th generation iPod Touch was attached laterally on the lower thigh. An eGONI (Biometrics) was placed laterally across the knee joint. The feet were on a force platform (AMTI) in front of the chair. Concurrently, iPod gyroscope data (rad), knee joint angle (rad), and ground reaction force (GRF, N) were sampled at 100Hz. The peak slope (0.1s time constant) of the iPod pitch signal, eGONI signal, and GRF was calculated for the rising phase of each rep, in addition to the peak GRF. The instantaneous slope was normalized to body mass to provide an index of power

for each rep. For each device, the max, min, and max-min across the 20 reps were calculated. Correlations were computed between the devices for all subjects combined. **RESULTS:** Within individual subjects, across the range of speeds, the iPod values were highly correlated with the eGONI values (all R²>0.97), and the iPod vs. GRF R² values ranged between 0.82 and 0.95. For 3,148 trials pooled across all subjects, the R² was 0.91 for iPod vs. eGONI, 0.77 for iPod vs. GRF peak slope, and 0.72 for iPod vs. GRF peak. Across all subjects, the iPod vs. eGONI R² values ranged between 0.80 and 0.84 for max, min, and max-min. The iPod vs. GRF peak slope R² values ranged between 0.24 and 0.34, and between from 0.38 to 0.54 for iPod vs. GRF peak. **CONCLUSION:** A large range of chair rising speeds can be detected with the iPod. The iPod is an adequate substitute for an electronic goniometer or force platform to assess changes in leg power during an extended sit-to-stand task.

1126 Board #305 May 31 3:30 PM - 5:00 PM
Validation Of Smartphone-based Assessment Of Sit-to-stand Power

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 (No relationships reported)

Modern smartphones are inexpensive, portable, user friendly, and contain sensitive gyroscopes. Apps can be used to sample, store, and wirelessly transmit data. Although easy to conduct, field tests of sit-to-stand (STS) power provide only a relatively crude (timed or counted) outcome measure of global performance. Expensive lab-based biomechanics equipment is required to obtain measures of leg power (LP) for individual repetitions during brief 5x STS tasks. **PURPOSE:** To determine the ability of the iPod to detect movement speed for each rep during a 5x STS test, and make comparisons with an electrogoniometer (eGONI) and force platform. **METHODS:** Young adults (22.9 ± 2.9yrs, 21 men, 21 women) performed a 5x STS task as rapidly as possible with strict form. Three trials were performed. A 5th generation iPod Touch was firmly attached (Velcro) to a strap around the lower thigh. An eGONI (Biometrics) was placed laterally across the knee joint. The feet were on a force platform (AMTI Accusway) in front of the chair. Concurrently, iPod gyroscope data (rad), knee joint angle (rad), and ground reaction force (GRF, N) were sampled at 100Hz. The peak slope (0.1s time constant) of the iPod pitch signal, eGONI signal, and GRF was calculated for the rising phase of each rep. The peak GRF was also measured. The instantaneous slope was normalized to body mass to provide an index of power for each rep. For each device, the mean power of 5 reps and the maximal single rep value was calculated for the three trials. Correlations were computed between the devices across all subjects. **RESULTS:** The mean (R²=0.85) and max (R²=0.86) iPod peak slope were highly correlated with the corresponding eGONI value. The mean (R²=0.47) and max (R²=0.44) iPod peak slope were moderately correlated with the corresponding GRF value. The mean and max values were highly correlated with each other for the iPod (R²=0.99), eGONI (R²=0.99), and GRF (R²=0.98). The greater rising power for men vs. women was detected similarly by the iPod (32.5%), eGONI (29.5%), and peak GRF (30.9%). **CONCLUSION:** As measured with the iPod, mean rising power from the 5x STS is very reflective of a single maximal rep. The iPod is sufficiently sensitive to detect differences in chair rising power between sexes and can replace an electronic goniometer for assessing chair rising power.

1127 Board #306 May 31 3:30 PM - 5:00 PM
Development of Smartphone-Based Balance Assessment System for Subjects with Chronic Stroke

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 (No relationships reported)

Stroke is a cerebral artery disease that may lead to death and long-term disabilities; common clinical features include: hemiplegia, muscle weakness, numbness, sensory and motor deficits. These features may cause balance impairments, which will affect performance of ADLs and Quality of Life. In recent years, smartphones had become very popular and powerful. With the built-in sensors, smartphones had been shown to have good validity and potential to assess balance. Therefore, the purpose of this study is to evaluate the feasibility of smartphone-based balance assessment system for subjects with chronic stroke.

Methods: Ten subjects with chronic stroke (9 male, 1 female; age=57.7±13.3 y/o) and thirteen healthy adults (5 male, 8 female; age=45.6±11.7 y/o) were recruited in the study. HTC 10 smartphone was used to conduct the balance assessment, by recording its built-in accelerometer data with an application developed using Android Studio. Six postures were tested for thirty seconds each: shoulder-width stance (SWS) with eyes opened (E/O) and closed (E/C), feet-together stance (FTS) with E/O and E/C, semi-tandem stance (STS) with E/O and E/C. The smartphone was fixed on the back

on the S2 level. The summation of changed acceleration data was used to represent the balance performance, and the higher value indicated more instability. Data was analyzed with independent t-test with SPSS 20, and statistical significance was set as $\alpha < 0.05$.

Results and discussions: Significant difference was found between subjects with chronic stroke and healthy adults under four assessment postures: SWS with E/C (stroke 0.040 ± 0.013 vs. healthy 0.032 ± 0.007 , $p = 0.048$, unit: g), FTS with E/O (stroke 0.037 ± 0.013 vs. healthy 0.032 ± 0.006 , $p = 0.027$, unit: g), FTS with E/C (stroke 0.050 ± 0.023 vs. healthy 0.035 ± 0.006 , $p = 0.000$, unit: g), STS with E/C (stroke 0.099 ± 0.075 vs. healthy 0.055 ± 0.017 , $p = 0.048$, unit: g). The result demonstrates that a smartphone with built-in accelerometer can be used to discriminate the different balance performance between subjects with chronic stroke and healthy adults.

Conclusion: The study shows that smartphones may be a convenient, easy-to-use and valid tool for balance assessment on subjects with chronic stroke.

1128 Board #307 May 31 3:30 PM - 5:00 PM
Reliability of Foot Morphology Measurements From a Three-Dimensional Scanner
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The relationship between structure and function of the foot may play a role in lower extremity injuries. Three-dimensional scanning techniques of foot structure have recently been developed to automate anatomical foot measurements.

Purpose: To assess the reliability of foot morphology measures from a commercially available three-dimensional scanner in a young, female population.

Methods:

15 females participated in this study (age: 19.9 ± 0.8 yrs, height: 1.7 ± 0.1 m, mass: 66.3 ± 13.8 kg). A hand-held 3D white light scanner was used to obtain specific foot related measurements. Each subject had both feet scanned using a standardized foot position. Twelve measurements were calculated: foot length, foot width, heel width, arch height, arch length, toe height, ball circumference, waist circumference, instep circumference, heel circumference, ball height, and instep height for both feet. Inter-rater reliability was assessed between two different raters on the same test day. Between day test-retest reliability (intra-rater) was evaluated by a single rater on two separate days. Additionally, within day test-retest reliability was evaluated from three separate scans from the same rater. Intraclass correlation coefficients ICC (2,1) were computed for each measure. Standard error of measurement (SEM) was also calculated for each variable.

Results: Between day test-retest reliability was excellent (ICC range=0.91-0.98) for left and right length and width measures (SEM 1.4 ± 0.7 mm). Between day height measures were lower with a range of 0.58-0.88 (SEM 1.6 ± 0.5 mm), with toe height exhibiting the lowest reliability, whereas, circumference measures ranged from 0.89-0.96 (SEM 2.7 ± 0.4 mm). Within day test-retest reliability was generally greater than between day reliability (range 0.75-0.99). Inter-rater reliability of height and width measures exhibited a range of 0.94-0.99 (SEM 1.1 ± 0.5 mm). The range of inter-rater reliability for height measures was 0.63-0.89 (SEM 1.7 ± 0.5 mm) and circumference measures were 0.90-0.97 (SEM 2.6 ± 0.3 mm).

Conclusion: The results indicate that height, width and circumference reliability were excellent for inter-rater, intra-rater, and within day test-retest. While generally acceptable, future work should investigate the lower reliability for height measures.

1129 Board #308 May 31 3:30 PM - 5:00 PM
Reliability And Validity Of Hip Proprioceptive Scores In Older People: Testing In Weight-bearing Stance With The Hip Sway Ameda
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To date, most hip proprioception tests have been conducted in lying position, which may be not relevant to functional performance. **PURPOSE:** To investigate the reliability of a novel hip proprioception test conducted in weight-bearing stance and its relevance to functional performance in older people.

METHODS: Twenty-one right-footed community-dwellings (8F, 13M, mean 72 years old, range 65-87), without neurological disorders or major lower limb injuries in the past 6 months volunteered. All participants could walk at least 100 meters independently without using a walking aid. Active Movement Extent Discrimination Apparatus (AMEDA) was purposely built for testing hip sway proprioception in the sagittal plane and the measure of proprioceptive sensitivity was obtained using Area Under the ROC Curve (AUC) analysis. The proprioceptive scores on the two occasions

were used to calculate a reliability ICC (3, 1). A paired-sample t-test was used to examine test-retest differences. To evaluate test validity, Pearson's correlations were calculated between scores of hip AMEDA and Step Test (ST) and 10 Meter Walk Test (10MWT).

RESULTS: The ICC (3,1) was 0.61 and there was no significant difference between the two occasions of testing ($p = 0.18$). Both the left and right hip proprioceptive scores were significantly correlated with ST results ($r = 0.52$ and 0.45 , both $p < 0.05$). Only right hip proprioceptive scores were correlated significantly with the Comfortable and Fast forms of the 10MWT ($r = -0.46$ and -0.44 , both $p < 0.05$). Proprioceptive scores for the right and left hips were significantly correlated ($r = 0.73$, $p < 0.001$).

CONCLUSIONS: The novel hip sway AMEDA test showed an acceptable reliability for the measurement of hip proprioception in older people. The hip proprioceptive scores obtained showed a significant relationship with functional performance. These findings have implications for rehabilitation intervention during aging.

1130 Board #309 May 31 3:30 PM - 5:00 PM
Pilot Study For The Reliability Of The 10-second Foot Tapping Test (FTT)
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 (No relationships reported)

The ability to produce and sustain rapid and repetitive movements is a vital aspect of almost any act of daily living (ADL). Without such ability, seemingly simple tasks such as walking would be all but impossible. Though commonly overlooked, the ability to rapidly and repetitively dorsiflex and plantar flex the foot is a crucial constituent of proper gait. So to that end, researchers have identified a means of assessing a person's ability to rapidly and repetitively dorsiflex and plantar flex the foot known as the 10-second foot-tapping test (FTT). Using the FTT, researchers have demonstrated that there is a marked decrease in foot tapping speed in clinical populations; e.g. stroke, multiple sclerosis, amyotrophic lateral sclerosis, cervical myelopathy, and Parkinson's disease; as well as degradations with age regardless of disease. It is hypothesized that this decline in foot tapping speed is attributed to changes taking place in the motor neurons responsible for the contraction of the muscles of the lower limbs. Despite showing a diminished foot tapping speed with disease and age, very little is known about the reliability of the FTT. **Purpose:** Therefore, the purpose of this study was to evaluate the test-retest reliability and inter rater reliability measures of the FTT using video playback of the test. **Methods:** Nine subjects were recruited for this study. Over the course of two visits, foot-tapping speed for each leg was measured using the FTT. During each visit the number of foot taps performed in 10 seconds was tested twice for each leg, yielding 4 tests per leg per subject over the course of two days. Each trial was video recorded and slowed down at varying speeds so as to allow each of the three raters to easily distinguish and count the individual foot taps, creating a total of 216 individual leg-test counts for analysis. **Results:** The FTT was found to have high interrater reliability (Cronbach's Alpha: 0.971) and immediate test-retest reliability (Pearson R Correlation: 0.918). **Discussion:** This study indicates that the FTT exhibits high test-retest and interrater reliability using video analysis. However, going forward, more research must be done on the reliability of the FTT using "live" counting, across the many apparent variations in test administration methods, and of course within a larger and more diverse group of subjects.

1131 Board #310 May 31 3:30 PM - 5:00 PM
Assessing the Reliability and Validity of an Objective Method of Measuring Postural Stability: Preliminary Data
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Reported Relationships: S.E. Scarneo: Contracted Research - Including Principle Investigator; BrainScope Company, Inc.

PURPOSE: Postural stability is frequently used in the evaluation of mild traumatic brain injury (mTBI) and can be measured in a variety of different ways. Although Balance Error Scoring System (BESS) is a supported tool for assessing postural stability assessment after mTBI, other clinical tools are available, such as body sensors such as APDM Opal body sensor). The purpose of this investigation was to assess the validity and relationship of the APDM Opal body sensor compared to the modified BESS (mBESS) in individuals after an mTBI. **METHODS:** Injured subjects were defined as those diagnosed by an appropriate health care professional with an mTBI and compared to healthy controls. Postural Stability was examined using both the mBESS and APDM Opal sensor during the same testing session with the three traditional stances. mBESS was scored according to the conventional grading system. APDM was used in conjunction with a tablet and mobility lab software to collect postural stability data. Root mean square values were calculated for anterior-posterior (AP) and medial-lateral (ML) acceleration. Pearson product-moment correlations were calculated to assess the relationship between average mBESS score and average

RMS value, between average mBESS score and diagnosis with a concussion, and between average RMS value and diagnosis with a concussion. **RESULTS:** The overall mean RMS value was $1.92 \pm 1.20 \text{ m}(s^2)^{-1}$ while subjects ($n=43$) committed a mean of 1.20 ± 0.88 balance errors during BESS testing on a firm surface. The coefficient of determination between calculated means of RMS and total mBESS score for the subject pool was modest, however trended towards significant ($R^2=0.08, p>.05$). The coefficient of determination between mean total BESS score and a positive concussion diagnosis was insignificant ($R^2=0.002, p>.05$). A weak and inverse relationship was found between calculated mean RMS and positive diagnosis with a concussion compared to healthy controls ($R^2=0.009, p>.05$). **CONCLUSION:** While our results did not show a strong correlation between mBESS score and the Opal's measurement of postural stability, there was a trend toward statistical significance that may be influenced by sample size. This is promising given previously established validity and reliability values of the APDM, especially when using only a single sensor.

1132 Board #311 May 31 3:30 PM - 5:00 PM
Test-Retest Reliability of Multiple Postural Control Assessment Measures
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Multiple assessment methods exist to identify postural control deficits in both healthy and pathological populations. Though force platform technology is frequently used and validated in quiet stance conditions, few studies have explored the reliability of dual task assessments. Additionally, few studies have utilized non-linear metrics derived from ground reaction forces to determine differences in dual task conditions. **PURPOSE:** The purpose of this study was to determine test-retest reliability of three different postural control assessments using both linear and nonlinear methodology. **METHODS:** 24 healthy participants (3 male, 21 female, age 20.38 ± 1.46) attended a single testing session once a week for four weeks. Participants completed three trials of eyes open (EO) and eyes closed quiet standing (EO) and a sport-like postural task, the Wii Fit Soccer Heading Game (WFS). Raw Center of Pressure (CoP) was collected using a force platform (1000Hz) and further analyzed. 95% Confidence Ellipse (CE), along with Peak Excursion Velocity (PEV), and Sample Entropy (SampEn) in anteroposterior (AP) and mediolateral (ML) directions was calculated from the data. Test-retest reliability was assessed using multiple repeated-measures ANOVA for each CoP variable across each time point (Time 1, Time 2, Time 3, Time 4). **RESULTS:** Significant differences were observed in 95% CE in EO ($p=.016$) and EC ($p=.032$) conditions. However, post hoc assessments determined no significant differences between time points 1, 2, 3, or 4. No significant differences were observed for EC PEV in the AP ($p=.211$) and ML ($p=.403$) directions, EO in the AP ($p=.340$) and ML ($p=.239$) directions, or WFS in the AP ($p=.065$) and ML ($p=.122$) directions across time. No significant differences were observed for EC SampEn in the AP ($p=.961$) and ML ($p=.030$) directions or EO in the AP ($p=.434$) and ML ($p=.150$) directions. **CONCLUSIONS:** Results indicate that the postural assessment metrics used for EO, EC, and the WFS conditions are a reliable measure across multiple weeks and do not indicate significant variability or a learning effect over time. Use of both linear and non-linear CoP measurements such as SampEn, PEV, and 95% CE show to be reliable over multiple time points, and thus should be taken into consideration for future studies utilizing postural control assessment.

1133 Board #312 May 31 3:30 PM - 5:00 PM
The Reliability of Foot Torsional Stiffness Measurements in Asymptomatic Recreational Runners
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Excessive foot mobility has been identified as a risk factor for overuse injuries in runners. Existing tools used to assess foot mobility either lack reliability, correlation with dynamic foot function, or require a significant amount of experience to use reliably. **PURPOSE:** To develop a clinical tool that can be used by novice clinicians to assess foot flexibility by measuring the torsional stiffness of the foot and evaluate its reliability. **METHODS:** A novice clinician (less than one year of experience) performed a structural foot assessment on 10 asymptomatic recreational runners. The assessment consisted of dorsal arch height index (DAHI) and foot torsional stiffness (FTS) measurements using a ForeFoot Torsion Measurement Device (FTMD). The same clinician repeated the measurements of DAHI and FTS at a second day approximately one week later. The FTMD provides measurements of angular displacement and torque at a sampling rate of 50 Hz and consists of a split platform controlled by a stepper motor with a torque sensor located in series with the motor

that allows for forefoot on rearfoot motion. **Data analysis** consisted of creating torque - angle curves using the FTS data and fitting the curves using a 2-degree polynomial of the form $c1X^2+c2X+b$. For each subject, a mean $c1$ and $c2$ coefficient and DAHI were obtained for the day 1 and day 2 measurement sessions. Intraclass correlations were used to assess the reliability of the coefficients across the three trials on the same day and Pearson correlations were used to assess test-retest reliability of the mean $c1$ and $c2$, and DAHI across days. **RESULTS:** The correlation between the day 1 and 2 DAHI measurements for the right and left feet were $r=.842$ ($p=0.002$) and $r=-0.101$ ($p=0.8$). The intraclass correlation coefficients for the $c1$ and $c2$ coefficients for the right and left feet were 0.887 and 0.927 and .813 and .738, respectively. The correlation between the day 1 and day 2 mean $c1$ and $c2$ coefficients were $r=.493$ ($p=0.027$) and $r=.695$ ($p=.001$), respectively. **CONCLUSIONS:** The FTMD appears to be a more reliable method of assessing foot flexibility than DAHI regardless of extremity that can be used by novice clinicians.

1134 Board #313 May 31 3:30 PM - 5:00 PM
The Development of a Seated Clinical Trunk Test to Assess Lower Extremity Injury Risk
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 (No relationships reported)

Poor neuromuscular control of the trunk is associated with numerous injuries, including anterior cruciate ligament tears. Currently, few reliable methods exist to clinically assess trunk neuromuscular control. The development of such a test could be used to screen individuals who require trunk neuromuscular control training for injury prevention and rehabilitation. **PURPOSE:** The objective of this study was to assess the between and within session reliability of a new seated clinical trunk control test. **METHODS:** 10 healthy subjects (10 F, ages 21 ± 1.83 , BMI 21.78 ± 3.01) with no prior lower extremity injuries were asked to sit on a wobble board placed on a solid surface on a plinth with their feet approximately 4 inches off the ground. Test length was 30 seconds and subjects had three practice trials followed by 2 test trials with their eyes closed. Performance on the test was measured as the time to the first predefined error and how many errors occurred in 30 seconds for each trial. An error occurred if the subject uncrossed their arms, opened their eyes, or if an edge of the wobble board touched the plinth. Reliability with and between days was assessed with an Intraclass Correlation Coefficient (ICC). **RESULTS:** Between day reliability for the time to error was good ($ICC=0.77$) and the reliability for the number of errors was excellent ($ICC=0.93$). Both the time to error and number of errors had excellent within session rater reliability ($ICC < 0.99$). The average time to error was (day 1: 17.3 ± 9.2 seconds, day 2: 21.5 ± 8.6 seconds), and the average number of errors was (day 1: 1.4 ± 1.8 errors, day 2: 1.2 ± 1.4 errors). The average difference for time to error within the same session was 0.1 ± 0.1 seconds, and there were no differences in the number of errors. **CONCLUSION:** The seated trunk control test shows good to excellent within and between day reliability for both the number of errors and time to the first error. Furthermore, there were minimal differences between trials, indicating that after the practice trials, there was no additional learning, yielding stable consistent results. These results indicate that the test is a reliable assessment of trunk neuromuscular control. Having established the tests reliability, subsequent studies should assess its ability to differentiate injured versus non-injured individuals.

1135 Board #314 May 31 3:30 PM - 5:00 PM
Comparison of Stability Scores on Adult Participants Using Commercial Balance Methods
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Methods. Currently, many commercial products or methods are being marketed for being the best way to improve overall balance and stability. Several of these products have not been tested or compared to see if stability range limits can be improved within a five week session by using these devices. **Purpose:** The purpose of this study was to compare if commercial balance methods can improve Limit of Stability (LoS) scores in healthy adult participants? **Methods:** A 4 group pre-test/post-test non-equivalent control group design was selected for the protocol. Subjects were grouped into 4 categories, Bosu Balance Trainer (BBT), Slack-line Device (SLD), Vinyasa Yoga (VG) and Control Group (CG). All subjects ($n=148$) were assessed pre and post via computerized posturography (Bertec, Inc. Columbus, OH) to determine (LoS) stability scores through sagittal and anterior/posterior planes. The experimental groups (BBT, SLD, VY) practiced their skills twice a week for at least 30 minutes for 5 straight weeks. A 4 x 2 multivariate MANOVA was used to determine any significance ($p < 0.05$) within subjects and between groups.

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Results: Significance was observed in the frontal ($p = .036$) and right sagittal planes ($p = .034$) within the experimental groups. VY was significantly higher in the frontal plane ($SD = 3.07 + 1.09$) than BBT ($SD = 3.64 + .82$) or SLD ($SD = 3.97 + .73$). However, SLD was significantly higher in the right sagittal plane ($SD = 4.16 + .72$) compared to VY ($SD = 3.67 + .54$) and BBT ($SD = 3.31 + .46$). Post-hoc power scores demonstrated a value of 1.0 with regards to effect between subjects (group) and within subjects (time/time * group).

Conclusion: Commercial balance methods can contribute to increasing Limit of Stability (LoS) scores in healthy adults. However, there is not a definitive program or device that increases LoS in all planes, based upon the results of this study.

1136 Board #315 May 31 3:30 PM - 5:00 PM

Balance Assessment using Microsoft Xbox Kinect

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(No relationships reported)

Reduction in balance has been identified as an indicator of risk of fall, and thus, an accurate and cost effective balance assessment tool is essential for prescribing effective postural control strategies. **PURPOSE:** To establish the validity of the Microsoft Xbox Kinect (Kinect v2) in assessing the whole body center of mass (CoM) excursion and velocity during single leg balance and voluntary ankle sway tasks among young and elderly subjects. **METHODS:** Twenty subjects (10 young: age = 20.5±2.3 years, Height = 171.8±7.2 cm, Weight = 70.7±11.6 kg; 10 elderly: age = 70.6±9.5 years, Height = 169.1±8.7 cm, Weight = 74.0±17.8 kg), with no history of lower extremity injury, participated in this study. Subjects performed a total of six randomized trials; four single leg stand (SLS) and two ankle sway trials. A comparison between the balance outcome measures (anteroposterior (AP) and mediolateral (ML) CoM excursion and velocity and average sway length) from the Kinect v2 and a traditional three-dimensional motion analysis (3DMA) system was performed. **RESULTS:** Results from the SLS and voluntary ankle sway trials showed that consistency, agreement, and correlation between systems was excellent ($ICC > 0.75$) for all CoM related variables when all subjects were considered a single group as well as when the elderly and young groups were analyzed. Concordance between systems ranged from poor to almost perfect depending on the group, task, and variable assessed.

CONCLUSION: This new technique, using a low cost motion analysis technology, may enable real time, objective assessments of balance parameters in the clinical and research environments, which represents a clear advancement in clinical balance assessment and home-based rehabilitation programs.

1137 Board #316 May 31 3:30 PM - 5:00 PM

Validation of the Kinect-based Star Excursion Balance Test

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The Star Excursion Balance Test (SEBT) is a simple clinical assessment of dynamic balance that is commonly used as a measure of performance and injury risk among healthy and injured populations. Continued efforts to improve the sensitivity and repeatability of the SEBT, while maintaining the relative ease with which the SEBT can be implemented, may aid clinicians in utilizing the SEBT as an evaluative tool in patients with suspected balance deficits. To date, there is no study examining the use of the Microsoft Kinect on assessing the SEBT reach distance measures. **Purpose:** To establish the validity and reliability of the Xbox One Kinect (Kinect v2) to automatically assess the SEBT reach data in all eight directions. **Methods:** A total of ten healthy subjects (5 males and 5 females, age: 26.8±5.7 years, height: 174.2±8.3 cm, weight: 73.5±10.8 kg) participated in this single session observational research study. The reach distances in the eight different directions of the SEBT were measured concurrently from the Kinect v2 and a traditional three-dimensional motion analysis (3DMA) system. **Results:** The maximum SEBT reach distance difference between the Kinect and a traditional motion analysis system (BTS) was 2.01cm, while the minimum difference obtained was 0.86cm. The maximum ICC difference between the two systems was 0.01 and the maximum difference in CV was 1.7%, indicating that the Kinect is able to provide similar absolute and relative reliability compared to the BTS. Additionally, Pearson's correlation coefficient showed high agreements between the Kinect and the BTS ($r > 0.97$) in all directions of the SEBT. **Conclusion:** The performance of the Kinect was comparable to that of the BTS in determining the trajectories of the subject's landmarks and thus the reach distance values during complex dynamic tests such as the SEBT.

1138 Board #317 May 31 3:30 PM - 5:00 PM

Inter-day Consistency Of The Regional Analysis Of Discomfort Survey

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Cleated footwear designs often differ in terms of stud configuration, stiffness, and other structural variables. Although these design differences have the potential to affect an athlete's performance, they may also directly influence the athlete's perceived comfort of the cleat. Established footwear comfort surveys are generally non-specific in identifying anatomic locations of discomfort. Thus, there is a need to develop more specific and reliable assessments of footwear comfort. **PURPOSE:** To identify the day-to-day reliability and consistency of the electronic Regional Analysis of Discomfort Survey (RADS). **METHODS:** Fifteen healthy female athletes (age= 19.9±0.8 yrs, height= 1.7±0.1 m, mass= 66.3±13.8 kg) completed a series of movement screening and physical performance tasks on an artificial turf surface in standard soccer cleats on two separate days. After finishing these tasks, participants completed the RADS, which provided them the opportunity to identify locations of regional discomfort on an illustration that included the lateral, posterior, medial, plantar, and dorsal areas of each foot on a computer screen. The day-to-day consistency of identifying discomfort in each of 16-regions of the foot were analyzed using the coefficients of agreement (number of exact agreements / number of possible agreements). **RESULTS:** Fourteen of the fifteen participants identified an area of discomfort on at least one of the two days (mean= 4.4±5.7 locations, range= 0-20). Overall, the coefficients of agreement indicated good-to-excellent day-to-day consistency, with values ranging from 0.73-1.00. The lowest consistency was found in the distal (0.73) and proximal (0.73) aspect of the lateral side of the right foot, and distal (0.73) and proximal (0.73) aspect of the medial side of the left foot. The RADS exhibited perfect day-to-day consistency (1.00) in the bilateral plantar hallux, bilateral central plantar forefoot, and left plantar midfoot regions. **CONCLUSIONS:** Preliminary analysis indicates that the RADS may provide consistent day-to-day measures of perceived footwear discomfort in an athletic female population. Further investigations using a larger sample size and broader range of cleated athletes are warranted to validate the RADS using plantar foot pressure and anthropometric foot structure data.

1139 Board #318 May 31 3:30 PM - 5:00 PM

Validation of Single Sensor Wireless In-shoe Force Insoles during Running

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Assessment of lower extremity loading during running is often completed either overground or on an instrumented treadmill in a biomechanics lab. A new product has been developed to allow for the acquisition of plantar loading on an iPod using Bluetooth, which could allow for the assessment of running in an outdoor setting. **PURPOSE:** To validate a single sensor in-shoe force insole (pedoped, Novel Electronics, St. Paul, MN) against a force plate during various running conditions. **METHODS:** The study included 12 subjects (age 25.3±4.2, height 68.7±4.1 cm, weight 758.9±173.9 N) each fitted with a pair of pedoped insoles (100Hz) and a pair of New Balance shoes. Each subject completed a 20 second running trial for 6 different conditions on an instrumented treadmill (1200 Hz). These conditions include running at a 9, 10 and 11 min/mi pace, running uphill at 10 min/mi, running with an exaggerated heel strike and a wide gait pattern at 11 min/mi (R9, R10, R11, RU, RHS, and RW respectively). A Matlab program was created to calculate peak vertical ground reaction forces (vGRF), loading rate (LR), and impulse (I) for each step. The interclass correlation (ICC 3,k) comparing the pedoped insoles with the force plate was calculated in SPSS. The ranges used for the ICC are: fair 0.40-0.59, good 0.6-0.74, and excellent 0.75-1.00. **RESULTS:** The average peak vGRF, LR and I are presented in Table 1 along with the specific ICC values. For the vGRF the ICC values are considered excellent (0.81-0.91), LR ICC values are good to excellent (0.74-0.95), and I ICC values are excellent (0.84-0.91). **CONCLUSIONS:** Loading differences between the pedoped and force plate could result from differences in measurement location. These results indicate that these single sensor wireless insoles (pedoped) are a valid alternative to assessing lower extremity loading parameters during running allowing researchers to expand testing to a variety of settings outside of the lab.

Table 1: Comparisons between pedoped and force plate loading parameters.

	vGRF (BW)			LR (BW/s)			I (BW*s)		
	pedoped	Force Plate	ICC (SEM)	pedoped	Force Plate	ICC (SEM)	pedoped	Force Plate	ICC (SEM)
R9	2.15±0.17	2.40±0.20	0.88 (0.05)	16.72±3.23	21.64±4.38	0.76 (0.92)	0.34±0.030	0.36±0.021	0.84 (0.01)
R10	2.140±0.17	2.38±0.21	0.89 (0.05)	16.43±3.50	20.48±4.07	0.78 (0.87)	0.34±0.026	0.37±0.022	0.91 (0.01)
R11	2.08±0.15	2.29±0.15	0.83 (0.04)	15.51±3.49	18.93±3.68	0.90 (0.80)	0.35±0.023	0.38±0.025	0.95 (0.01)
RHS	2.04±0.18	2.28±0.15	0.91 (0.04)	15.06±2.71	17.92±2.05	0.95 (0.56)	0.34±0.024	0.38±0.023	0.87 (0.01)
RW	2.02±0.17	2.27±0.15	0.88 (0.04)	15.53±3.36	20.53±6.95	0.74 (1.21)	0.34±0.030	0.37±0.028	0.90 (0.01)
RU	2.09±0.12	2.30±0.15	0.81 (0.04)	14.93±2.21	18.17±3.14	0.93 (0.64)	0.34±0.029	0.36±0.028	0.89 (0.01)

*SEM = standard error of the measurement.

B-76 Free Communication/Poster - Medical Issues

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1140 Board #319 May 31 3:30 PM - 5:00 PM

Disturbed Shear Rate Patterns And Endothelial Dysfunction In Young Men On Anabolic Androgenic Steroid Abuse

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(No relationships reported)

Previous studies showed that disturbed in the shear rate (SR) patterns, characterized by high retrograde and oscillatory SR on conduit artery, are associated with pro-atherogenic phenotype. This phenomenon seems to be caused by increased sympathetic nervous activity and reduced bioavailability of nitric oxide. Considering the anabolic androgenic steroids (AAS) abuse induces autonomic dysfunction, it is possible to speculate that AAS users present alterations in the SR on conduit artery. **Purpose:** The aim of this study was to evaluate the shear rate patterns in young men under AAS abuse. **Methods:** 18 volunteers were divided into 2 groups: self-reported Anabolic Androgenic Steroid Users (AASU, n=10), Anabolic Androgenic Steroid Non-Users (AASNU, n=8), both group were bodybuilder (strength exercise training). The patients were submitted to evaluate SR patterns and flow-mediated dilation (FMD) both in the brachial artery. Furthermore, carotid artery intima-media thickness (IMT) was evaluated. All vascular variables were obtained by Doppler ultrasound and the images were analyzed by brachial analyzer. **Results:** Age was similar among AASU and AASNU (27±1 vs. 27±1 years, p=0.87). Anterograde SR (118.0±11.0 s⁻¹ vs. 117.0±17.0s⁻¹, p=0.9) and mean SR (78.0±12.0 s⁻¹ vs. 98.0±21.0 s⁻¹, p=0.3), were similar between groups. AASU showed higher retrograde SR (-42.0±6.0s⁻¹ vs. -19.0±5.0 s⁻¹, p=0.01) and oscillatory SR (0.30±0.03 uu vs. 0.16±0.04 uu, p=0.03) compared to AASNU. AASU showed lower FMD compared to AASNU (7.2 ± 0.7% vs. 9.6 ± 0.7%, p=0.04). In addition, AASU showed higher carotid artery IMT compared to AASNU (0.62±0.02 mm vs. 0.49±0.02, p=0.005). **Conclusion:** Our results suggest that AAS abuse induces disturbed in the SR patterns in the brachial artery and endothelial dysfunction. These alterations could increase the risk of developing atherosclerosis in young men under AAS abuse.

1141 Board #320 May 31 3:30 PM - 5:00 PM

Long Compared To Short Haul Travel Effects On Wheelchair Basketball Player'S Preparation For The World Championships

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(No relationships reported)

Transmeridian travel often results in sleep disruption and increased daytime fatigue, both of which could negatively affect performance if travel is undertaken in close proximity to competition. Preliminary evidence from elite able-bodied athletes

regarding the impact of travel prior to competition is available to inform medical staff practice, however such data has not been collected from elite Paralympic athletes. This seems a considerable oversight given the unique challenges these athletes face with respect to travel and sleep.

PURPOSE: To investigate the impact of long compared to short haul travel on sleep, jet-lag, mood and performance in a group of elite Paralympic athletes prior to and during competition.

METHODS: For 19 consecutive days, including baseline (12 days), travel (1 day) and competition (6 days), objective measures of sleep and subjective measures of jet-lag, vigour, fatigue, and performance were assessed in 11 elite wheelchair basketball players using wrist actigraphy and self-report questionnaires, respectively. International travel to the World Championships (Manchester, United Kingdom [4 games over 6 days, commencing 2 days post arrival]) from various destinations was categorized into either LONG (n=6; 8-11 h time-zone change) and SHORT (n=5; less than 2 h time-zone change). Linear mixed models, standardised effect sizes (ES) and magnitude-based inferences were used to analyse the data.

RESULTS: There was no substantial influence of travel group (LONG vs. SHORT) on sleep quantity and quality, or subjective responses. However, for all players combined the mean sleep duration during baseline was below National Sleep Foundation guidelines, with a further likely small (ES = 0.36 ± 0.25) reduction during competition (6.7 ± 1.4 h vs. 6.3 ± 1.6 h, p=0.02). Increased vigour was associated with a likely moderate increase in subjective performance rating during competition (ES = 0.33 ± 0.26).

CONCLUSIONS: This group of Paralympic athletes did not obtain sufficient habitual sleep at home, with travel, regardless of the number of time-zones crossed, and/or competition further reducing sleep quantity. Individualised strategies to increase sleep quantity prior to and particularly following travel would therefore be recommended for this specific group of athletes.

1142 Board #321 May 31 3:30 PM - 5:00 PM

Exercise-Induced Asthma Knowledge among Coaches of the Special Olympics National Team

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(No relationships reported)

Evidence suggests that adults with an intellectual disability (ID) who have asthma worry about side-effects of using medications and do not like using their inhalers in public due to stigma. This is problematic, particularly for athletes, as medication needs to be taken 10-15 minutes prior to exercise. Further, research indicates that adults with ID may not be using their inhalers properly. Thus, coaches may need to assist with ensuring appropriate use of inhalers. **PURPOSE:** The purpose of this study was to determine whether Special Olympics coaches know how to manage their athlete's asthma effectively. **METHODS:** Coaches were asked to complete a short survey anonymously while attending training camp with their athletes. The survey consisted of 11 true or false statements regarding asthma, three questions on symptoms, triggers, and preventive techniques, and six yes/no questions on their athletes asthma status, their comfort and confidence in dealing with an athlete having an attack, and their emergency action plan (related to asthma). Twenty seven coaches completed the questionnaire. **RESULTS:** On average, coaches got 3.9 ± 1.6 of the true/false statements incorrect. However, they generally identified correct triggers, symptoms and preventive techniques. Less than half of the coaches felt confident dealing with an asthma attack if their athlete had one while playing their sport. Only 5 coaches had received training to prepare them for working with an athlete with asthma and only 9 coaches had an emergency action plan to deal with an asthma attack. **CONCLUSION:** These results demonstrate a need for asthma related training for Special Olympics coaches.

1143 Board #322 May 31 3:30 PM - 5:00 PM

The Effect Of Resistance Training On Strength, Balance, And Coordination In Elderly Women

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Purpose: Analyze the effect of 12 weeks of resistance training on strength, coordination, and balance performance in elderly women. **Methods:** The effect of resistance training on strength, coordination, and balance performance was assessed in a total of 39 postmenopausal elderly women (age 71 ± 9 yrs) who were selected to participate in a protocol of 12 weeks of resistance training. The sample was separated into two groups, the intervention group (IG) with 29 women and the control

group (CG) with 10 women. The resistance training protocol was applied three times a week engaging muscle groups between superior and inferior muscles. The exercises performed to superior muscles were the Pulley, Peck-Deck, Triceps Pulley, Hammer and Side Lateral Raise and the exercises to the inferior muscles were the Abductor, Adductor, Extension Chair, Flexor Bench, and Leg press 90°. Flexibility was tested using a Well's Bench where the participant performed 3 attempts and the best score was recorded. The dynamic balance was analyzed using a circuit that was performed before the intervention beginning and at the end of 12 weeks. Following the prescriptions proposed by Rikli & Jones, the coordination test was performed using a complex task mixed with a circuit. **Results:** The strength in superior limbs statistically improved between CG and IG (11.40 ± 2.87 vs 19.50 ± 1.52) with similar results with the inferior limbs strength (14.90 ± 3.10 vs 26.56 ± 3.17, p=0.001). Regarding dynamic balance, the IG presents a decrease in the time to complete to task compared to the CG (14.62s ± 1.83s vs 12.71s ± 0.62s, p<0.05). There are no differences in the coordination between GC and IG. **Conclusion:** The main conclusion of this manuscript brings a new paradigm to the training methods used in elderly populations. The benefits related to the strength development using resistance training are in accordance with the present literature, however, in opposition to the present literature, we found that resistance training is effective in developing dynamic balance. Dynamic balance is fundamental in avoiding falls, which are one of the most common injuries in the elderly population. Therefore, it is fundamental that elderly people work to develop health and wellness by incorporating resistance training as a strategy to develop strength and balance.

1144 Board #323 May 31 3:30 PM - 5:00 PM
Maximizing Respiratory Health In Elite Swimmers - A Systematic Approach To Optimize Total Airway Health
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 (No relationships reported)

Elite Swimmers are known to have high prevalence of exercise induced bronchoconstriction (EIB), nasal and sinus disorders. There is however limited data available regarding the impact of a systematic assessment, addressing all aspects of airway health in this cohort.

PURPOSE: To report the findings of a systematic approach to evaluating total airway health in elite swimmers with EIB, prior to the 2016 Olympics.

METHODS: 15 elite swimmers (9 males, 6 females), age 22.2 ± 2.9 yrs underwent a systematic assessment of total airway health three months prior to the Olympics. All swimmers had a prior diagnosis of EIB, confirmed by indirect bronchoprovocation challenge and measurement of exhaled nitric oxide (FeNO). All were prescribed appropriate inhaler therapy and educated on inhaler technique. At the systematic assessment spirometry, FeNO, inhaler flow-rate, nasal flow was measured and they also underwent an assessment with a pulmonologist. Results were analysed using paired *t*-tests and are presented as mean ± SD.

RESULTS: All swimmers had at least one co-existing condition in addition to EIB including nasal disease, reflux, sensations of laryngeal closure, recurrent respiratory tract infection and abnormal breathing sensations. One-third reported side effects from inhaler use. All swimmers demonstrated sub-optimal inhaler technique based on an inhalation rate of 348 ± 49.4 L.min⁻¹. Despite being prescribed treatment for EIB, three swimmers had on-going airflow obstruction with bronchodilator reversibility of FEV₁ by 12.9 ± 7.7 % above baseline. At the review FeNO was reduced (pre: 27.7 ± 15.1, post: 16.3 ± 6.5 ppb (p = 0.006) from first consult.

CONCLUSION: Despite being prescribed EIB treatment over half of an elite cohort of swimmers reported troublesome respiratory and allied symptoms. Moreover, inhaler technique was sub-optimal with frequent report of side-effects. Respiratory health in elite swimmers can be optimized through systematic assessment of airway health.

1145 Board #324 May 31 3:30 PM - 5:00 PM
Venous Thromboemboli Associated with Acute Aerobic Exercise: A Review of Case-Report Commonalities
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 (No relationships reported)

Venous thromboembolic (VTE) events (deep vein thrombosis (DVT) and pulmonary embolism (PE)), have been reported in otherwise healthy athletes following acute bouts of aerobic exercise. **PURPOSE:** To review case reports and assess the commonalities of athletic individuals diagnosed with VTE, as well as the return-to-play recommendations prescribed by their physicians. **METHODS:** We reviewed reports (n=14) of trained individuals (mean±sd; age 30.9 ± 15.3; F/M = 8/6) who were

diagnosed with DVT and/or PE following a bout of aerobic exercise. We assessed frequency of VTE risk factors, symptoms with which patients presented, and return-to-play recommendations presented by clinicians. Age comparisons between the female and male groups were assessed by a one-way ANOVA. **RESULTS:** Of the 14 cases of diagnosed VTE reported in healthy trained athletes, seven patients (50%) were diagnosed with PE, four (28.6%) with DVT, and three (21.4%) with both DVT and PE after a bout of vigorous exercise (11.7±3.0 METs). Female patients were on average younger than males (22.6±5.9 vs. 41.8±17.7; p=0.014). The most frequently reported commonality was the presentation of symptoms after a period of prolonged inactivity (> 1 hour) following an aerobic exercise bout, seen in nine (64.3%) individuals. Additionally, seven (87.5%) of the eight women were oral contraceptive (OC) users. Only two (12.3%) individuals were diagnosed with an inherited clotting disorder. Five cases (35.7%) did not report return-to-play recommendations, and those who did varied widely, with six (42.9%) clinicians recommending a range of physical activity restrictions, and three (21.5%) clinicians advising use of compression garments. **CONCLUSIONS:** Female athletes presenting with VTE were significantly younger than male athletes, and most were using OCS, suggesting that the mechanisms underlying VTE may differ in men vs. women. Moreover, the frequency with which a period of inactivity preceded VTE also supports the possibility that aerobic exercise in combination with other risk factors can exacerbate VTE independent of underlying preexistent coagulopathy disease. This information may help clinicians better prevent, diagnose and treat VTE in athletic patients and also highlights the need for better defined return-to-play guidelines for athletes following VTE.

1146 Board #325 May 31 3:30 PM - 5:00 PM
L-glutamine Enhances Plasma Glutamine And Maintains Concentrations Of Alanine And Arginine Following High Intensity Cycling
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 (No relationships reported)

Glutamine is a naturally occurring nonessential, gluconeogenic amino acid. Prolonged exercise is associated with a decrease in intramuscular and plasma concentrations of glutamine, which may be linked to performance decrements. Thus, we hypothesized that exogenous glutamine supplementation would preserve the plasma glutamine pool following high intensity cycling, as well as improve performance in a repeated bout of cycling. Two solutions [61 g glucose polymer (PLC); 61 g glucose polymer and 0.3 g·kg⁻¹·bodyweight L-glutamine (GLN)] were tested using a double-blind, randomized, cross-over design. During each trial, ten cyclists ingested one liter of test solution immediately following an initial exercise bout (30 min at 70% VO₂ max, 6 x 1 min sprints at 140% VO₂ max, 45 min at 70% VO₂ max) and recovered for two hours in a seated position. Immediately following the recovery period, subjects completed a time to exhaustion (cycle at 80% VO₂ max until no longer maintaining 100 RPM) test. Blood was collected immediately following the initial exercise bout, after 2 h recovery, and immediately following the time to exhaustion test. Glutamine concentration was increased (p < 0.05) by approximately twofold (676±126 to 1410±636 μmol/L) from baseline to the completion of recovery for GLN, while no difference was detected in the PLC trial. At the end of recovery, GLN maintained alanine and arginine concentrations, while these amino acids significantly decreased in the PLC trial. However, the increased concentration of plasma glutamine and maintained concentrations of alanine and arginine did not influence performance (GLN: 20.98±10.35; PLC: 21.5±8.53 min).

1147 Board #326 May 31 3:30 PM - 5:00 PM
The Influence of Exercise Volume on Cardiorespiratory Fitness and Cardiovascular Disease Risk Factors
 Thomas Burke, Kelsie Ostojic, Nicole Koontz, Leonard A. Kaminsky, FACSM, Matthew Harber, FACSM. Ball State University, Muncie, IN. (Sponsor: Dr. Matthew Harber, FACSM)
 (No relationships reported)

Purpose: To investigate the relationship of total exercise volume in relation to the American College of Sports Medicine (ACSM) aerobic exercise guidelines on improving cardiovascular disease (CVD) risk factors and cardiorespiratory fitness (CRF). **Methods:** Ninety-two individuals (57.0±11.1 (28-79) years; 41% male, 59% female) in a self-referred exercise program completed a CVD risk factor assessment, body composition (iDXA), and maximal exercise testing pre- and post- 6 months of participation. All were provided an individualized exercise prescription based on ACSM aerobic exercise guidelines. Exercise volume (frequency, intensity, and duration) was recorded daily and subjects were stratified into three groups (HIGH, MODERATE, LOW) based on the total volume performed. A two factor (group x time) ANOVA with repeated measures on time was performed to assess differences between groups for resting hemodynamics, blood lipids, body composition, and CRF. Correlation analyses were used to examine the relationship between exercise volume,

CVD risk factors, and CRF. **Results:** Exercise volume was higher ($p<0.05$) in HIGH compared to MODERATE and LOW, and MODERATE was higher ($p<0.05$) than LOW. A main effect for time ($p<0.05$) was present for resting heart rate, systolic/diastolic blood pressure, total cholesterol, triglycerides, LDL, body weight, waist circumference, BMI, CRF, body fat composition, and lean mass, independent of group. Exercise volume was correlated ($p<0.05$) with markers of aerobic fitness; resting heart rate ($r=-0.236$) and CRF ($r=0.286$). Improved plasma lipid profile was ($p<0.05$) correlated with exercise volume; total cholesterol ($r=-0.287$), LDL ($r=-0.222$), glucose ($r=-0.247$). Additionally, exercise volume was significantly correlated with markers of body composition, mainly fat distribution; body weight ($r=-0.369$), body mass index ($r=-0.356$), fat mass ($r=-0.417$). **Conclusion:** Participation in a self-referred exercise program improves CRF and CVD risk factors regardless of exercise volume. Correlations between exercise volume and CVD risk factors (e.g. blood lipids, body composition) suggest a dose response relationship. Randomized control trials are warranted to assess the impact of exercise volume on CVD risk factors.

B-77 Free Communication/Poster - Nutrition and Health

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1148 Board #327 May 31 2:00 PM - 3:30 PM

Assessing Urine Concentration in Children by Combining Urine Color and Void Number

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Reported Relationships: L.T. Jansen: Consulting Fee; S.A. Kavouras - Scientific Consultant for Quest Diagnostics. Contracted Research - Including Principle Investigator; S.A. Kavouras - Active Grants with Danone Research.

Purpose: To evaluate the diagnostic ability of two combined practical markers for high urine concentration in children. **Methods:** Twenty-four hour urine samples from 210 Greek children (age: 8-14 y, body mass: 43.4 ± 12.6 kg, height: 1.49 ± 0.13 m, girls: 105) were collected and analyzed for urine osmolality (UOsm), color (UC), while the number of voids (Void) was recorded. Receiver Operating Characteristic (ROC) analysis was performed for UC, Void, and combination of UC and Void to determine markers' diagnostic ability for detecting high urine osmolality ($UOsm > 800$ mmol \times kg⁻¹). **Results:** Sixty-four out of the 210 children (30%) had UOsm greater than 800 mmol \times kg⁻¹, with mean UOsm, UC, and Void of 686 ± 223 mmol \times kg⁻¹, 3 ± 1 , and 6 ± 2 , respectively. UC displayed an overall diagnostic accuracy (area under the curve, AUC) of 90% (adjusted for gender, age and body mass index) with 98.4% sensitivity, 59.6% specificity, and threshold of >3 . The overall accuracy for Void was 73.7% (adjusted for age and gender) with 63.1% sensitivity, 64.1% specificity, and threshold of >5 times per day. When combined ROC analysis performed for UC & Void presented an AUC of 91% with 100% sensitivity and 62.6% specificity. **Conclusion:** Both urine color alone and the combination of urine color assessment and void count can be used as valid and simple diagnostic measures to detect high urine concentration. **Grant Funding Info:** Funding provided by Danone Research

1149 Board #328 May 31 2:00 PM - 3:30 PM

A First Morning Spot Sample Overestimates 24-Hour Urine Osmolality in Children and Adults

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Reported Relationships: A.D. Seal: Consulting Fee; Quest Diagnostics. Contracted Research - Including Principle Investigator; Danone Research.

Hydration is frequently assessed using the concentration of single spot urine samples collected from first morning urine. However, circadian variations and overnight fasting (i.e., during sleep) likely affect morning urine concentration. Twenty-four-hour urine samples provide a more complete view of daily hydration, but collection is time-consuming and is difficult to manage, particularly in studies involving children. The degree to which first morning urine overestimates 24-h urine concentration has been characterized in adults, but less in children. **Purpose:** To evaluate the diagnostic

accuracy of first morning urine concentration to accurately identify children and adults with high 24-h urine concentration (>800 mmol \times kg⁻¹). **Methods:** Hydration was assessed via urine osmolality (U_{Osm}) in a total of 210 children (age: 8-14 years, body mass: 43.4 ± 12.6 kg, height: 1.49 ± 0.13 m, girls: 105) and 82 adults (age: 23.6 ± 2.9 , body mass: 65.8 ± 8.1 kg, height: 1.72 ± 0.76 m, women: 41). Data collection included both a full 24-h collection (U_{Osm-24}) as well as the associated first morning spot urine sample (U_{Osm-AM}). The diagnostic accuracy of U_{Osm-AM} to identify $U_{Osm-24} > 800$ was evaluated using receiver operating characteristic (ROC) analysis in children and adults separately. **Results:** Mean U_{Osm} in children and adults, respectively, were as follows: U_{Osm-AM} : 780 ± 235 and 782 ± 244 mmol \times kg⁻¹; U_{Osm-24} : 686 ± 223 and 567 ± 214 mmol \times kg⁻¹. ROC analysis for U_{Osm-AM} for detecting $U_{Osm-24} > 800$ in children yielded an area under the curve (AUC) of 82.3% with sensitivity, specificity, and threshold values of 53.1%, 95.2%, and 1009 mmol \times kg⁻¹, respectively. In adults, the AUC was 89.0%, with sensitivity, specificity, and threshold values of 91.7%, 87.1%, and 969 mmol \times kg⁻¹, respectively. **Conclusions:** Urine osmolality measured with a first morning spot sample overestimates 24-h urine osmolality in both children and adults. This is in line with previous research in adults suggesting that spot urine samples only reach equivalence with 24-h urine osmolality in the early to late afternoon. Similar research needs to be performed in children. Funding provided by Danone Research.

1150 Board #329 May 31 2:00 PM - 3:30 PM

Effects of Vitamin D3 Supplementation on Lean Mass, Muscular Strength, and Cardiorespiratory Fitness: A Double-Blind Randomized Controlled Trial

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Low levels of serum 25-hydroxyvitamin D [25(OH)D] are associated with low lean mass, decreased muscle strength, and poor cardiorespiratory fitness. However, the evidence in support of the effect of vitamin D supplementation on lean mass and physical fitness is inconsistent. **Purpose:** To clarify whether there is a direct effect of a 1-year vitamin D₃ supplementation on lean mass, muscular strength and cardiorespiratory fitness in healthy adults. **Methods:** Ninety-five participants (34 men) randomly received either 420 IU vitamin D₃ per day or placebo in a double-blind manner for 1-year. Lean body mass and fat mass were determined by dual energy X-ray absorptiometry (DXA). Hand grip strength (HGS) was measured using a hand grip dynamometer and leg extension power (LEP) was measured using a leg extension power measurement system. Cardiorespiratory fitness (CRF) was assessed by measuring peak oxygen uptake (VO_{2peak}) using bicycle ergometer. Physical activity (PA) was assessed using uniaxial accelerometer and quantified as time spent in moderate- and vigorous physical activity (MVPA). Serum 25(OH)D and 1,25-dihydroxyvitamin D [$1,25(OH)_2D$] concentrations were assessed using commercial ELISA kits. **Results:** Serum 25(OH)D and $1,25(OH)_2D$ concentrations were significantly increased by approximately 29.5nmol/L and 7.0 pg/mL, respectively, after 1-year vitamin D₃ supplementation. After vitamin D₃ supplementation, lean body mass was significantly increased from 43.8 kg to 44.3 kg ($P<0.05$), while the muscle strength and cardiorespiratory fitness were not changed. **Conclusion:** The present study indicates that vitamin D₃ supplementation for one year effectively improves lean mass, but not muscle strength and cardiorespiratory fitness in healthy adults. Supported by a Grant-in-Aid for Scientific Research (C), National Natural Science Foundation of China (No. 31571226), and Program for Professors of Special Appointment (Eastern Scholar) at Shanghai Institutions of Higher Learning (No. TP2014057) to ZBC.

1151 Board #330 May 31 2:00 PM - 3:30 PM

The Prevalence Of Vitamin D Deficiency In Elite Winter Sport Athletes

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Purpose: In recent years, vitamin D's role in health and athletic performance has become evident. As a result, research on the prevalence of vitamin D insufficiency has been a topic of growing interest. The current literature assessing vitamin D status in the athletic population is limited. Therefore, the purpose of this study is to determine the prevalence of vitamin D insufficiency in elite winter sport athletes. **Methods:** A retrospective analysis was performed on data from various elite winter sport types throughout 2015 ($n=91$, 24.9 ± 4.2 yrs). Multiple serum 25-hydroxyvitamin D (25(OH)D) lab values were collected and athletes answered a questionnaire with information on sport type, geographical training/living locations, vitamin D

supplementation, and sun exposure. Descriptive statistics, student and paired t-tests, repeated measures, one- and two- way ANOVAs were used to detect differences in vitamin D levels across time, within and between groups. SPSS v 23 was used. Significance was set at $p < 0.05$.

RESULTS Prevalence of vitamin D insufficiency across all winter sports was highest at the beginning of the year and during the winter season (27.3% and 24.3%, respectively). There were no significant changes in 25(OH)D levels observed over time, however, indoor winter athletes (IWAs) had consistently lower 25(OH)D levels when compared to outdoor winter athletes (OWAs) across the entire year. Supplementation during winter season increased 25(OH)D levels in IWAs by 11.5 ng/ml when compared to non-supplementing IWAs ($p < 0.05$); 25(OH)D levels in OWAs were not affected by supplementation. During the summer season athletes of lighter skin pigmentation had 7.5 ng/ml higher 25(OH)D levels than athletes of darker skin pigmentation ($p < 0.05$).

CONCLUSION The findings of this study demonstrate vitamin D insufficiency is prevalent in elite winter sport athletes with an increased risk for IWAs. With negative effects associated with inadequate vitamin D, it is recommended for sports dietitians to increase the frequency of vitamin D testing throughout the year and consider supplementation in athletes during winter seasons.

1152 Board #331 May 31 2:00 PM - 3:30 PM

Can Increased Sodium Intake Reduce Exercise-associated Hyponatremia?

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The primary risk factor for exercise-associated hyponatremia is overhydration, but other factors can play a role, including Na⁺ losses and intakes. **PURPOSE:** To test the efficacy of a CHO-containing (6%) beverage with 60 vs. 21 mmol/L on plasma [Na⁺] when consumed to nearly match mass loss, while cycling in the heat.

METHODS: In a randomized, crossover study, 10 males (VO_{2max} 60 ± 3 mL/min/kg, 75 ± 5 kg, 20-50 y) cycled (55% VO_{2max}) in the heat (34 °C) for 3 h while consuming a beverage containing either 21 mmol/L Na⁺ (L) or 60 mmol/L Na⁺ (H). Beverage volume was based on body mass changes in 1 h pre-trials under similar conditions. Blood was sampled every 30 min. Tc, HR, and body mass were monitored. Linear mixed effects model analysis of variance was conducted with Subject as a random effect, and Diet and Time as fixed effects. T-tests were conducted on single measures.

RESULTS: Not all subjects completed 3 h of exercise, with mean exercise time being 175 min on both L and H. Mean fluid intake was (3.3 ± 0.6 L, 3.4 ± 0.7 L, resp.; $p = 0.45$). Body mass change was (-0.39 ± 0.31 , -0.20 ± 0.36 kg, resp.; $p = 0.09$). Plasma sodium decreased over time on L, whereas increased slightly on H ($p < 0.001$), with mean rate of change being (-0.6 ± 0.6 mmol/L/h, 0.6 ± 0.6 mmol/L/h, resp.; $p = 0.057$). At ride completion, four subjects were hyponatremic (plasma [Na⁺] < 135 mmol/L) on L, and only one on H. No differences in end Tc (38.6 ± 0.8 , 38.6 ± 0.8 °C, resp.; $p = 0.90$) or end HR (147 ± 31 , 157 ± 24 bpm, resp.; $p = 0.39$) were observed.

CONCLUSION: Consumption of a beverage with sodium concentration of 60 mmol/L has advantage over one with a concentration typically found in sports drinks (21 mmol/L), preventing plasma sodium reduction during long-lasting exercise in the heat.

1153 Board #332 May 31 2:00 PM - 3:30 PM

Iron Supplementation During 3 Consecutive Days Of Endurance Training Augmented Hepcidin Concentration

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PURPOSE: Several physiological mechanisms have been proposed to explain impaired iron status, such as gastrointestinal bleeding, hemolysis, lack of iron in dietary diet and losses in sweat. However, detailed mechanisms underlying exercise-induced iron deficiency among athletes remain unclear. Hepcidin, the 25-amino acid peptide hormone, is a key mediator of iron homeostasis and it may represent another mechanism for iron deficiency in response to exercise training. The present study was designed to investigate impact of consecutive days of strenuous endurance training on hepcidin concentration. The influence of iron supplementation during training period was also determined. **METHODS:** Fourteen male endurance athletes (long distance runners, triathletes) participated (mean \pm standard error, age: 19-22 yrs; height: 1.68 ± 0.01 m; body mass: 57.3 ± 1.6 kg; maximal oxygen uptake (VO_{2max}): 59.6 ± 0.8 ml/kg/min). Subjects were randomly assigned to either an iron treatment group (Fe group, $n = 7$) or a placebo group (CON group, $n = 7$). All subjects completed 3 consecutive days of endurance training, consisting of two bouts of 75 min of treadmill running at

75 % of VO_{2max} , separated with 3h of rest between bouts. In the Fe group, 12 mg of iron was provided using flavor drink twice a day (24 mg/day), whereas the subjects in the CON group took the same flavor drink without iron. Venous blood samples were collected in early morning on days 1-4 and 3h after second bout of exercise on day 1. Serum hepcidin, ferritin, iron, myoglobin and plasma IL-6 concentrations were evaluated. **RESULTS:** The Fe and CON groups showed acute elevations of serum hepcidin, myoglobin and plasma IL-6 concentrations 3h after exercise ($P < 0.05$ vs. baseline). After 3 days of training period (day 4), serum hepcidin concentration was significantly higher in Fe group than in CON group (11.0 ± 2.5 ng/mL vs. 5.9 ± 1.6 ng/mL, $P < 0.05$). Moreover, serum iron concentration was decreased only in Fe group on day 4 (91.3 ± 13.5 in the Fe group vs. 129.7 ± 7.4 μ g/dL in the CON group). **CONCLUSIONS:** Three consecutive days of endurance training increased hepcidin concentration at baseline when the iron was supplemented.

1154 Board #333 May 31 2:00 PM - 3:30 PM

Lower Choline Intake is Associated with Diminished Strength and Lean Mass Gains in Older Adults

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PURPOSE: Choline is an essential micronutrient involved in many physiological processes including membrane integrity/signaling, lipid transport, methylation reactions, neurotransmission, and muscle contraction. We examined the relationship between habitual, food-based choline consumption and muscle responses to resistance exercise training (RET).

METHODS: Forty-six, 60-69-year-old men and women underwent 12 weeks of whole body RET (3x/week, 3 sets, 8-12 reps, 75% of maximum strength [1RM]). Body composition (DEXA) and 1RM tests were performed before and after training. After analyzing 1,656 dietary logs (3x/week for 12 weeks with 46 participants), participants' mean choline intakes were categorized into three groups: Low (2.9-5.5 mg/kg lean/d), Med-Low (5.6-8.0 mg/kg lean/d), or Adequate (8.1-10.6 mg/kg lean/d). This corresponds to <50%, ~63%, and ~85% of Adequate Intake (AI), respectively. ANOVA/ANCOVA were performed to compare changes in composite strength (leg press + chest press 1RM) and lean mass between groups controlling for the effects of other nutrients.

RESULTS: Gains in composite strength were significantly less in the Low group compared with the other groups (Low: $30.9 \pm 15.1\%$, Med-Low: $70.3 \pm 48.5\%$, Adequate: $81.9 \pm 68.4\%$; $p = 0.004$). ANCOVA with cholesterol, protein, or other nutrients did not alter this result. Reduced gains in lean mass were also observed in the Low group, compared with the higher choline intake of 5.6-10.6 mg/kg lean/d ($1.3 \pm 0.6\%$ vs. $3.2 \pm 0.6\%$, $p < 0.05$) with folate as a covariate.

CONCLUSION: These data suggest lower choline intake is negatively and independently associated with muscle responses to RET in older adults.

1155 Board #334 May 31 2:00 PM - 3:30 PM

Dietary Guidelines For Americans: Comparing Menus To What Is Served And Consumed In Preschool Children

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Preschool menus must meet the Dietary Guidelines for Americans however, what is actually served and consumed by children is not restricted, potentially affecting consumption of a balanced diet. **PURPOSE:** Compare preschool menus that meet dietary guidelines to what is actually served and consumed. **METHODS:** Fifty-two preschool children (mean \pm SD, age 3y and 10m \pm 8m) from a university early childhood center participated in the 10-week study. Each day, 15 children were randomly selected for nutritional analysis of their lunch. Prior to and immediately after consumption, a picture of the child's tray was taken using digital photography. If a child had additional food (second serving), additional pictures were taken. Analysis of energy and nutrient content for menus, food served, and food consumed was completed using Food Processor Nutrition Analysis by ESHA. Food color (white, brown, orange, yellow, red, green, other) was determined by observation during analysis. A food preference survey was administered orally to children immediately after each meal. **RESULTS:** There was a significant ($p < 0.05$) difference for total kilocalories (kcal) between menu (448 ± 130), served (523 ± 148) and consumed (361 ± 178). There was a significant ($p < 0.05$) difference for grams of carbohydrate between menu (55.3 ± 18.9 g) and served (56.5 ± 20.5 g) compared to what was consumed (38.5 ± 21.7 g). There was a significant ($p < 0.05$) difference for grams of fat between menu ($16.0 \pm$

8.7g), served (21.2 ± 9.7g) and consumed (14.5 ± 10.0g). There was a significant (p<0.05) difference for protein between menu (21.7 ± 5.7g), served (27.9 ± 10.6g) and consumed (19.5 ± 11.8g). The majority of food served was white (38.1%), brown (20.4%), or yellow (14.2%) with minimal green (10.7%), orange (10.2%), or red (6.1%) foods. Children described food as yummy (75.2%), okay (7.6%), and yucky (17.2%). Consumption of vegetables (46.9%) was significantly (p<0.05) lower than dairy (88.9%), fruits (82%), grains (81.8%), and meats (72.8%). Children consumed a high percentage (77.9%) of fats/sweets. **CONCLUSION:** The amount of food consumed was significantly less than the menu and served amounts, indicating that children were not meeting the dietary recommendations as intended, potentially contributing to long-term health consequences.

1156 Board #335 May 31 2:00 PM - 3:30 PM
Characterization of Nutritional Intake and Distribution in Pediatric Burn Patients

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PURPOSE: The hypermetabolic response after a severe burn results in whole body catabolism and calorie deficits leading to malnutrition and losses in lean body mass (LBM). Thus, proper nutrition after a severe burn is essential to recovery. Current practice is to increase nutritional intake by (1.2-1.5 kcal x resting energy expenditure (REE)) and protein (1.5-2.5 g protein/kg/day) to increase LBM. Research in non-burn populations suggests an ideal protein intake of 25-30 g per meal for optimal protein synthesis. However, outpatient nutritional monitoring is currently not well documented; the amount and distribution of protein among meals is unknown. Therefore, we examined the nutritional profile and distribution of substrates in severely burned pediatric outpatients in comparison to non-burned children to further direct recovery efforts to mitigate catabolism and increase LBM.
METHODS: Caregivers of 23 burned children (>30% total body surface area burned) and 7 non-burned children (NB) (21 male, 9 female; 13 + 4 years; mean ± SD) completed 24-hour dietary recalls for 3 consecutive days to obtain a detailed report of foods consumed. Unpaired t-tests with Welch's correction were performed between burned and NB children. Alpha was set at p<0.05.
RESULTS: Burned children consumed significantly more kcal (3032 ± 888 kcal) than NB children (2147 ± 551 kcal, p=0.006) and averaged 1.6 x REE kcal per day. Burned patients consumed similar amounts of protein/kg body weight (2.9 ± 0.9 g) as NB children (2.0 ± 1 g/kg/day, p>0.05) and had similar distributions of protein at each meal (p>0.05). Burn patients consumed 40-52% carbohydrates, 30-37% fat and 17-18% protein in main meals; protein intake significantly differed at breakfast (p=0.007) and lunch (p=0.041) between burned and NB children.
CONCLUSIONS: The data showed burned children consume more kcal than the recommended amount established for the burn population and consume roughly the same amount of total protein as NB. The protein distribution among each main meal is adequate in burned children. If further studies show that catabolism is not curbed and losses in LBM still persist in spite of adequate nutrition, other interventions such as drug therapy and exercise programs should be considered to increase LBM in severely burned children.

1157 Board #336 May 31 2:00 PM - 3:30 PM
Consumption Of Sugar-sweetened Beverages By Sex And Weight Status In Children From The Mexico-US Border

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It has been studied that school-age children have access to a diet with a high caloric content and low nutritional value, in addition, these population similarly consumes sugar sweetened beverages. The consumption of these beverages is associated with the development of obesity, cardiovascular disease, diabetes, cancer and metabolic syndrome. **PURPOSE:** To identify the frequency of consumption of sugar sweetened beverages by sex and weight status in children from the Mexico-US border.
METHODS: A total of 453 students (235 girls and 218 boys) from 4th to 6th grade of five elementary schools in the city of Tijuana, Baja California, Mexico were measured. Height, weight and BMI was obtained by anthropometry. The questionnaire of beverage consumption (Hedrick et al 2010) was administered, to calculate the caloric and sugar content the Nutritionist Pro (v 5.2) program was used. **RESULTS:** The prevalence of overweight and obesity was 45%. Thirty two per cent of boys and 22%

of girls consumed more than 50 grams per day of sugar from drinks. As revealed by the Mann-Whitney Test, significant differences by sex were observed in the consumption of grams of sugar per day (p = 0.001) and total calories from beverages (p = 0.002). Also, the boys reported a higher consumption of kilocalories from sugar sweetened beverages (p = 0.001) and milliliters per day (p = 0.001) than girls. No significant differences of sugar and kilocalories consumption from sugar sweetened beverages among children with normal weight and those who were overweight and obese were found. **CONCLUSIONS:** The results of this study indicates a high intake of sugar from drinks, which is higher than recommended by WHO. The boys reported a higher consumption of sugar sweetened beverages and kilocalories than girls. The study shows no significant differences in the sugar and kilocalories consumption by weight status.

1158 Board #337 May 31 2:00 PM - 3:30 PM
Weight Loss Knowledge Among Current And Future Health Professionals In Exercise Science And Nutrition

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Knowledge among current and future health professionals of the most recent literature pertaining to applicability of the 3500 calorie rule for predicting weight loss is unknown. **PURPOSE:** To assess levels of knowledge, among those in the fields of exercise science and nutrition, of the applicability of the 3500 calorie rule for predicting weight loss (WL) over time and whether knowledge differed with a person's training level and their perceived WL knowledge.
METHODS: Students (S), faculty (F), and professionals (P) [n = 352, 68% female, 31 ± 13.5 years] responded to an anonymous online survey sent via email lists and social media platforms. Level of WL knowledge was assessed using a list of 9 statements pertaining to the 3500 calorie rule and its ability to accurately predict WL over time. Respondents were asked to identify which statements were true and were scored (0-100%) based on their correct responses. Participants also reported current exercise and nutrition certifications. They reported level of WL knowledge on a 5 point Likert scale and were divided into 2 groups: very good or excellent (EX) knowledge vs good, fair and poor (Poor) knowledge. Respondents were grouped as certified or not certified. A one-way ANOVA was used to test for differences in scores on WL facts between S, F, and P. Independent t tests were used to detect differences in scores on WL facts between certified and not certified and between EX knowledge and Poor knowledge.
RESULTS: Scores on WL facts were not different between S, F, and P [64.1 ± 18.9% (n=217); 70.1 ± 19.9% (n=39); 63.5 ± 21.2% (n=96), respectively; p = 0.176]. Certified S had higher scores on WL facts than S without certifications [72.8 ± 17.9% vs 62.6 ± 18.7%, respectively; p = 0.005] while no differences in scores on WL facts existed between those with and without certifications for F [67.2 ± 19.7% vs 73.5 ± 20.2%, p = 0.335] and P [64.0 ± 20.8% vs 62.4 ± 22.7%, p = 0.748]. Those who rated themselves as having EX knowledge did not score differently than those who rated themselves as having Poor knowledge [69.8 ± 16.0% vs 69.3 ± 16.8%, respectively; p = 0.789].
CONCLUSIONS: Knowledge of WL concepts is similar among S, F, and P. Certification may enhance students' knowledge of WL facts but does not influence knowledge for F or P. High levels of perceived knowledge may not reflect better actual knowledge of WL facts.

1159 Board #338 May 31 2:00 PM - 3:30 PM
The Acute Effects of Nutrition Labels on Beverage Consumption in a College Cafeteria

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Previous research is inconsistent in determining if nutrition labels on food and beverages influence consumer behavior. **PURPOSE:** To determine the acute effect of nutrition labels on consumer beverage consumption in a college cafeteria setting.
METHODS: Consumption for 13 beverages in a university cafeteria was recorded over a two-week period. Week one acted as a control week (CW) and week two as an experimental week (EW). Nutrition labels were placed above beverage dispensers after the CW. Beverages included five enhanced water, five milk, and three juice options. Daily consumption was measured by tracking the total amount of beverage restocked divided by the number of cafeteria patrons (mL/number of patrons). In addition, to better understand the effect of the nutrition labels a three question follow up survey was administered at the end of the two weeks in the cafeteria during dining hours (N=150). One-way ANOVAs were employed for significance testing. **RESULTS:** Passion orange guava (POG) was the only beverage to have a significant difference in consumption between the CW (3.73±1.21) and EW (2.11±1.44), p=0.041. No other enhanced water flavor, type of milk, or juice significantly differed in consumption, p>0.05. Overall, total beverage consumption did not significantly differ between the CW (19.57±4.76) and EW (16.80±9.43), p=0.502. The results of the survey indicated

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95% of cafeteria patrons noticed the nutrition labels, but 71% responded the nutrition labels did not influence their behavior towards selecting a particular beverage or the quantity of the beverage consumed. However, 61% of all the respondents preferred having nutrition labels available. **CONCLUSION:** Nutrition labels appear to have an acute influence to decrease beverage consumption of POG, but not beverages such as milk, enhanced water, or other juices. Further research is needed to determine why nutrition labels may influence the consumption of some products, but not others.

1160 Board #339 May 31 2:00 PM - 3:30 PM
The Relationship between Social Jetlag and Cardiorespiratory Fitness in New Zealand Adolescents

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Social jetlag occurs when there is a mismatch between an individual's circadian clock and their sleep schedule. Recent research has shown that social jetlag is associated with many health related factors, particularly with overweight and obesity. However, the relationship between social jetlag and cardiorespiratory fitness has not yet been studied, including in adolescents. **PURPOSE:** To investigate the relationship between social jetlag, measured as the difference in hours between the midpoint of sleep on school and non-school days, and cardiorespiratory fitness. **METHODS:** Cardiorespiratory fitness, anthropometric, demographic and dietary data were collected from students aged 15 to 18 years attending secondary schools in Otago, New Zealand. Students completed an online lifestyle survey in one class period. Food choice was assessed using the validated New Zealand Adolescent FFQ and three dietary patterns ('Treat Foods', 'Fruits and Vegetables' and 'Basic Foods') were generated using principal components analyses. A subset of participants also undertook fitness testing measurements. The primary outcome, cardiorespiratory fitness, was expressed as maximal oxygen uptake (VO₂max) values, estimated from a multi-stage 20-metre shuttle run test. Multivariate linear regression analyses were undertaken with VO₂max as the primary outcome. Analyses were adjusted for dietary pattern scores, Body Mass Index (BMI) Z scores, sex, age, socio-economic status and ethnicity. An interaction between sex and social jetlag was also tested for.

RESULTS: Questionnaire, BMI and cardiorespiratory fitness data were available for 279 participants, with a mean (SD) age of 15.7 (0.9) years. Mean (SD) VO₂max was 43.3 (5.6) ml/kg per min for girls and 48.5 (7.1) ml/kg per min for boys. Mean (SD) social jetlag was 1 hour 53 minutes (1 hour 17 minutes). A one-hour increase in social jetlag was associated with a 0.78 ml/kg per min decrease in VO₂max (CI: -1.39, -0.18). There was no significant interaction between sex and social jetlag.

CONCLUSIONS: Social jetlag is a significant correlate of cardiorespiratory fitness in adolescents. Minimising social jetlag may be beneficial to improve physical fitness of adolescents and has the potential to be a simple and measurable goal in lifestyle interventions.

1161 Board #340 May 31 2:00 PM - 3:30 PM
Differential Relationship between Habitual Physical Activity and Consumption of Key Dietary Factors

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Previous research indicates that energy intake is lower in moderately active when compared to sedentary and highly active individuals. However, relationships between choices of foods varying in energy density and physical activity (PA) remain largely unexplored.

PURPOSE: To determine the relationship between habitual PA and dietary factor consumption with high/low energy density in a nationally representative sample. **METHODS:** Data from the National Health and Nutrition Examination Survey 2009-2010 Dietary Screener Questionnaire were utilized to estimate key dietary factor intake. Participants (n=5,302; age range: 18-69) were divided into quartiles based on PA behavior, defined as moderate- or high-intensity activities for work, recreation and walking/biking. Data were adjusted for age, body mass index, and sex. **RESULTS:** Added sugar intake was highest among very high (25.9±0.9 tsp) and low activity (25.7±1.0 tsp), and was significantly (p<0.001) lower with moderate (23.9±0.9 tsp) and high activity (22.8±0.9 tsp). Added sugar intake from sugar-sweetened

beverages was lower (p<0.001) in moderate (18.4±1.1 tsp) and high activity (17.0±1.1 tsp) when compared to low (20.8±1.2 tsp) and very high activity (20.6±1.1 tsp). Fruit and vegetable intake increased gradually from low (2.32±0.10 cup eq) to high activity (2.70±0.10 cup eq), but did not increase further with very high activity (2.64±0.10 cup eq). Whole grain and fiber intake increased gradually from low (0.93±0.19 oz eq; 14.4±0.7 g) to high activity (1.30±0.18 oz eq; 16.1±0.6 g) but plateaued at very high activity levels (1.13±0.18 oz eq; 16.0±0.6 g).

CONCLUSIONS: Our results suggest differential associations between PA and food choices: Moderate to high PA was associated with healthier food choices, indicated by lower intake of energy-dense, nutrient-poor foods and higher consumption of fruits, vegetables, and whole grains. However, the increase in added sugar consumption and stagnating intakes of healthier foods among very high activity suggest the beneficial effect of PA on dietary patterns is inhibited at this upper end, possibly due to compensatory mechanisms to meet increased energy needs. Future research is needed to determine physiologic and behavioral mechanisms underlying this differential relationship between PA and dietary patterns.

1162 Board #341 May 31 2:00 PM - 3:30 PM
Association of Fruit and Vegetable Intake with Cardiorespiratory Fitness in Adolescents

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 (No relationships reported)

An association has been established between total energy intake and cardiorespiratory fitness (CRF) in adolescents; however, there is little research examining dietary components. **PURPOSE:** To determine if an association exists between F/V intake and CRF in adolescents. **METHODS:** A sample of 424 adolescents (234 males and 190 females) age 10-18 years completed the Dietary Behavior section of the Youth Risk Behavior Survey (YRBS) and the FITNESSGRAM 20 meter Pacer test (PACER). This section of the YRBS assesses F/V intake based on intake frequency over a one week period. Peak oxygen consumption (VO₂peak) was calculated from the PACER results and categorized based on the FITNESSGRAM aerobic standards, placing individuals into one of three categories: Healthy Fitness Zone (HFZ), Needs Improvement (NI), and Needs Improvement - Health Risk (NI-HR). Mean differences in total F/V intake for participants in each of the CRF categories were assessed using a one way ANOVA. **RESULTS:** The mean total F/V intake values (times per week) showed slight differences between each of the categories. For male participants the F/V intake values in the HFZ, NI, and NI-HR categories were 19.9 (SD 15.2), 15.8 (SD 19.2), and 19.1 (SD 13.8) respectively. The mean F/V intake for female participants in the HFZ, NI, and NI-HR categories were 20.9 (SD 16.2), 20.3 (SD 19.6), and 15.9 (SD 9.6) respectively. However, none of these differences were statistically significant (all p>0.05). Average fruit and vegetable intakes were also individually analyzed, but with similar results (all p>0.05).

CONCLUSION: F/V intake does not have a significant association with CRF in adolescents.

1163 Board #342 May 31 2:00 PM - 3:30 PM
Metabolome Analysis Of Sex Differences In Plasma Metabolite Profiles Caused By Acute Resistance Exercise

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PURPOSE: The present study used metabolome analysis to determine sex differences in plasma metabolite profiles cause by acute resistance exercise.

METHODS: Six healthy men and six eumenorrhic women (age, 25.7±4.5 and 20.7±1.1 years; height, 169.3±2.0 and 162.9±4.5 cm; weight, 66.6±6.0 and 56.9±6.1 kg, respectively) volunteered to participate in this study. All of them performed three sets of leg extensions at 70% of one repetition maximum (RM) until failure for each set. Blood samples were collected at rest and immediately after exercise from the women in the luteal phase of the menstrual cycle. Blood concentrations of progesterone and 17-β-estradiol in the samples were determined by ELISA, and endogenous metabolites in plasma were estimated using capillary electrophoresis time-of-flight mass spectrometry.

RESULTS: Blood concentrations of estradiol and progesterone were significantly lower in men than in women at rest (30.8±9.8 vs. 242.8±95.4 pg/mL, p<0.01 and 0.7±0.2 vs. 11.5±10.3 ng/mL, p<0.05, respectively). Metabolomics analysis indicated that values for amino acids and a glycosylated pyrimidine analog were significantly greater in men than in women at rest (valine: 232±2 vs. 188±20 μM, p<0.01; leucine: 135±18 vs. 100±9.6 μM, p<0.01; lysine: 235±33 vs. 183±23 μM, p<0.01; uridine: 15±2.2 vs. 10±1.1 μM, p<0.01; methionine: 23±2.4 vs. 19±4.1 μM, p<0.05;

tryptophan: 61 ± 5.9 vs. 52 ± 6.1 μM , $p < 0.05$). Rates of change in metabolites increased significantly more in men than in women after exercise (lactic acid: $1231.1 \pm 263.8\%$ vs. $672.5 \pm 521.9\%$, $p < 0.05$; malic acid: $320.1 \pm 136.4\%$ vs. $168.5 \pm 92.2\%$, $p < 0.05$; glycerol 3-phosphate: $37.5 \pm 11.0\%$ vs. $-3.8 \pm 25.8\%$, $p < 0.01$; creatine: $26.8 \pm 16.2\%$ vs. $3.7 \pm 9.0\%$, $p < 0.05$; citrulline: $1.8 \pm 6.2\%$ vs. $-8.5 \pm 8.4\%$, $p < 0.05$).

CONCLUSIONS: Metabolite profiles and values for sex hormones changed in a sex-dependent manner after acute resistance exercise. Therefore, sex hormone concentrations might influence energy utilization during resistance exercise.

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Aerobic Exercise Protects Against Intestinal Villus Damage Induced by Inflammation in Rats

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(No relationships reported)

Intestinal villi are modified under the action of inflammation and aerobic exercise protects against this damage, but the mechanisms of action of cell proliferation or apoptosis have not been elucidated. **Purpose:** Evaluate the effect of aerobic exercise on the intestinal morphology of Wistar rats with lipopolysaccharide (LPS) challenge. **Methods:** Twenty rats (200-300g) randomized into two experimental groups matched for body mass: training group ($n=10$) and sedentary group ($n=10$). Training group was submitted to moderate intensity aerobic training on a motorised treadmill at 65% of maximal speed for 60 min, 5 days/week during 8 weeks. Forty-eight hours following the last exercise training session, the animals were randomly allocated to four groups: sedentary group-S ($n=5$), sedentary with LPS-S+LPS ($n=5$), Training group-T ($n=5$) and training with LPS-T+LPS ($n=5$). LPS groups received one dose of LPS intraperitoneally during three days to stimulate chronic inflammation; S and T groups received saline. Water and food was ingested ad libitum. Euthanasia was performed 24h after the last dose of LPS and the middle jejunum was harvested and stored for histological analysis with hematoxylin and eosin. Villous height was evaluated under light microscopy (Image-Pro Plus 6.0, Media Cybernetics). For each intestinal sample, at least 10 well-oriented villi were measured and the mean value was calculated. Data were analysed using two-way ANOVA with Tukey's post-hoc test; statistical significance was accepted at $p < 0.05$. **Results:** Villus height (μm) was significantly higher for T+LPS than S+LPS (340.8 ± 11.8 vs. 237.6 ± 24.2), and for T compared to TLPS (418.2 ± 11.7 vs. 340.8 ± 11.8), but was lower for S+LPS compared to S (237.6 ± 24.2 vs. 368.3 ± 23.5). Interestingly, T+LPS was not significantly different from S (340.8 ± 11.8 vs. 368.3 ± 23.5). **Conclusion:** Eight weeks of aerobic exercise training appears to be capable of improving intestinal villi and protect against inflammatory damage. Supported by: CAPES

B-78 Free Communication/Poster - Obesity

Wednesday, May 31, 2017, 1:00 PM - 6:00 PM
Room: Hall F

1165 Board #344 May 31 2:00 PM - 3:30 PM

An 8-month Small-group Circuit Functional Training Program Improves Body Composition And Performance Of Overweight/obese Women.

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The body weight training, high-intensity interval training (HIIT), functional fitness, group personal training, and circuit training are currently some of the top worldwide trends in the commercial, corporate, clinical, and community landscapes within the health and fitness industry. Additionally, adult obesity and physical inactivity are considered as the top global public health problems nowadays.

PURPOSE:

This study aimed to evaluate the effects of a circuit functional training program on body composition and performance in sedentary overweight or obese women.

METHODS:

Twenty-eight premenopausal overweight or obese women ($n=28$; 36.8 ± 4.6 years; 166.0 ± 0.1 cm; 79.7 ± 9.1 kg; 28.8 ± 2.8 kg/m²) volunteered to participate and were randomly assigned to either a control (C, $n=14$) or an experimental group (E, $n=14$). Exercise consisted of a low volume circuit functional training program (~30 min) and

3 sessions per week in nonconsecutive days for 32 weeks. Both groups were tested pre- and post-intervention in body mass index (BMI), waist-to-hip ratio (WHR), body composition (DXA), resting metabolic rate (RMR), upper and lower body muscular strength (1RM) and endurance (curl up and push up), cardiovascular endurance (VO_{2peak}), flexibility (sit and reach test), static balance (Sharpened Romberg test), and subjective vitality. Comparisons were made using two-way ANOVA with repeated measures.

RESULTS:

Significant improvements were observed between pre- and post-testing measures in E. Body fat, BMI, and WHR declined ($p < 0.001$) by 11.4%, 6%, and 4.6% while fat-free mass ($p < 0.05$), upper and lower body muscular strength, trunk and upper body muscular endurance, VO_{2peak}, flexibility, static balance, and subjective vitality increased ($p < 0.001$) by 1.9%, 30.9% and 27.2%, 91.6% and 238.5%, 26.8%, 34.5%, ~254%, and 131.8%, respectively.

CONCLUSION:

These results suggest that a time-effective exercise modality that combines the circuit training, HIIT, and functional fitness using body weight exercises may improve all components of physical fitness in premenopausal, inactive overweight or obese women. These findings may be attributed to the hybrid nature of this exercise regimen for small groups applying full-body movements and high-intensity routines according to HIIT principles adapted to sedentary individuals.

1166 Board #345 May 31 2:00 PM - 3:30 PM

Effects Of Exercise Intervention On Visceral Fat In Obese Youth: Meta-analysis

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(No relationships reported)

Childhood obesity is associated with a higher chance of the development of several diseases, premature death, and disability in adulthood. Previous studies have examined the effects of exercise on visceral fat; however, many of these studies applied different methodologies and showed different results. **PURPOSE:** To assess the effects of different exercise types on visceral fat in obese youth and to suggest the most effective way to reduce visceral fat using a meta-analysis. **METHODS:** Electronic database searches were performed in Pubmed, MEDLINE, Academic Search Complete, SportDiscus, and CINAHL from the earliest record to May 2016. Key words included 'exercise or training', 'visceral fat', and 'child or adolescent or youth'. The inclusion criteria for eligible studies were as follows: 1) subjects were obese at baseline, 2) subjects aged 6-18 years, 3) body weight was reported at baseline and after intervention, and 4) studies were published in peer-reviewed journals written in English. Two authors independently selected trials, assessed trial quality and extracted data. Comprehensive Meta-Analysis version 3 software was used to compute effect size (ES) and the 95% confidence intervals (CI) using a random effects model. Heterogeneity was assessed using the Cochran's Q statistic. Four moderator variables (gender, types of exercise, treatment periods, and disease conditions) were analyzed. **RESULTS:** Of the 177 studies from the initial search, 61 ESs were derived from the 30 selected studies. The overall treatment effect was large (Cohen's d (ES) = 1.05, 95% CI = 0.94, 1.16). Subgroup analyses showed that exercise type ($Q_b = 10.84$, $df = 2$, $p = 0.004$) and treatment length ($Q_b = 23.76$, $df = 1$, $p < 0.001$) influenced the overall ES. The combined exercise program (Aerobic + Resistance training; ES = 1.19, 95% CI = 1.06, 1.35) and treatment periods longer than 6 months (ES = 1.23, 95% CI = 1.10, 1.35) appeared to be the most effective in reducing visceral fat. However, ESs were similar among gender and disease conditions. **CONCLUSIONS:** There was a large overall effect for exercise intervention on visceral fat in obese youth. Findings from this meta-analysis can help in designing an effective exercise intervention to reduce visceral fat in obese youth.

1167 Board #346 May 31 2:00 PM - 3:30 PM

Hemodynamic Response to Acute and Chronic Exercise in Obese and Lean Prehypertensive Men

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PURPOSE: Approximately 7.1 million deaths worldwide are ascribed to hypertension (HTN). Those with HTN who fit the lean body phenotype are characterized by mechanistically different HTN compared to an obese HTN phenotype. The purpose of this study was to assess whether body phenotype influences blood pressure (BP)

response following both acute and chronic exercise. **METHODS:** Obese (body mass index (BMI) >30 kg/m²) and normal weight (BMI <25 kg/m²) men with pre-hypertension (PHTN) (systolic BP (SBP) 120-139 or diastolic BP (DBP) 80-89 mmHg) were asked to participate in a two phase trial. Phase 1 assessed differences in post-exercise hypotension between groups in response to an acute exercise bout. Phase 2 consisted of a two-week aerobic exercise intervention at 65-70% of heart rate (HR) max on a cycle ergometer. Primary outcome measures were; brachial BP, central BP, cardiac output (CO), and systemic vascular resistance (SVR) measured acutely after one exercise session and following two-weeks of training. **RESULTS:** There were no baseline resting brachial BP (126 ± 7 mmHg vs. 126 ± 5 mmHg, P=0.976), central BP (110 ± 5 mmHg vs. 113 ± 6, P=0.123), age (24 ± 4 yr vs. 25 ± 4 yr, P=0.547), or VO₂ peak (2.9 ± .4 l.min⁻¹ vs. 3.2 ± .7 l.min⁻¹, P=0.248) differences between Lean and Obese. At rest, obese PHTN had greater CO compared to lean PHTN (6.3 ± 1 vs 4.7 ± 1 L/min, P = 0.005) and decreased SVR compared to lean PHTN (1218 ± 263 vs 1606 ± 444 Dyn.s/cm², P = 0.003). Lean PHTN saw a 3 mmHg reduction on both brachial and central SBP (P < 0.05) in response to acute exercise, while obese PHTN witnessed a significant 4 mmHg increased brachial and 3 mmHg increased central SBP (P < 0.05). SVR decreased greater following acute exercise in lean PHTN compared to obese PHTN (224 dyn.s/cm² vs. 75 dyn.s/cm², P<0.001). Chronic training evoked a 4 mmHg reduction in brachial SBP and 3 mmHg reduction for central SBP for lean PHTN with no change in obese PHTN. Lean BP reduction in response to training was accompanied by a significant SVR reduction of 169 dyn.s/cm² (P<0.05), while obese experienced a significant increased SVR following training (95 dyn.s/cm² P<0.05). **CONCLUSION:** Body phenotype may play a significant role in relation to the efficacy of aerobic exercise on BP reduction.

1168 Board #347 May 31 2:00 PM - 3:30 PM
Dyspnea on Exertion in Nonobese and Obese Patients
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PURPOSE: Dyspnea on exertion (DOE) is a common symptom in otherwise healthy obese individuals and in patients with serious illness. Whether obese patients have an exaggerated rating of breathlessness (RPB) as compared with nonobese patients is unknown. In a retrospective analysis, we investigated RPB in nonobese and obese patients who were referred for clinical cardiopulmonary exercise testing (CPET) due to unexplained DOE.

METHODS: Data from 112 patients were separated into nonobese (BMI < 30; n = 28; 20 F) and obese (BMI ≥ 30; n = 47; 24 F) groups. All patients cycled at two individualized constant load work rates (one easy & one harder) for 4-6 mins, followed by a peak exercise test. Constant load work rates were set based on the patient's symptoms and physical activity habits. During the last minute of each constant load exercise bout, patients' RPBs were obtained (Borg scale 0-10). Groups were compared by independent *t* test and relationships between variables were examined by regression analysis.

RESULTS: BMI was 22 ± 2 kg/m² in the nonobese (62 ± 9 kg) and 36 ± 4 kg/m² in the obese (103 ± 16 kg) patients (mean ± SD; p < 0.001). Age was not different between groups (50 ± 20 yr vs 57 ± 12 yr). Work rates were not significantly different between the nonobese and obese patients at the lower (29 ± 19 W vs 24 ± 14 W) or higher constant load work rates (59 ± 35 W vs 49 ± 27 W). Exercise intensity was also not different between groups at the lower (53 ± 11 vs 56 ± 13% of peak O₂ uptake) or higher work rates (74 ± 11 vs 72 ± 11%). RPB was significantly (p = 0.05) greater in the obese patients (2.3 ± 1.4 vs 3.3 ± 2.2) at the lower work rate, but not at the higher work rate (4.4 ± 1.8 vs 4.9 ± 2.2). Maximal exercise capacity was higher in the nonobese patients (77 ± 24 vs 58 ± 21% predicted). There was no significant relationship between RPB and BMI within either group. However, there was a significant (p < 0.001) association between RPB and ratings of perceived exertion (RPE) in the nonobese (r = 0.68 & 0.82 for lower & higher constant work rates) and the obese (r = 0.87 & 0.81) patients.

CONCLUSIONS: Obesity appears to have a significant effect on breathlessness at lower work rates in this mixed patient population, and should be considered when assessing breathlessness in patients. Supported by NIH R01 HL096782, King Charitable Foundation Trust, and Texas Health Presbyterian Hospital Dallas

1169 Board #348 May 31 2:00 PM - 3:30 PM
Improvements in Endothelial Function Following Whole-Body Vibration Training in Overweight and Obese Young Women
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Brachial artery flow-mediated dilation (FMD) is a significant predictor of future cardiovascular disease and preferred non-invasive marker for endothelial vasodilatory function. Importantly, central/abdominal obesity and physical inactivity are associated with endothelial dysfunction. Whole-body vibration training (WBVT) has been shown to improve overall arterial function in sedentary obese pre- and post- menopausal women. Yet, the impact of WBVT on endothelium-mediated vasodilation has not been examined. **PURPOSE:** To determine whether WBVT would induce greater benefits than a non-exercising control (CON) on endothelial function in young overweight/obese women. **METHODS:** Thirty-seven young overweight/obese women (age: 21 ± 2 years; body mass index: 31.4 ± 3.4 kg/m²) were randomized into WBVT (n=24), or CON (n=13) for 6 weeks (3 days/week). Brachial artery diameter was measured using Doppler ultrasound before and after 5 min of forearm ischemia. FMD was measured before and after the 6-week period. **RESULTS:** There were no between-group differences at baseline in any of the variables. Following 6 weeks, brachial artery FMD increased (Δ 3.80 ± 1.03%, P < 0.01) in the WBVT when compared to CON. No significant differences were observed in resting brachial artery diameter after WBVT. **CONCLUSIONS:** Six weeks of WBVT elicited a significant improvement in brachial artery vasodilatory function in young sedentary overweight/obese women. Collectively, WBVT may be considered an effective alternate exercise modality for the prevention and treatment of arterial dysfunction in young overweight/obese women.

1170 Board #349 May 31 2:00 PM - 3:30 PM
Irisin Is Associated With Insulin Sensitivity Improvement Following An Exercise Training In Obese Youth
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PURPOSE: The purpose of this prospective study is to determine if a change in circulating irisin during an acute bout of exercise was associated with insulin sensitivity after a 6-week exercise training in obese youth. **METHODS:** A total of 11 obese youth aged between 12 and 18 years completed a 45-minute acute bout of exercise. Irisin, the primary exposure variable, was measured using an immunoassay Elisa from blood draws taken before and during exercise at 15, 30, and 45 minutes. Then participants underwent a 6-week strength training intervention performed at 65% of their one repetition maximal. The primary outcome measure was changes in insulin sensitivity, measured using the Matsuda index. To investigate the metabolic response, participants were categorized as either responder or non-responder according to the median change on the Matsuda index. **RESULTS:** The proportion of irisin increased significantly during the acute bout of exercise (56.3 ± 63.3%; p=0.028). Overall, the average relative insulin sensitivity did not improve following 6-week of strength training (+18.5 ± 43.1%; p= 0.860). Absolute change in irisin during the acute bout of exercise was associated with absolute change in Matsuda index (r=0.68; p=0.022). A similar association was observed between the relative change in irisin and the relative change in Matsuda index (r=0.73; p=0.010). Participants above the median of change in the Matsuda index, significantly increased irisin (90.0 ± 28.0%; p=0.020), while individuals below the median did not (22.8 ± 18.7%; p > 0.05). **CONCLUSIONS:** An acute bout of exercise increases plasma irisin in obese youth and is associated with a greater insulin sensitivity despite a large variability in response. More studies are needed to better understand the impact of irisin on other metabolic parameters.

1171 Board #350 May 31 2:00 PM - 3:30 PM
Effects of Different Exercises Training associated with Phototherapy on Cardiometabolic Risk in Obese Women
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In the past, exercise in obesity control, mostly weight loss programs are associated with aerobic training. However, aerobic plus resistance training (ART) can promote weight loss and positively affect some metabolic parameters. Recently, it has demonstrated the benefits to use the phototherapy associate to physical exercise practice in obese women. **PURPOSE:** Investigate the effects of different exercises training associated with phototherapy on cardiometabolic risk in obesity women. **METHODS:** It was involved 33 obese women with age of 20-40 years in a weight loss therapy during 4 months. Inclusion criteria were primary obesity, body mass index greater than 30 kg/m² and less than 40 kg/m². The volunteers were assigned in two different groups: Aerobic Training (AT) and Aerobic plus Resistance Training (ART) groups. The interventions consisted on physical exercise training and application of phototherapy (830nm), immediately after the physical exercise. Metabolic parameters were evaluated. **RESULTS:** It were showed reduction in body mass (ART: 93±11 vs 89±11, p 0.001; AT: 94±16 vs 89±16kg, p 0.001), body mass index (ART: 35±4 vs 31±4, p 0.001; AT: 35±4 vs 33±4kg/m², p 0.001), fat mass (ART: 40±3 vs 37±4, p 0.001; AT: 47±3 vs 44±4%, p 0.001), visceral fat (ART: 153±19 vs 135±17, p 0.004 AT: 160±34 vs 150±36cm³, p 0.003), total cholesterol (ART: 205±24 vs 180±22, p 0.002; AT: 183±43 vs 163±51mg/dl, p 0.04), neck (ART: 38±3 vs 35±2, p 0.001; AT: 38±2 vs 37±2cm, p 0.04) and waist (ART: 108±11 vs 105±10, p 0.002; AT: 99±8 vs 92±7cm, p 0.001) circumferences in both groups. Only ART group demonstrated increase in lean mass (60±3 vs 66±7%, p 0.001) and adiponectin (7.5±3.4 vs 10.17±4.1ng/l, p 0.001). In addition, reduction in triglycerides (133±38 vs 108±42mg/dl, p 0.01) was noted only in ART group. Two-way ANOVA with repeated measures was applied. **CONCLUSIONS:** It was showed that ART associated with phototherapy applied in obese women was more effective than AT to improve health status in obese woman, reducing the cardiometabolic risk in this population. Supported by FAPESP (2013/041364; 2013/19046-0; 2013/08522-6; 2015/14309-9), CNPq (573587/2008-6; 300654/2013-8; 150177/2014-3) and CAPES.

1172 Board #351 May 31 2:00 PM - 3:30 PM
Obesity Moderates the Effects of Motivational Interviewing Treatment Outcomes in Fibromyalgia
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 (No relationships reported)

PURPOSE: Obesity is a common comorbid condition among patients with fibromyalgia (FM). The purpose of this study was to assess if obesity moderates the treatment benefits of exercise-based motivational interviewing (MI) for FM. **METHODS:** This is a secondary data analysis of a completed clinical trial of 198 FM patients who were randomized to receive either MI or attention control (AC). Using body mass index (BMI) to divide participants into obese (BMI > 30 kg/m²) and non-obese (BMI < 30 kg/m²) groups, mixed linear models were used to determine interaction between treatment arms and obesity status with regards to the primary outcome of global FM symptom severity (Fibromyalgia Impact Questionnaire, FIQ). Secondary measures included pain intensity (Brief Pain Inventory, BPI), 6-minute walk test, and self-reported physical activity (Community Health Activities Model Program for Seniors). **RESULTS:** Of the 198 participants, 91 (46%) were non-obese and 107 (54%) were obese. On global FM symptom severity (FIQ), the interaction between treatment arms and obesity status was significant (p=0.02). In the non-obese group, MI was associated with a greater improvement in FIQ than AC. In the obese group, MI participants reported less improvement in FIQ compared to AC. The interaction analysis was also significant for BPI pain intensity (p=0.01), but not for the walk test and self-reported physical activity. **CONCLUSIONS:** This is the first study to show that obesity negatively affects the treatment efficacy of MI in patients with FM. Our findings suggest that exercise-based MI may be more effective if initiated after weight loss is achieved.

1173 Board #352 May 31 2:00 PM - 3:30 PM
High Intensity Interval Training Changes Skeletal Muscle Insulin Signalling Pathway Of Obese Individuals
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PURPOSE: Obesity, characterized as excess of body fat (BMI ≥ 30 kg•m⁻²), is related to the development of various metabolic disorders, including insulin resistance. Exercise is known to serve as a non-pharmacological approach to increase skeletal muscle insulin sensitivity, although the mechanisms have not been fully elucidated. Additionally, the molecular underpinnings of the effects of high intensity interval training (HIIT) on insulin resistance are less understood. This study evaluated the effects of HIIT on biochemical and molecular markers related to insulin resistance in physically inactive obese individuals. **METHODS:** 9 obese insulin sensitive (OB; 32 ± 10 y; 92.4 ± 12.9 kg; 35.1 ± 3.8 kg•m⁻²) and 8 obese insulin resistant (OBR; 30 ± 11 y; 106.0 ± 19.6 kg; 37.8 ± 4.6 kg•m⁻²) volunteers were subjected to 8 weeks of HIIT using a cycle ergometer. Insulin resistance was defined as homeostasis model assessment index (HOMA-IR) equal or greater than 2.71. Before and after the training, a maximal ramp test was performed to measure maximal cycling power output. HIIT was performed 3 times a week with progressively increasing intensity and volume (8 to 12 bouts of 1 min duration at 80 to 110% of the maximum power output separated by 1 min active recovery at 30 W). A muscle biopsy and venous blood were performed 72 hours before and after HIIT to allow HOMA-IR calculation. Skeletal muscle samples were analyzed by Western Blot. **RESULTS:** HIIT increased insulin sensitivity evaluated by HOMA-IR in OBR (4.4 ± 1.4 versus 4.1 ± 2.2, p=0.02) but not in OB (1.8 ± 0.5 versus 2.3 ± 1.0) volunteers. In skeletal muscle, HIIT increased phosphorylation of the insulin receptor substrate (Tyr612), Protein kinase B (AKT Ser473) and protein kinase dependent calcium/calmodulin (CaMKII) (Thr286), and increased expression of β-hydroxyacyl-CoA dehydrogenase (β-HAD), and cytochrome C oxidase (COX-IV). There was also a reduction of phosphorylation of extracellular signal regulated kinase (ERK1/2) in OBR. **CONCLUSIONS:** 8 weeks of HIIT promoted improvements in insulin sensitivity, modified components of insulin signaling pathway, and improved oxidative metabolism in skeletal muscle. These changes were independent of changes in body fat. This work was supported by CAPES (PNPD-2455/2011), FAPEMIG (CDS APQ01621-10), and CNPq (477154/2011-5) grants.

1174 Board #353 May 31 2:00 PM - 3:30 PM
Effects of Underwater Treadmill Training on Health-Related Fitness and Daily Caloric Expenditure in Adults with Type 2 Diabetes
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PURPOSE: To document the influence of underwater treadmill training (UTT) on components of health-related fitness and daily energy expenditure in middle-aged adults with type 2 diabetes. **METHODS:** Using a randomized, controlled, single-blind, crossover design, 26 adults with type 2 diabetes (age = 58.3 ± 4.5 yrs; 16 females, 10 males) were randomly assigned to complete a 12-week control period followed by 12 weeks of UTT (Group 1; G1; n = 13) or 12 weeks of UTT (3d-wk⁻¹) followed by a 12-week period of no UTT (Group 2; G2; n = 13). During UTT, water height was maintained at 10 cm below the xiphoid process, walking speed was set to elicit a relative intensity of 40-50% of heart rate reserve (HRR) and gradually raised to 50-70% HRR by week 12, and the duration of walking sessions was increased from 30 to 60 minutes over the course of UTT. Primary outcome measures included cardiovascular fitness [resting heart rate (RHR), resting systolic and diastolic blood pressure (RSBP; RDBP), 6-min walk distance (6MWD)]; body composition [body mass (BM), body fat percentage (BF%), waist circumference (WC)]; leg strength [hamstring and quadriceps isokinetic peak torque at 30°-sec⁻¹ and 60°-sec⁻¹], and daily average caloric expenditure (DACE). Using 1-way repeated-measures analysis of variance, post-treatment scores were compared to pre-treatment scores across G1 and G2 participants. **RESULTS:** Compared to pre-treatment scores, significant (p < .05)

improvements in cardiovascular fitness (decreased RHR, RSBP, and RDBP; increased 6MWD), body composition (decreased BM, BF%, and WC), and leg strength (greater peak hamstrings torque at 30°·sec⁻¹, 60°·sec⁻¹, and peak quadriceps torque at 30°·sec⁻¹ and 60°·sec⁻¹), along with an increase ($p < .05$) in DACE, were observed following UTT. **CONCLUSIONS:** Our findings demonstrate that an underwater treadmill walking program featuring a gradual and progressive increase in walking speed and duration can enhance health-related fitness and raise daily caloric expenditure in middle-aged adults with type 2 diabetes.

1175 Board #354 May 31 2:00 PM - 3:30 PM

Insulin Therapy is Associated With Increased Sedentary Behaviour and Weight Gain in T2DM Patients

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PURPOSE Start of insulin treatment in type 2 diabetes mellitus (T2DM) is associated with weight gain, which further increases cardiovascular and metabolic risk. Changes in moderate-to-vigorous physical activity (MVPA), light physical activity (LPA) and/or sedentary behaviour (SB) may contribute to weight gain. Here, we compared physical activity patterns in T2DM and controls and studied the effects of initiation of insulin therapy.

METHODS First, we objectively assessed free-living MVPA, LPA and SB in patients with T2DM without (n=40) and with prolonged insulin therapy (T2DM-I, n=42), as well as weight matched (n=38) and lean controls (n=35). Secondly, 40 T2DM patients were followed prospectively across 12-months after initiation of insulin therapy. Weight, MVPA, LPA and SB were measured at baseline, 6 months and 12 months after start of therapy.

RESULTS Weight matched controls, T2DM and T2DM-I spent less time in MVPA than lean controls (1.6±1.4h, 1.1±0.8h, 1.5±1.1h and 2.7±1.5h, respectively, $P<0.001$). T2DM-I, but not T2DM and weight matched controls, spent less time in LPA ($P=0.045$). Sitting time was higher in T2DM and T2DM-I compared to lean controls ($P=0.003$), but not compared to weight matched.

Prospectively, body weight increased 2.9±4.5kg over 12 months ($P<0.05$). We found no changes in MVPA, whilst LPA declined from 2.0±1.1 to 1.6±0.9h ($P=0.027$) and sitting time increased (11.7±1.7 to 12.3±1.9h, $P=0.028$). Non-obese (BMI<30kg/m²) T2DM patients who started insulin therapy showed a positive correlation between the increase in sitting time vs weight gain ($r=0.446$, $P=0.037$) and vs waist circumference ($r=0.446$, $P=0.033$). These relations were not present in obese T2DM patients, who started with more sitting time and higher waist circumference (both $P<0.05$).

CONCLUSION T2DM patients, especially those on insulin therapy, show lower levels of MVPA and LPA, but more sitting time, compared to lean controls. Start of insulin therapy is associated with an increase in sitting time. This increase in sitting time was associated with weight gain in non-obese subjects, but not in obese subjects. This suggests that increased SB, rather than decreased MVPA, may contribute to weight gain associated with insulin therapy in T2DM.

1176 Board #355 May 31 2:00 PM - 3:30 PM

Validation Of A System-specific Dual-energy X-ray Absorptiometry-derived Body Volume Equation For 4-compartment Body Composition Calculations

Katie R. Hirsch, Meredith G. Mock, Eric T. Trexler, Malia N.M. Blue, Abbie E. Smith-Ryan, FACSM. *University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Abbie E. Smith-Ryan, FACSM)

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(No relationships reported)

A dual-energy x-ray absorptiometry (DEXA)-derived estimation of body volume (BV) has been shown to be a valid alternative to air displacement plethysmography (BodPod) in the calculation of body composition using a traditional 4-compartment (4C) model. Previously established equations have been derived using a Hologic DEXA model, but validation of the equation with other DEXA models is needed.

Purpose: To determine the validity of DEXA-derived BV and 4C body composition (DEXA-4C) calculations using a GE iDXA system compared to the traditional 4C criterion method. **Methods:** Forty-six overweight and obese adults (Mean ± SD; Age=35.3 ± 9.0 yrs; Body mass index=33.2 ± 4.7 kg·m⁻²) underwent a traditional 4C body composition assessment. Fat mass (FM), lean mass (LM), and bone mineral content (BMC) were measured using a GE Lunar iDXA system; variables were used to calculate BV using a previously established Hologic-derived equation (DEXA BV = [FM/0.84] + [LM/1.03] + [BMC/11.63]) and compared to BV values obtained from BodPod. Body composition variables (FM, percent body fat [%FAT], LM) calculated from a DEXA-derived BV 4C model were compared to body composition variables

calculated from a traditional 4C criterion model. **Results:** When compared to BodPod BV, DEXA-derived BV was significantly higher (Mean ± SD; 96.3 ± 18.1 L vs. 95.4 ± 17.6 L; $p<0.001$) with a total error (TE)=1.121 L and standard error of the estimate (SEE)=0.015 L. DEXA-4C FM (38.1 ± 11.4 kg vs. 35.6 ± 10.2 kg; $p<0.001$) and %FAT (39.3 ± 7.9 % vs. 36.9 ± 7.5 %; $p<0.001$) were significantly greater than the 4C criterion; LM was significantly lower than the criterion (58.4 ± 11.8 kg vs. 60.9 ± 12.7 kg; $p<0.001$). For DEXA-4C body composition values, TE values were 3.082 kg for FM, 2.922% for %FAT, and 3.082 kg for LM. SEE values were 0.218 kg for FM, 0.326 % for %FAT, and 0.220 kg for LM. **Conclusions:** Although DEXA-derived calculations of BV and body composition were significantly different from 4C criterion measures, results demonstrated TE and SEE values that are considered acceptable, especially compared to other common composition methods. Utilizing DEXA-derived equations, irrespective of the model available, to determine BV may allow for accurate 4C composition assessments without use of BodPod. Supported by Scivation Inc.

C-10 Thematic Poster - Bioenergetics and Training

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
Room: 403

1227 **Chair:** Gretchen A. Casazza. *UC Davis Sports Medicine, Sacramento, CA.*

(No relationships reported)

1228 Board #1 June 1 8:00 AM - 10:00 AM

Resistance Exercise Attenuates Mitochondrial Function: Effects Of NSAID Intake And Eccentric-Overload Training

Daniele Cardinale¹, Mats Lilja², Mirko Mandic², Thomas Gustafsson², Filip J. Larsen¹, Tommy R. Lundberg². ¹*The Swedish School of Sport and Health Sciences, Stockholm, Sweden (GIH), Stockholm, Sweden.* ²*Karolinska Institutet, Stockholm, Sweden.*

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(No relationships reported)

Although nonsteroidal anti-inflammatory drugs (NSAIDs) have been shown to modulate skeletal muscle adaptations and protein metabolism in response to resistance exercise, little is known about the effects of NSAIDs on mitochondrial function. Thus, the current study aimed to examine the effects of resistance exercise with concomitant NSAID consumption on mitochondrial oxidative phosphorylation in skeletal muscle. Twenty participants were randomized in a single-blinded fashion to either an experimental group receiving ibuprofen (IBU: 27±5 yr; n=11; 1200 mg/d) or a control group receiving a low-dose acetylsalicylic acid (CON: 26±4 yr; n=9; 75 mg/d) During this period, subjects performed 8 weeks of supervised resistance exercise involving the knee extensors muscles. Each of the subject's legs were randomized to complete the training program using either a flywheel (FW) device emphasizing eccentric-overload, or a traditional weight stack machine (WS). Maximal mitochondrial oxidative phosphorylation (OXPHOS) from permeabilized skeletal muscle bundles was assessed using high resolution respirometry before and after the training intervention. Citrate synthase activity was assessed using spectrophotometric techniques. After training, OXPHOS decreased (P<0.05) in both IBU (23%) and CON (29%) with no difference across medical treatments. Although OXPHOS decreased in both legs, the decrease was greater (interaction P= 0.015) in WS (33%, P= 0.015) than in FW (19%, P= 0.078). Citrate synthase (CS) did not change after the intervention. The increase in quadriceps muscle volume was not significantly correlated with the change in OXPHOS (R=0.15). These results suggest that 1) eight weeks of resistance training reduces mitochondrial function but not mitochondrial content, 2) The decreased mitochondrial function with resistance exercise was not affected by ibuprofen consumption, 3) flywheel resistance training, emphasizing eccentric overload, rescues some of the reduction in mitochondrial function seen with conventional resistance training.

1229 Board #2 June 1 8:00 AM - 10:00 AM

Human Skeletal Muscle Oxidative Capacity Is Up-regulated After High-intensity Training In Competitive Soccer Players

Dan Fransson¹, Nikolai Baastrup Nordsborg², Peter Krstrup³, Magni Mohr⁴. ¹*University of Gothenburg, Gotheburg, Sweden.* ²*University of Copenhagen, Copenhagen, Denmark.* ³*University of southern Denmark, Odense, Denmark.* ⁴*University of the Faroe Island, Torshavn, Faroe Islands.*

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(No relationships reported)

In sedentary persons, high-intensity training (HIT) induces a larger up-regulation of skeletal muscle oxidative capacity than moderate-intensity training (MOD). However, it is unknown if HIT compared to MOD also induces larger muscular oxidative adaptations in trained athletes. **PURPOSE:** To investigate the hypothesis that HIT induces larger changes in skeletal muscle oxidative capacity and high-intensity exercise performance than MOD in trained soccer players.

METHODS: In a randomized controlled trial, 31 competitive soccer players (mean±SD, age, 22±2 years, height, 183±8 cm, weight, 76±6 kg) were assigned to either HIT (n=16) or a MOD (n=15). HIT performed 6-10 x 30 s all-out exercise bouts separated by 3 min recovery (high speed running distance of 238±51 m, peak blood lactate 13.7±3.4 mM), while MIT performed small-sided games (6v6 2 x 7-9 min with 2 min recovery; high speed running distance of 14±14 m, peak blood lactate 4.8±2.3 mM). The training-intervention was conducted three times per wk in 4 wks in addition to the normal team-training. A muscle biopsy was obtained pre and post-intervention from m. vastus lateralis for analysis of 3-hydroxyacyl-CoA-dehydrogenase (HAD) and citrate synthase (CS) maximal enzyme activity. In addition, the Yo-Yo Intermittent Recovery test level 2 (YYIR2) was completed.

RESULTS: Skeletal muscle CS maximal activity increased (P<0.05) from 25.5±3.1 to 30.0±3.1 μmol·g⁻¹·min⁻¹ in HIT only, with larger (P<0.05) improvement compared to MIT. Muscle HAD maximal activity increased (P<0.05) in HIT 15.3±1.9 to 18.5±4.0 μmol·g⁻¹·min⁻¹ and in MIT (15.7±2.8 to 19.5±3.0 μmol·g⁻¹·min⁻¹) with no between-group difference. YYIR2 score was improved (P<0.05) ~39% more in HIT compared to MIT post-intervention (323 ± 125 vs. 222 ± 113 m).

CONCLUSIONS: Additional high-intensity and moderate-intensity training augmented skeletal muscle oxidative capacity and high-intensity exercise performance in trained athletes with an overall higher effect of high-intensity training.

1230 Board #3 June 1 8:00 AM - 10:00 AM

Decreased Energy Availability During Intensified Training is Associated with Non-Functional Overreaching in Female Runners

Karine Schaal¹, Marta Van Loan, FACSM¹, Christophe Hausswirth², Gretchen Casazza¹. ¹*UC Davis, Davis, CA.* ²*Institut National du Sport, de l'Expertise et de la Performance (INSEP), Paris, France.* (Sponsor: Marta Van Loan, FACSM)

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(No relationships reported)

PURPOSE: We examined the hypothesis that failing to maintain energy availability (EA, calculated as energy intake (EI) - exercise energy expenditure (ExEE)) during intensified training (IT) would predispose athletes to a state of overreaching (OR; high perceived fatigue and prolonged performance impairment).

METHODS: After 4 weeks of baseline training, 16 female runners (28 ± 5 yrs) performed 4 weeks of IT (130% of baseline volume), followed by a 2 week recovery (REC, 50% of baseline). Over the last 7 days of each phase, ExEE was measured with chest-worn activity monitors (Actiheart) and EI was recorded using my Fitness Pal phone application. Running performance (distance covered during a graded treadmill test) and perceived fatigue (REST-Q) were assessed at the end of each phase to classify athletes as OR or acutely fatigued (AF, increased fatigue but no decrease in performance). VO₂max, heart rate (HR), systolic blood pressure (SBP), plasma epinephrine and norepinephrine and blood lactate concentrations were measured at 65, 75 and 85% of VO₂max and immediately after maximal exercise.

RESULTS: 7 runners became OR and 9 were AF (Δperformance: -9±2% vs +4±2%). Performance was still suppressed in OR after REC (-6 ± 5%). A significant decrease in EA was found in OR (-178±104 kcal/d), who failed to increase EI with IT. By contrast, AF increased EI (184±48kcal/d) and maintained EA. ΔEA correlated with Δperformance and ΔVO₂max (R = 0.61 and 0.66, p < 0.05). VO₂max and peak lactate, epinephrine and norepinephrine, HR and SBP were suppressed in OR, but were maintained in AF after IT. At submaximal intensities at the same speed after IT, AF showed reduced HR, and lactate and norepinephrine responses, while OR showed no change in these variables but did have increased ratings of perceived exertion.

CONCLUSIONS: Failure to maintain EA during IT was associated with a state of non-functional OR in female runners. High perceived fatigue and impaired performance in OR was accompanied by blunted physiological responses at maximal exercise and a lack of any desirable cardiovascular or endocrine-metabolic adaptation to submaximal intensities. In contrast, AF runners that increased EI to match ExEE with IT showed improved performance and lower HR, blood lactate and plasma norepinephrine at the same submaximal speeds after IT.

1231 Board #4 June 1 8:00 AM - 10:00 AM

The Effect of Aerobic and Resistance Training Exercise on Blood Pressure Response in College Aged Students

Mark Rudich, Randy Canivel, Bradley Warren. *Southern Methodist University, Dallas, TX.*

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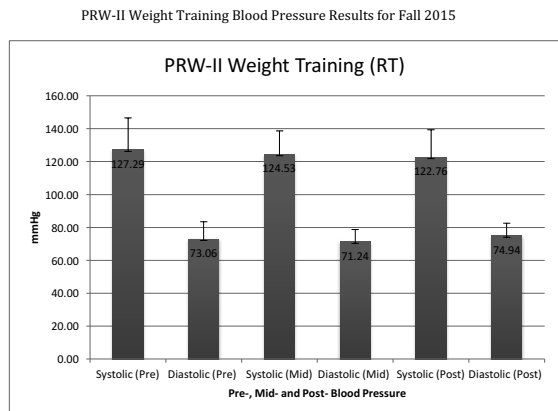
(No relationships reported)

PURPOSE: College years are a time of learning and adopting positive healthy habits into one's lifestyle, so it seems prudent to measure any changes in cardiovascular profiles (i.e. blood pressure) Thus, the purpose of this study was to determine blood pressure (BP) responses in college-aged students enrolled in a 16-week Indoor Cycling or Resistance-Training course. **METHODS:** Thirty-eight students (N =38) volunteered for this study during The Fall 2015 Semester and signed a Human Subjects consent form. Inclusion criteria included the following: healthy males and females, normotensive, and non-smokers. Students were between the ages of 18-21 years of age. Exclusion criteria included those who were symptomatic, on contradicting medications, or habitual smokers. Students' resting systolic and diastolic BP was assessed pre-, mid-, and post- semester. **RESULTS:** Means and standard deviations (SD) were determined for age (21 ± 3.36 years), height (69 ± 4.07 in.), and weight (156 ± 34.88 lbs.) A Paired Sample T-Test was utilized to compare blood pressure responses between classes. Statistical significance was set *a priori* at p≤ 0.05. Statistical analyses revealed significant findings for mid-to-post- BP between aerobic (mid-121.24 ±

14.79; post-116.38 ± 12.76) and resistance training (mid- 124.53± 14.03; post- 122.76 ± 16.64) classes. **CONCLUSIONS:** Both classes experienced statistically, positive changes in BP from mid- to post- semester.

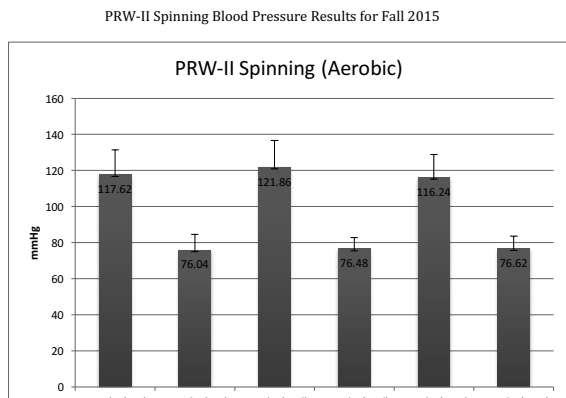
Supported by Just-in-Time Teaching & Technology Grant (CTE: SMU)

Figure 1.



RT=Resistance Training

Figure 2.



1232 Board #5 June 1 8:00 AM - 10:00 AM
6 Weeks of Eccentric Cycling Training Improves Walking Economy in Healthy Individuals

Albino G. Schifino, Andrew J. Weiler, Luis F. Diaz, Chee-Hoi Leong. *Central Connecticut State University, New Britain, CT.* (Sponsor: Dr. Sean Walsh, FACS) Email: a.g.schifino@my.ccsu.edu (No relationships reported)

Low muscular strength is associated with physical decline. Progressive strength training has been demonstrated to improve physical functional outcomes. Because eccentric exercise is a potent stimulus for increasing muscle size, strength and power, it has the potential to serve as a time-effective intervention to improve ambulatory function at a lower metabolic cost compared to traditional strength training. **PURPOSE:** To examine if a 6-week eccentric cycling training intervention could improve walking economy in healthy individuals. **METHODS:** Seven healthy individuals (six males and one female; age=27±6 yrs; mass=73.4±9.7 kg; height=1.7±0.9m) trained on an eccentric ergometer for 6 weeks (3x/week; 10-30 min; 54-66% of HR_{max}). Metabolic cost of walking (C_w ; J/kg/m) was assessed one week prior to, and one week following eccentric cycling training. C_w was determined as the net energy cost (J/kg/s), divided by walking speed (m/s) during steady-state walking at 5 walking speeds (0.7, 1.11, 1.39, 1.67, and 1.9 m/s). Cohen's *d* effect sizes (*ES*) were calculated for all analyses and *ES* magnitudes of 0.10, 0.30, and 0.50, were interpreted as small, medium, and large effects, respectively. **RESULTS:** Following eccentric cycling training, post-training C_w was significantly improved while walking at 0.7m/s ($P=0.03$; Table 1). Although there were no statistical significance detected at the walking speeds of 1.11, 1.39, 1.67, and 1.9 m/s (all $P>0.05$), the lower post-training C_w observed provide strong evidence for a trend of decreased C_w following eccentric cycling training. **CONCLUSIONS:** Our results demonstrate that 6 weeks of eccentric cycling training was effective in improving walking economy. To the best of our

knowledge, this is the first report of a significant improvement in ambulatory function following chronic eccentric training. Improvement in ambulatory function would be beneficial for both healthy and aging populations.

Table 1. Pre- versus post-training C_w values following eccentric training. Data presented as mean±SD.

Walking Speed (m/s)	C_w (J/kg/m)		<i>P</i>	<i>ES</i>
	Pre-training	Post-training		
0.7	2.1±0.44	1.9±0.42*	0.03	0.75
1.11	2.1±0.38	2.0±0.27	0.56	0.24
1.39	2.3±0.43	2.1±0.24	0.06	0.68
1.67	2.7±0.42	2.5±0.27	0.09	0.64
1.9	3.3±0.57	3.0±0.90	0.09	0.69

*Significantly different compared to pre-training ($P<0.05$).

1233 Board #6 June 1 8:00 AM - 10:00 AM
Effect Of Acute Acetaminophen Ingestion On Running Endurance Performance

Fotini Pagotto Dagli, M. Maridaki, G. Paradisis, T. Piliandis, E. Zacharogiannis. *National and Kapodistrian University of Athens, Athens, Greece.* Email: 14.03@live.com (No relationships reported)

Acetaminophen (ACT) has analgesic properties and reduces fever. It blocks cyclooxygenase (COX) action and attenuates the production of prostaglandins (PG). It has been shown that ACT administration relieves pain by elevating the pain threshold. Therefore, ACT may improve performance by enabling participants to exercise closer to a true physiological limit. **Purpose:** The aim of this study was to establish whether acetaminophen improves performance of self-paced exercise through the reduction of perceived pain. **Method:** Twenty recreationally active runners performed an incremental test to determine VO_{2max} . Participants completed a familiarisation test of a 3 km time-trial (TT) treadmill run. On separate days the participants completed two experimental self-paced 3 km TT on a treadmill beginning their effort at 90% VO_{2max} . During the experimental trials participants ingested either 1.5 g acetaminophen or placebo in a double blind, randomized, crossover design. Mean and maximum heart rate were recorded every 30 s during each 3 km TT. Time (pace) per kilometer was also recorded. At the end of each TT, a category-ratio scale was used to assess perceived pain. Blood lactate concentration was measured 3-5 min after completion of each TT. **Results:** Mean 3 km performance time was lower ($p<0.05$) after ACT (733.7 ± 92.86 s) compared with PLA (747.8 ± 95.9 s). ACT administration induced mean 2% improvement in 3 km running performance. Rate of perceived exertion was slightly higher in PLA condition (PLA 18.9 ± 1.04 vs ACT 18.3 ± 1.00). Subjects also during TT ran the 2nd km (PLA 250.43 ± 32.02 vs ACT 245.61 ± 32.60 s) and 3rd km (PLA 248.18 ± 34.18 vs ACT 239.91 ± 33 s) faster ($p<0.05$). Blood lactate and maximum heart rate were not different between experimental TT. **Conclusions:** ACT administration improved running endurance performance through increased pain tolerance, allowing the runners to exercise at a greater intensity for the same level of perceived pain and exertion.

1234 Board #7 June 1 8:00 AM - 10:00 AM
MVPA, Peak 1, And Peak 30 Min Cadence Relationship With Cardiovascular Health

Christopher Arboleda¹, Jessica G. Redmond², Tiago Barreira¹. ¹Syracuse University, Syracuse, NY. ²Utica College, Utica, NY. Email: carboled@syr.edu (No relationships reported)

The link between cardiovascular health and moderate-vigorous physical activity (MVPA) in adults has been investigated to a great extent, however little is known about the relationship between peak cadence and cardiovascular health.

PURPOSE: To determine the relationship between peak cadences (mean daily peak 1 min [P1] and mean daily peak 30 min [P30]) and MVPA with indicators of cardiovascular health (i.e. VO_{2max} , HDL, triglycerides, blood pressure, blood glucose levels, body mass index (BMI), and waist circumference).

METHODS: 106 apparent healthy men and women (aged of 18-36 yrs) were recruited for the study. MVPA and peak cadence were measured using an ActiGraph GT3X+ accelerometer worn at the waist (24 h/day for 7 consecutive days) attached by an elastic belt. The accelerometer was only removed for water based activities. MVPA was determined using Troiano cut-point of 2020, P1 was determined as the highest number of steps achieved in any minute during the wake period and P30 was the best 30 min at any time of day, independent of order. Lipids and glucose were measured following an overnight fast. Blood pressure was measured following 10 minutes of seated rest. Subjects completed the VO_{2max} test on a treadmill using a metabolic cart. Participants were only included in the analysis if they had all the cardiovascular health data and 4+ days with 10+ hours of wake wear accelerometer data. Pearson Correlation was used to determine the relationship between variables.

RESULTS: A total of 87 participants were included in the analysis. There was a statistically significant and moderate relationship between VO₂max and all three measures of physical activity, .55 with MVPA, .49 with P1, and .45 with P30. P1 and P30 were significant correlated with waist circumference (-.36 and -.26 respectively), glucose (-.25 and -.22 respectively), HDL (.33 and .25 respectively), and BMI (-.32 and -.29 respectively). P1 was also significantly related to diastolic blood pressure r=-.27. MVPA was only significantly correlated one other time with diastolic pressure r=-.29.

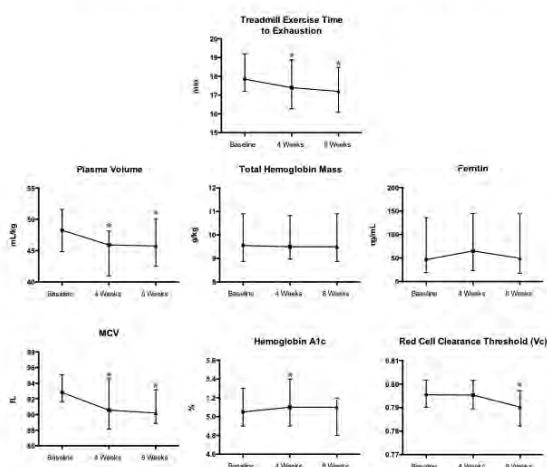
CONCLUSION: P1 and P30 were significantly correlated with a larger number of cardiovascular health variables than MVPA. Both those measures should be investigated further as an alternative measure of physical activity.

1235 Board #8 June 1 8:00 AM - 10:00 AM
Haematological Responses to Detraining Following the Boston Marathon

Charles R. Pedlar¹, John M. Higgins², Marcel Brown¹, Robert Shave³, Jennifer Michaud-Finch¹, James Otto⁴, Anwesha Chaudhury¹, Richard Burden⁵, Brian Moore⁶, Carlo Brugnara², Aaron L. Baggish, FACSM¹. ¹Massachusetts General Hospital, Boston, MA. ²Harvard Medical School, Boston, MA. ³Cardiff Metropolitan University, Cardiff, United Kingdom. ⁴University College London, London, United Kingdom. ⁵St Mary's University, London, United Kingdom. ⁶Sligo Institute of Technology, Sligo, Ireland.
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 (No relationships reported)

Purpose: While vigorous exercise is well known to stimulate erythropoiesis, the hematological response to exercise detraining remains incompletely understood. We sought to characterize red blood cell (RBC) mediated determinants of oxygen carry capacity, including RBC population dynamics, during a period of detraining. Methods: Recreational marathon runners participated in a structured 18-week training program (~7-8 h/w) then completed the 2016 Boston Marathon. Participants then reduced total exercise exposure to <2 h/w (no single session >1 hour) for 8 weeks. Exercise testing, carbon monoxide rebreathing tests and venous blood draws were performed 10-14 days before, and at 4 and 8 weeks after the marathon. Mixed linear modeling adjusting for age and marathon finish time was used to compare data across time points. Results: Twenty-two runners (age = 34.5 ± 7.5 y, 50% men) completed the study protocol. Detraining was confirmed by serial reductions in time to exhaustion during treadmill testing (p<0.01, Figure 1). Plasma volume significantly declined by 4 weeks. In contrast, total hemoglobin mass (tHbmass) and serum ferritin remained stable. By 4 weeks, glycated hemoglobin was significantly elevated while RBC mean corpuscular volume was significantly reduced, indicating an increase in mean RBC age. By 8 weeks, there was a significant decrease in the RBC clearance threshold (Vc). Conclusion: tHbmass, a primary determinant of oxygen carrying capacity, appears to be stable during 8 weeks of exercise detraining. We speculate that this phenomenon is mediated by a subtle decrease in RBC production rate, and that an extended Vc after 8 weeks occurs to defend tHbmass in the absence of a sufficient erythropoietic stimulus.

Figure 1. Changes in exercise capacity and hematologic parameters in response to 8 weeks of exercise detraining following completion of the Boston Marathon.



* = P < 0.05 compared to baseline value. Significance assessed using mixed linear modeling with adjustment for age and marathon finish time (fixed effects) and subject baseline values (random effect).

Values are expressed as median with interquartile range.

C-11 Thematic Poster - Exercise and Cancer

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
 Room: 404

1236 **Chair:** Laura Q. Rogers, FACSM. *University of Alabama at Birmingham, Birmingham, AL.*

(No relationships reported)

1237 Board #1 June 1 8:00 AM - 10:00 AM
Stroke Volume and Cardiac Output Response to Maximal Exercise is Attenuated in Anthracycline Treated Cancer Survivors

Ashley M. Larson¹, Peter H. Brubaker, FACSM¹, Jennifer Jordan², Gregory Hundley². ¹Wake Forest University, Winston Salem, NC. ²Wake Forest Baptist Medical Center, Winston Salem, NC.

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(No relationships reported)

PURPOSE: Cancer survivors often experience exercise intolerance well after the completion of adjuvant chemotherapy. Although cardiotoxicity is a known consequence of anthracycline-based chemotherapy, its relationship to exercise intolerance has not been elucidated. Consequently, the objective of this study was to compare cardiovascular responses, at rest and peak exercise, in anthracycline treated cancer survivors (ATS) and age-matched healthy controls (CON) to examine the mechanisms of exercise intolerance.

METHODS: Four ATS, three males and one female, that were > 12 months post-anthracycline-treatment or are currently receiving treatment, were assessed. Four age and gender matched CON participants were recruited as a comparison group. Each participant had a resting cardiac MRI (CMR) and then performed a maximal exercise test on a treadmill to obtain peak oxygen consumption (peak VO₂) and heart rate (HR). Immediately (<30 sec) following the exercise test, the participant was redirected into the scanner for repeat CMR measures. CMR measures obtained both at rest and peak exercise included cardiac output (Q), stroke volume (SV), and ejection fraction (EF). Cardiac volumes were indexed for body surface area. Appropriate statistical analyses will be performed when the sample size of the study increases.

RESULTS: VO₂ peak was greater in CON versus ATS (37.3 ± 10.8 ml/kg/min vs. 20.8 ± 4.0 ml/kg/min). Additionally, the change in Q from rest to peak exercise was highly correlated with VO₂ peak (r = .92) in these eight participants.

	Δ (Peak - Rest)	
	ATS	CON
HR (bpm)	82.75 ± 9.55	90.25 ± 19.70
SV (ml/m ²)	2.28 ± 1.27	5.34 ± 9.99
Q (L/m ²)	2.11 ± 0.89	4.31 ± 2.31
EF (%)	14.5 ± 0.82	17.75 ± 3.58

CONCLUSION: Both groups had a normal EF% at rest and a similar increase with exercise. Despite negligible differences in peak HR, CON had a two-fold greater increase in Q from rest to peak exercise compared to ATS, mainly due to a reduced SV response in ATS. The results of this small study suggests that anthracycline treatment may cause long-term impairments to cardiovascular system that contribute to the exercise intolerance observed in ATS.

1238 Board #2 June 1 8:00 AM - 10:00 AM

Exercise Programming Considerations Among Head And Neck Cancer Survivors In Socially Deprived Area Of England

Adrian W. Midgley¹, Derek Lowe², Andrew R. Levy¹, Vishal Mevani³, Simon N. Rogers⁴. ¹Edge Hill University, Ormskirk, United Kingdom. ²Astraglobe Limited, Cheshire, United Kingdom. ³Northampton General Hospital, Northampton, United Kingdom. ⁴University Hospital Aintree, Liverpool, United Kingdom. (Sponsor: Prof Lars McNaughton, FACSM)

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(No relationships reported)

Head and neck cancers (HNCs) and their treatment result in considerable prolonged debilitation and unique symptoms likely needing consideration for effective exercise programming.

PURPOSE: Establish whether HNC survivors in one of the most socially deprived areas of England would be interested in participating in an exercise-based cancer rehabilitation program, and obtain data to inform evidence-based programming.

METHODS: Patients treated for primary squamous cell carcinoma of the head and neck between 2010 and 2014 were identified from the University Hospital Aintree

database and sent a postal questionnaire pack to establish perceived exercise benefits, preferences, and barriers, and quality of life. Non-responders were sent a postal reminder 4 weeks later.

RESULTS: The survey comprised 1021 eligible patients of which 437 (43%) responded. The only bias observed between responders and non-responders was a lower response for those under 55 years (29%) and over 85 years (36%). Median (interquartile range) age of responders at survey was 66 (60-73) years and 74% of responders were male. Of the responders, 30% said 'Yes' they would be interested in participating in an exercise rehabilitation program and 34% said 'Maybe'. Greater interest was associated with lower social-emotional aspects of quality of life and greater perceived exercise benefits ($p < 0.05$). The most commonly cited exercise barriers were dry mouth or throat (40%), fatigue (37%), shortness of breath (30%), muscle weakness (28%) difficulty swallowing (25%), and shoulder weakness and pain (24%). Exercise preferences were diverse; however, the most common were a frequency of three times per week, moderate-intensity, and 15-29 minutes per bout. The most preferred types of exercise for regular participation were walking (68%), flexibility exercises (35%), swimming (33%), and cycling (31%). Home (55%), outdoors (46%) and health club/gym (33%) were the main choices for where to regularly exercise.

CONCLUSIONS: These findings provide exercise preferences to guide exercise programming for HNC survivors. Exercise barriers specific to HNC were commonly cited and need addressed to promote exercise uptake and adherence. The need for education on potential benefits of exercise to promote greater interest and engagement in exercise also was apparent.

1239 Board #3 June 1 8:00 AM - 10:00 AM
Stress Hormone Response To Acute Aerobic Exercise During Prostate Cancer Treatment
 Erik D. Hanson¹, Samy Sakkal², William S. Evans¹, John A. Violet³, Glenn K. McConell², Alan Hayes². ¹University of North Carolina at Chapel Hill, Chapel Hill, NC. ²Victoria University, Melbourne, Australia. ³Peter MacCallum Cancer Centre, Melbourne, Australia. (Sponsor: Claudio Battaglini, FACSM)
 Email: edhanson@email.unc.edu
 (No relationships reported)

Exercise training has been used to reduce the side effects of cancer treatment. However, the stress response to acute exercise during hormone dependent cancer treatment is unclear. **PURPOSE:** To examine the effects of a single bout of moderate intensity exercise on cortisol (CORT), epinephrine (EPI), and norepinephrine (NE) levels during prostate cancer (PCa) treatment with and without androgen deprivation therapy (ADT). **METHODS:** Men with PCa on ADT (N=11, 67 (2yr)), not on ADT (N=11, 67 (2y)), and non-cancer controls (CON, N=8, 64 (3y)) had blood samples taken before a 45min discontinuous cycling bout at 60% of peak wattage and after 0h, 2h, and 24h of recovery. Stress hormone concentrations were measured via ELISA. Differences between groups and time points were determined using two-way repeated measures ANOVA. Percent changes were expressed relative to baseline. **RESULTS:** Men on ADT had significantly greater mass and % fat, more advanced cancer, and suppressed testosterone (all $P < 0.05$). NE increased by 385% ($P < 0.001$) at 0h and remained elevated at 2h and 24h (118% and 24%, both $P < 0.05$) with no group differences. CORT significantly increased at 0h (36%, $P = 0.012$), significantly decreased at 2h (-24%, $P < 0.001$) and remained suppressed at 24h (-11%, $P = 0.037$). ADT CORT levels were 32% lower than PCa ($P = 0.006$) with no differences vs. CON. A significant group x time interaction was present for EPI ($P < 0.001$) where CON increased by 817%, ADT by 700%, and PCa by 333% at 0h but PCa and ADT absolute levels were attenuated relative to CON (ADT: -54%, PCa: -52%, $P = 0.004$). **CONCLUSIONS:** Compared with age-matched CON, PCa and ADT exhibited similar hormonal responses to a single acute aerobic exercise bout for NE and CORT but an attenuated EPI response. Future studies should examine the stress response to multiple exercise bouts to verify these findings and to explore the functional hormonal effects (e.g. immune and metabolic responses) during cancer treatment.

1240 Board #4 June 1 8:00 AM - 10:00 AM
Exercise Improves Vo2max And Body Composition In Adt-treated Prostate Cancer Patients
 Brad Wall¹, Daniel Galvao², Naeem Fatehee², Dennis Taaffe, FACSM², Nigel Spry², David Joseph², Jeffrey Hebert¹, Robert Newton². ¹Murdoch University, Murdoch, Australia. ²Edith Cowan University, Joondalup, Australia. (Sponsor: Dennis Taaffe, FACSM)
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 (No relationships reported)

Prostate cancer is the most common cancer in men and patients treated with androgen deprivation therapy (ADT) experience unfavourable changes in body composition and associated metabolic complications, which can increase the risk of cardiovascular disease. **PURPOSE:** To examine the effect of a 6-month program of aerobic and

resistance exercise aimed at improving body composition and cardiorespiratory health in this patient population. **METHODS:** Ninety-seven men (43-90 years) with localised prostate cancer receiving ADT were randomized to either exercise (EX, n=50) or usual care (CON, n=47). Supervised exercise was undertaken twice-weekly at moderate-to-high intensity. Measures of cardiorespiratory capacity (VO₂max), resting metabolic rate, central blood pressure, hemodynamic variables, blood markers, and body composition were assessed. **RESULTS:** There was a significant group by time interaction present for VO₂max ($p = 0.033$) with a treatment effect for EX of 0.11 (95% CI, 0.04-0.19) L.min⁻¹, and fat oxidation ($p = 0.037$) of 12.0 (95% CI, 2.3-21.7) mg.min⁻¹. Similarly, there was a significant improvement in glucose ($p < 0.001$) for EX of -0.5 (95% CI, -0.8 to -0.3) mmol/L, with no change in PSA or testosterone as a result of exercise. Body composition was enhanced for EX with adjusted mean differences in lean mass ($p = 0.015$) of 0.8 (95% CI, 0.3-1.3) kg, total fat mass ($p = 0.020$) of -1.1 (95% CI, -1.8 to -0.5) kg, and trunk fat mass ($p < 0.001$) of -1.0 (95% CI, -1.4 to -0.6) kg. **CONCLUSION:** We conclude that a 6-month combined aerobic and resistance exercise program has a significant favourable impact on cardiorespiratory capacity, resting fat oxidation, glucose and body composition despite the adverse effects of hormone suppression. Combined aerobic and resistance training should be considered a key adjuvant component in men undergoing ADT for the treatment of prostate cancer. Supported by NHMRC Project Grant AppID 534409

1241 Board #5 June 1 8:00 AM - 10:00 AM
Cardiopulmonary Fitness in Prostate Cancer Patients Defines Subpopulations at Risk of Metabolic and Performance Declines
 Richard A. LaFountain, Debbie Scandling, Connor M. Geraghty, Ciaran M. Fairman, Brian C. Focht, FACSM, Steven T. Devor, FACSM, Carmen B. Swain, Subha V. Raman, Orlando P. Simonetti, Steven K. Clinton. The Ohio State University, Columbus, OH.
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 (No relationships reported)

Androgen deprivation therapy (ADT) plays a critical role in the treatment of prostate cancer (PC), the most common malignancy in American men. ADT results in diverse physiological effects impacting health and quality of life. **PURPOSE:** To characterize the cardio-metabolic phenotype of men with prostate cancer prior to ADT, define the heterogeneity of this population, and identify those at greater risk of complications who may benefit from dietary and fitness interventions. **METHODS:** Metabolic evaluation of ventilatory gas exchange was completed in a sample of 19 men with prostate cancer age range of 49- 74 years (mean and SD; 62.9 ± 7.6) immediately prior to initiation of ADT. Patient body mass index (BMI) was calculated, range 21.9 to 39.7 (29.2 ± 4.1 kg/m²). Peak oxygen consumption (VO₂peak) data was collected via treadmill Bruce protocol to volitional exhaustion. Cardiopulmonary testing measures including respiratory exchange ratio (RER), O₂ pulse, max heart rate (HRmax), and test duration, were recorded. **RESULTS:** VO₂peak was measured in PC patients ranged from 20.4 ml/kg/min to 35.2 ml/kg/min (27.6 ± 4.8 ml/kg/min). Metabolic parameters, RER (1.06 ± 0.1) and O₂ pulse (15.7 ± 3.2) were measured at peak exercise. Test duration (9.2 ± 1.6 min) resulted in average peak heart rate (156.9 ± 15.1 bpm). **CONCLUSIONS:** VO₂peak ranged in PC patients from 5th percentile to the 75th percentile for aged-matched men, according to ACSM Guidelines. Patients initiating ADT vary significantly in their cardio-metabolic phenotype. Although degradation of cardiopulmonary health related to ADT is being investigated and reported, it remains imperative to define objective strategies to identify men at risk of cardiopulmonary decline and metabolic complications with ADT. This data will allow the design of effective fitness interventions at the initiation of ADT that will promote healthy cancer survivorship. Supported by Pelotonia/The OSU Comprehensive Cancer Center

1242 Board #6 June 1 8:00 AM - 10:00 AM
Assessing Cardiorespiratory Fitness in Early Stage Breast Cancer: The M.D. Anderson Healthy Heart Program
 Whitney S. Thoman, 77030, Allica D. Austin, 77030, Shamsha J. Damani, Therese B. Bevers, Susan G. Lakoski. The University of Texas MD Anderson Cancer Center, Houston, TX.
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 (No relationships reported)

Purpose: Cardiovascular disease (CVD) is rapidly becoming the predominant cause of mortality in early stage breast cancer survivors. The magnitude of this problem is likely to increase with the aging US population, improvements in breast cancer-specific survival, and the continued use of adjuvant therapies with cardiovascular toxicities. Thus, novel strategies are required to predict and mitigate excess CVD risk in breast cancer survivors. **Methods:** The MD Anderson Healthy Heart Program was created to improve cardiorespiratory fitness (CRF) and reduce existing cardiovascular risk factors in cancer survivors. Patients undergo a one-time consultation with a cardiologist to discuss previous cancer treatment and CVD risk factor modification after measurement

of CVD risk factors (e.g. LDL cholesterol, blood pressure). A cardiopulmonary exercise test (CPET), using a TrueOne 2400 metabolic cart (Parvo Medics Inc, Sandy, UT), is then administered by an exercise physiology technologist (EPT) in concert with the cardiologist to assess CRF (Vo_{2peak}). For the current results, we included only women with a history of early stage breast cancer examined between January 2016 and September 2016. **Results:** A total of 47 women with a history of early stage breast cancer had a mean age of 60±8 years and a mean BMI of 27.6 ± 6.5 kg/m². The mean Vo_{2peak} was 20.9± 4.1 mL·kg⁻¹·min⁻¹, the equivalent of 29.6% below healthy, sedentary women. Mean time from breast cancer diagnosis to Healthy Heart consult was 8 ± 6 years. **Conclusion:** There is a significant and sustained loss of CRF in early breast cancer patients presenting to the MD Healthy Heart Program. Given these findings, a personalized exercise prescription developed by the EPT as part of the Healthy Heart Program is provided to increase exercise adherence. Ultimately, the goal of the program is to utilize exercise as a non-pharmacologic strategy to mitigate cardiac insult and promote improvement in CRF to maintain healthy hearts throughout the cancer continuum.

1243 Board #7 June 1 8:00 AM - 10:00 AM
Supervised Exercise as Supportive Care for Women with Breast Cancer: Improvements in Physical Fitness
 Kelcey A. Bland¹, Amy A. Kirkham², Cheri L. Van Patten³, Holly M. Wollmann¹, Alis Bonsignore⁴, Don C. McKenzie¹, Karen A. Gelmon³, Kristin L. Campbell¹. ¹University of British Columbia, Vancouver, BC, Canada. ²University of Alberta, Edmonton, AB, Canada. ³British Columbia Cancer Agency, Vancouver, BC, Canada. ⁴University of Toronto, Toronto, ON, Canada.
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Breast cancer treatment can result in significant and long-lasting reductions in aerobic fitness and strength. Reduced aerobic fitness among breast cancer survivors is associated with lower quality of life and an increased risk of future comorbidities and all-cause mortality. Supervised exercise training with adjuvant breast cancer therapy is a promising strategy to improve health outcomes. **PURPOSE:** To describe changes in aerobic fitness and strength among women with breast cancer engaging in exercise training as supportive care during and post adjuvant treatment. **METHODS:** Women with stage I-III breast cancer were enrolled into the Nutrition and Exercise during adjuvant Treatment (NEXt) study within the first half of chemotherapy. Supervised aerobic and resistance exercise was performed for 60-80 min 3x/wk during adjuvant treatment and 1-2x/wk for 20 weeks after treatment. Submaximal aerobic exercise and leg press (LP) testing were performed at: 1) baseline; 2) end of treatment; 3) end of intervention; and 4) 1-year follow-up. Maximal aerobic capacity (VO_{2peak}) and LP 1RM were estimated using regression equations. Linear mixed models (time as fixed factor, participant as random factor, and BMI as covariate) and pairwise Bonferroni-corrected contrasts were used to detect differences between time points. **RESULTS:** 68 women (age=51±11) started the exercise program. Baseline VO_{2peak} and LP 1RM were 26.8±0.8mL/min/kg and 186.5±6.6lbs, respectively. VO_{2peak} was not significantly different from baseline to end of treatment (+1.0mL/min/kg, p=1.0), increased from baseline to end of intervention (+2.2±0.6mL/min/kg, p=0.003), and this improvement was maintained at the 1-year follow-up (-0.5mL/min/kg, p=1.0). LP 1RM increased from baseline to end of treatment (+37.2±6.0lbs, p<0.01) and from end of treatment to end of intervention (+30.5±4.4lbs, p<0.01), but decreased at the 1-year follow-up relative to end of intervention (-25.6±8.6lbs, p=0.03) and remained higher than baseline (+42.1±8.5lbs, p<0.01). **CONCLUSIONS:** Breast cancer patients engaging in supervised exercise training during and after adjuvant treatment experienced significant improvements in aerobic fitness and strength. While strength had declined at the 1-year follow-up, improvements in aerobic fitness were maintained.

1244 Board #8 June 1 8:00 AM - 10:00 AM
Concurrent Aerobic and Resistance Training Prevents Physical Fatigue in Patients with Breast Cancer during Chemotherapy
 Sara Mijwel¹, Malin Backman¹, Kate A. Bolam², Carl Johan Sundberg¹, Jessica Norrbom¹, Jonas Bergh¹, Yvonne Wengström¹, Helene Rundqvist¹. ¹Karolinska Institutet, Stockholm, Sweden. ²The Swedish School of Sport and Health Sciences, Stockholm, Sweden.
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 (No relationships reported)

PURPOSE: After a cancer diagnosis, one of the most commonly reported symptoms is cancer related fatigue (CRF). The use of physical exercise to improve cardiorespiratory fitness, body composition, and symptoms for patients with cancer during therapy is an emerging area of research. This in-clinic trial compared the effects of high intensity concurrent aerobic and resistance training (CART) and aerobic training (AT) to usual care (UC) on multiple parameters of physical function in patients with breast cancer during chemotherapy.

METHODS: Women with breast cancer stage I-IIIa receiving chemotherapy were randomly allocated to 16 weeks of CART (2-3 sets of 8-12 repetitions at 70-80 % of estimated 1 repetition maximum strength, followed by 3x3 min bouts of high intensity intermittent aerobic exercise), AT (20 min moderate intensity continuous aerobic exercise, followed by 3x3 min bouts of high intensity intermittent aerobic exercise), or UC (control group). Physical CRF, cardiorespiratory fitness, muscle strength, and BMI were measured at baseline and after 16 weeks. Clinically important changes were estimated as standardized effect sizes.

RESULTS: A significant difference in fatigue was found between CART and UC post-intervention (p=0.015, ES=-0.48), with CART maintaining baseline levels and UC demonstrating a significant deterioration of CRF. Significant differences in estimated VO_{2peak} were found favoring CART (p<0.001, ES=0.44) and AT (p<0.001, ES=0.57) compared to UC. Women in the CART group demonstrated significant differences in muscle strength superior to both AT and UC for right handgrip- (CART vs. AT: p=0.009, ES=0.29; CART vs. UC: p<0.001, ES=0.41) and lower limb muscle strength (CART vs. AT: p=0.007, ES=0.24; CART vs. UC: p<0.001, ES=0.65). Increases in BMI were significantly smaller in both CART (p=0.013, ES=-0.14) and AT (p=0.005, ES=-0.14) compared to UC.

CONCLUSIONS: A 16-week high intensity CART intervention appears to be more effective than AT alone in counteracting physical CRF and improving muscle strength, and was equally as efficient as AT in maintaining cardiorespiratory fitness. Concurrent high intensity aerobic and resistance training is an effective and feasible training intervention, and can be prescribed to patients with breast cancer during chemotherapy.

C-12 Thematic Poster - Military Physiology

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
 Room: 304

1245 **Chair:** Francis G. O'Connor, FACSM. *Uniformed Services University, Bethesda, MD.*
 (No relationships reported)

1246 Board #1 June 1 8:00 AM - 10:00 AM
Predicting Load Carriage Performance Using Physical Fitness and Anthropometric Measures in Soldiers
 Peter N. Frykman, Stephen A. Foulis, Jan E. Redmond, Bradley J. Warr, Jay R. Hydren, Edward J. Zambraski, Marilyn A. Sharp. *USARIEEM, Natick, MA.*
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 (No relationships reported)

Load carriage is one of the most physically demanding of the common soldiering tasks. The average loads carried during infantry patrol operations often exceed 45 kg. Carrying these loads increases the potential for injury while foot marching. It would be advantageous to predict load carriage performance based upon commonly available information such as anthropometry and physical fitness tests without having the soldier perform the load carriage task. **PURPOSE:** To determine if physical fitness tests and anthropometric measures predict a Soldier's physical capabilities to perform the task of marching under load. **METHODS:** While carrying a load weighing approximately 46.4 kg, 67 male and 37 female Soldiers performed a 12 mile foot march for time (FM₁₂). Soldiers provided scores from their most recent Army Physical Fitness Test which consisted of a 2 mile run for time (2m Run), maximum number of pushups (PU) and sit-ups (SU) completed in 2 min. The soldier's height in cm (HT) and body mass in kg (BM) were also measured. **RESULTS:** The average time (mean ± SD) to complete the FM₁₂ task was 239 ± 36 min. The following variables were significantly correlated with FM₁₂: HT (r=-0.64, p≤0.001), BM (r=-0.55, p≤0.001), PU (r=-0.53, p≤0.001), 2m Run (r=0.57, p≤0.001). A stepwise multiple regression was used to develop the following equation: FM₁₂=411.15-1.01(HT)+5.25(2m Run)-0.44(PU)-0.69(BM), (SEE = 23.92 min: R=0.749, p≤0.01). Approximately 56 percent of the variability in the prediction (i.e. R²) of FM₁₂ performance can be explained by the combination of these 4 factors. **CONCLUSIONS:** A soldier's time to complete the FM₁₂ task can be predicted by several individual factors as well as the combination of the 4 factors in this model. These readily available data provide an easy to employ method of predicting a Soldier's physical capabilities for FM₁₂. *These views are those of the authors and are not official policy of the Department of Army, DOD, or the U.S. Government.*

1247 Board #2 June 1 8:00 AM - 10:00 AM

A Predictive Model of 12.8km Loaded March Performance for Male and Female British Army Personnel

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(No relationships reported)

Statistical models have previously been developed to predict performance on a Loaded March (LM; 12.8 km, carrying 25 kg), which is a fitness test for British Army Infantry personnel. Because female personnel have not previously been permitted to serve in Infantry roles, existing models have not evaluated whether gender *per se* may influence the prediction of 12.8 km LM performance carrying 25 kg. **Purpose:** To develop a model to predict 12.8 km LM performance for male and female British Army personnel. **Methods:** 135 trained male (age; 25 ± 4 y; body mass; 78.8 ± 10.1 kg; 2.4 km run time; 09:43 ± 00:42 min:s) and female soldiers (age; 27 ± 5 y; body mass; 66.0 ± 8.2 kg; 2.4 km run time; 11:23 ± 01:05 min:s) completed four representative military tasks (RMT) tests to best effort across two sessions, separated by at least 7 days. Session 1: height and body mass were recorded, and body composition was measured from a whole body scan using dual energy X-ray absorptiometry. Participants also completed the following physical tests; single lift (SL), jerry can carry (JCC), and 2.4 km run. Session 2: participants completed a 12.8 km LM carrying 25 kg (6.4 km paced and 6.4 km individual best effort). Prediction of 12.8 km LM time was undertaken using a hierarchical forced entry ordinary least squares multiple regression. Data are presented as the means ± SD. The level of significance was set at $P < 0.05$. **Results:** 8 female participants were unable to complete the LM (voluntary withdrawal) and were therefore excluded from the analysis. 2.4 km run time and body mass were strongly predictive of 12.8 km LM performance for male and female military personnel when carrying 25 kg load ($R^2 = 0.71$; Standard error of estimate = 4.17 min; $P < 0.01$). Including further physical characteristics (height, fat free mass) and physical performance tests scores (SL, JCC) did not significantly improve the predictive ability of the models ($P > 0.05$). In addition, gender was not significant when included in the model. **Conclusion:** An individual's aerobic capacity (i.e. 2.4 km run time) and body mass predict an individual's 12.8 km LM performance irrespective of gender.

1248 Board #3 June 1 8:00 AM - 10:00 AM

The Assessment of Training Load During British Army Phase One Training

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(No relationships reported)

The physical demands of British Army Phase One Standard Entry (SE) training have previously been reported to be high and linked to musculoskeletal incidence in recruits. As such the SE Phase One training program was revised in 2015 to reduce these demands, primarily by decreasing running distance and including self-paced training sessions. With the advent of technologies such as global positioning systems (GPS), external training loads (distance and speed) can now be quantified and compared to measures of internal training load (heart rate [HR] and ratings of perceived exertion [RPE]). **Purpose:** To quantify the internal and external training load of the revised British Army Phase One SE training program. **Methods:** Following completion of an initial medical assessment, 26 female (21 ± 4 yrs, 61.8 ± 8.4 kg, 1.64 ± 0.05 m) and 24 male recruits (22 ± 4 yrs, 77.6 ± 9.7 kg, 1.78 ± 0.08 m) were fitted with a combined heart rate and GPS device (Polar Team Pro, Polar Electro, Oy, Finland). Recruits were monitored during waking hours (06:00 – 22:00 hrs) for 10 days in weeks 1 and 2 of training and reported whole-day RPE (0-10). **Results:** Recruits completed an average daily distance of 12.07 ± 4.27 km at an average speed of 0.80 ± 0.25 km h⁻¹. The mean HR reserve (HRR) was 31 ± 7% and average RPE was 4 ± 3. Correlation analysis indicated that RPE had a significant positive relationship with %HRR ($r = 0.467$, $P < .001$) and daily distance ($r = 0.616$, $P < .001$). **Conclusion:** This is the first study to report external training loads (distance and speed) of British Army recruits during Phase One training using GPS which provides a framework for further investigation. Distance was a key determinant of perceptual daily training stress, as measured by RPE, suggesting this is an important characteristic of training that should be managed. Future work should attempt to link the external and internal training loads with injury risk, which could be a key approach to optimise training to maximise adaptation whilst minimising risk of fatigue and injury. This research has been sponsored by the UK MOD (Army).

1249 Board #4 June 1 8:00 AM - 10:00 AM

The Effect of Anthropometric Measures and Upper Body Strength on a Physically Demanding Soldiering Task

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(No relationships reported)

Soldiers serving in the combat arms are required to perform tasks with high physical demands. Armor personnel perform a tank ammunition loading task (TAL) where Soldiers repeatedly lift and carry rounds. While having Soldiers perform the actual TAL is the most direct method for determining their ability to perform the TAL, the combination of height, body mass and upper body strength may provide guidance on potential for successful task performance and possible training strategies. **Purpose:** To determine the effect of height, body mass and upper body strength on a Soldier's ability to perform the TAL task. **Methods:** While wearing a fighting load minus a weapon (approximately 32 kg), 94 men and 90 women Soldiers carried 18 tank rounds (25 kg each) 5 meters and lifted the rounds onto a platform simulating an Abrams tank hull (lift height = 1.63m). TAL performance was measured by the number of rounds moved per min (rounds·min⁻¹). Soldiers performed an isometric bicep curl (BC_{kg}) for upper body strength and their height in cm (HT_{cm}) and body mass in kg (BM_{kg}) were measured. Stepwise multiple regression was used to develop separate equations for males and females. **Results:** For male Soldiers, average HT_{cm} was 177.68 ± 19.56 cm (mean ± SD), BM_{kg} 75.96 ± 12.18 kg, and they moved 7.69 ± 1.61 rounds·min⁻¹. The regression equation was $TAL = 7.03 - .011(HT_{cm}) - .012(BM_{kg}) + .079(BC_{kg})$ (SEE = 1.51 rounds·min⁻¹). Approximately 15 percent of the variability in the prediction (i.e. R²) of TAL performance is explained by the combination of HT, BM and BC. For women Soldiers, average HT_{cm} was 165.80 ± 6.48 cm, BM_{kg} 63.46 ± 9.23 kg, and they moved 3.32 ± 1.82 rounds·min⁻¹. The regression equation was $TAL = -9.83 + .029(HT_{cm}) + .090(BM_{kg}) + .097(BC_{kg})$ (SEE = 1.36 rounds·min⁻¹). Approximately 48 percent of the variability in the prediction (i.e. R²) of TAL performance is explained by the combination of HT, BM and BC. **Conclusions:** The combination of HT, BM and BC did not have a significant effect on male Soldier's performance of the TAL, but the BC did. For women, BM and BC had the greatest effect. Training programs designed to develop a Soldier's upper body strength may enhance TAL task performance and mitigate injury. *Views expressed in this abstract are those of the authors and do not reflect official policy of the Department of Army, Department of Defense, or U.S. Government.*

1250 Board #5 June 1 8:00 AM - 10:00 AM

Does Recruit Performance In Generic Fitness Assessments Predict Performance In Military-related Tasks?

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(No relationships reported)

Purpose: To investigate the utility of existing recruit physical barrier tests in predicting performance of occupationally-relevant tasks. **Methods:** All recruits participating in the study were undertaking the Australian Army 12-week basic training course. A total of 186 male recruits were included in the study (age 21.6 ± 4.2 y, height 178.6 ± 6.8 cm, mass 77.7 ± 11.9 kg). Physical performance was assessed at weeks 1 and 11. At each time point participants were subjected to a battery of tests that comprised: generic fitness tests; maximal push-ups (2 min) and multi-stage shuttle test (MSST) and military-related tests; I-repetition-maximum box lift and place and 3.2-km loaded run (22 kg). The 'generic fitness tests' form part of the Australian Army recruit physical barrier tests. All data is reported as mean ± SD and significance was set at $p < 0.05$. **Results:** Maximal push-up performance during week 1 of basic military training (BMT) was not correlated with box lift and place performance at week 1 or 11 ($r^2 = 0.097$ and 0.113 respectively, $p > 0.05$). Push-up performance was moderately to strongly correlated with load carriage performance at week 1 and 11 of BMT ($r^2 = -0.514$ and -0.406 respectively, $p < 0.05$). Maximal MSST performance during week 1 of BMT was strongly correlated with load carriage performance at both week 1 and 11 of BMT ($r^2 = -0.676$ and -0.520 respectively, $p < 0.05$). **Conclusions:** The results showed that performance in the MSST and push-ups were moderately to strongly correlated with load carriage performance. The predictive utility of these generic fitness tests decreased over BMT. There was a weak correlation between push-up performance and occupationally-relevant muscular strength performance. Both manual handling and load carriage are enduring requirements for Army personnel. In fact, a recent review of physically demanding tasks across all Army employment categories revealed that muscular strength was the dominant physical capacity. These results indicate that the current Australian Army recruit physical barrier tests do not predict the ability of male candidates to perform key occupational tasks (i.e. manual

handling). It is therefore recommended that an additional test is incorporated into the recruit barrier test battery that assesses and/or predicts whole-body muscular strength performance.

1251 Board #6 June 1 8:00 AM - 10:00 AM
Physical Fitness Predictors Of A Warrior Task Simulation Test
 Hung Chun Huang¹, Takashi Nagai¹, Timothy C. Sell², Mita Lovalekar¹, Christopher Connaboy¹, Bradley C. Nindl, FACSM.
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Modern warfare requires full-spectrum physical fitness to achieve combat effectiveness, resiliency, and survivability on the battlefield. Determining which physical fitness components are essential to performing well in a Warrior Task Simulation Test (WTST) can contribute toward a better understanding on how best to test and train military physical performance. Currently, there are limited studies that have examined the relationship between WTST performance and the physical fitness components. **PURPOSE:** To identify the underlying and modifiable components of physical fitness related to WTST performance. **METHODS:** Forty-three healthy and physically active men (age: 22 ± 3 yrs; height: 178 ± 8 cm; mass: 78 ± 11 kg) participated in one WTST session and one laboratory test session. The WTST was a continuous 9 sequential-event course comprised of running, jumping, crawling, climbing, obstacle negotiation, and material handling tasks. Physical fitness measurements in the laboratory test sessions included muscular strength and endurance, postural stability, aerobic capacity, anaerobic capacity, flexibility, body composition, fat-free mass, and agility. Backward stepwise multiple linear regression analysis was performed to predict time to completion of the WTST using the physical fitness measurements. **RESULTS:** Average time to completion of the WTST was 238.6 ± 31.1 seconds. (a) Muscular endurance, (b) aerobic capacity, (c) body composition, (d) fat-free mass, and (e) agility significantly contributed to a model that predicted time to completion of the WTST ($R^2 = 51.78, p < 0.001$). The regression equation was: time to completion of the WTST = 250.21 - 0.02 * (a) - 1.34 * (b) + 0.81 * (c) - 0.77 * (d) + 24.12 * (e). **CONCLUSION:** The WTST assesses a combination of modifiable physical fitness components consisting of muscular endurance, aerobic capacity, body composition, fat-free mass, and agility, which suggest that skill-related components of physical fitness such as agility need to be measured and tracked in addition to health-related ones in order to gain better insight to Soldiers' ability to accomplish their mission successfully. Supported by Freddie H. Fu, MD Graduate Research Award, SHRS Research Development Fund

C-13 Thematic Poster - Muscle Basic Science

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
 Room: 101

1252 Chair: Michael Roberts. Auburn University, Auburn, AL.
 (No relationships reported)

1253 Board #1 June 1 8:00 AM - 10:00 AM
Size Profile and Selective Protein Packaging of Exosomes Released from Atrophiying Muscle Cells
 Matthew B. Hudson¹, Carina M. Pautz¹, Carlos A. Barrero¹, Ellen M. Kelly¹, Joshua T. Selsby², Brittany E. Wilson¹. ¹Temple University, Philadelphia, PA. ²Iowa State University, Ames, IA.
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 (No relationships reported)

Skeletal muscle atrophy occurs in a variety of conditions and can result in decreased quality of life and mortality. Previous work from our lab established that certain microRNAs in muscle cells play a role in the progression of muscle atrophy and the intracellular level of these microRNAs are altered during atrophy, at least in part, due to incorporation into small vesicles (termed exosomes) released into the extracellular environment. Currently, little information exists about muscle released exosomes. Potentially these vesicles could be taken up by other tissues and identify a mechanism by which muscle signals other tissues during chronic conditions in which atrophy is occurring. However, to know what signaling pathways these exosomes may potentially be involved in, it is important to know what potential signaling molecules are present in exosomes released from muscle cells during atrophy. **PURPOSE:** To identify if exosomes released from muscle cells during atrophy contain different internal cargo proteins than exosomes from healthy muscle cells. **METHODS:** C2C12 cells were treated with dexamethasone (DEX; 1µM) for 6 hours in serum free media, media was

collected, and exosomes were isolated from the media. LC-MS proteomic analysis was performed on proteins isolated from exosomes, and analyzed using Ingenuity Pathway Analysis software. Nanoparticle tracking analysis (Nanosight) was performed on a separate set of exomes measure vesicle size and number. **RESULTS:** Compared to control cells, the exosomes released during DEX-induced muscle atrophy contained 135 proteins increased greater than two-fold and 159 proteins decreased greater than two. Nanoparticle tracking analysis revealed no change in the number of exosomes released during atrophy (6.77×10^8 vs 7.06×10^8 vesicles/mL). However, while there was no change in the total number of exosomes the size profiles of the exosomes released during atrophy was significantly different ($p < 0.05$). **CONCLUSIONS:** Skeletal muscle atrophy results in both a selective packaging of proteins into exosomes and unique size profile of exosomes released from muscles, but does not alter the total number of exosomes released. These novel findings could have broad implications for the development of biomarkers and signaling during skeletal muscle atrophy.

1254 Board #2 June 1 8:00 AM - 10:00 AM
Ribosomal Capacity's Relationship To Muscle Oxidative Metabolism: A Role For Exercise And Gp130 Signaling
 Brittany R. Counts, Dennis K. Fix, Justin P. Hardee, James A. Carson, FACSM. University of South Carolina, Columbia, SC.
 (Sponsor: Dr. James A. Carson, FACSM)
 (No relationships reported)

Skeletal muscle's capacity for oxidative metabolism parallels the basal rate of protein synthesis and ribosomal capacity. Muscle metabolic activity and protein synthesis are regulated by both muscle contraction and cytokine signaling. While endurance exercise induces oxidative metabolism, a role for ribosomal capacity in these changes is not well understood. The interleukin-6 (IL-6) cytokine family through the glycoprotein 130 receptor (gp130) induces cellular signaling that regulate muscle metabolism and remodeling. While muscle oxidative metabolism is induced by exercise, the regulatory role of ribosomal capacity and the IL-6 cytokine family for this induction is not known.

PURPOSE: To examine the relationship between muscle oxidative metabolism and ribosomal capacity in basal and trained muscle, and determine the potential regulation by gp130 signaling.

METHODS: Male C57BL/6 (B6; N=18) and skeletal muscle specific gp130 knockout (KO; N=17) mice were randomly selected to either cage control or treadmill exercise. Treadmill training (6 day/wk., 1 h/d) was initiated at 6 weeks of age and mice were sacrificed at 12 wks. of age. Quadriceps muscle cytochrome c oxidase (COX) enzyme activity, and total RNA and protein were examined.

RESULTS: At baseline B6 COX activity was positively correlated with total RNA content ($R^2=0.63, p=0.01$), but not in KO muscle ($R^2=0.02, p=0.65$). Exercise increased B6 and KO COX activity ($p < 0.0001$), and ablated the relationship between COX activity and total RNA content in B6 muscle ($R^2=0.01, p=0.90$).

CONCLUSIONS: These data demonstrate that basal COX enzyme activity is positively associated with ribosomal capacity, but increased ribosomal capacity is not required for the exercise induction of COX activity. Additionally, the relationship between basal muscle oxidative metabolism and ribosomal capacity requires muscle gp130 signaling.

Supported by NCI R01-CA121249

1255 Board #3 June 1 8:00 AM - 10:00 AM
The Relationship Between Serum Testosterone And Skeletal Muscle Wnt Signaling Markers In 3-24-month Old Rats
 Petey W. Mumford¹, C. Brooks Mobley¹, Wesley C. Kephart¹, Cody T. Haun¹, Matthew A. Romero¹, Xuansong Mao¹, Shelby C. Osburn¹, Kaelin C. Young², Darren T. Beck², Jeffery S. Martin², Ryan P. Lowery³, Jacob M. Wilson³, Michael D. Roberts¹. ¹Auburn University, Auburn, AL. ²Edward Via College of Osteopathic Medicine, Auburn, AL. ³Applied Sports Performance Institute, Tampa, FL.
 (No relationships reported)

PURPOSE: We sought to determine if canonical Wnt signaling markers are related to serum testosterone concentrations and muscle weights in rodents. **METHODS:** Male Fischer 344 rats (300-600g) were aged 3, 6, 12, 18 and 24 months, euthanized, gastrocnemius muscle was extracted and wet skeletal muscle weights were obtained. Muscle tissue was then processed for analysis via western blotting. Additionally, serum was obtained and assays were performed for total and free testosterone (TEST). **RESULTS:** Relative (body mass-adjusted) gastrocnemius masses revealed significant between-group differences ($p < 0.001$) and were greater at 3 and 6 versus 12, 18 and 24 months ($p < 0.05$). Serum free TEST was 102% greater at 6 versus 3 ($p < 0.05$), 165% greater at 6 versus 12 ($p < 0.05$), 101% greater at 6 versus 18 ($p < 0.05$), and 95% greater at 6 versus 24 months ($p < 0.05$). Total TEST was 305% greater at 6 versus 12 ($p < 0.05$), 273% greater at 6 versus 18 ($p < 0.05$), and 185% greater at 6 versus 24 months

($p < 0.05$). Wnt5a/b was 26% greater at 3 versus 12 ($p < 0.05$), and 54% at 3 versus 24 months ($p < 0.05$). Additionally, Wnt5a/b was 26% greater at 6 versus 12 ($p < 0.05$), and 54% at 6 versus greater than 24 months ($p < 0.05$). Relative gastrocnemius masses and Wnt5a/b exhibited a moderate positive correlation $r = 0.397$, ($p = 0.007$). Beta-catenin was greater at 6 versus 3 and 18 months ($p < 0.05$). Additionally, beta-catenin was greater at 12 versus 3 and 18 months ($p < 0.05$), and 24 versus 3 and 18 months ($p < 0.05$). Androgen receptor (AR) was greater at 3 versus 18 and 24 months ($p < 0.05$), greater at 6 versus 18 and 24 months, and greater at 12 versus 18 and 24 months ($p < 0.05$). Furthermore, AR had a moderate positive correlation $r = 0.438$, ($p = 0.003$) with relative gastrocnemius masses. Additionally, AR had a strong positive relationship correlation $r = 0.670$, ($p < 0.001$) with Wnt5a/b. **CONCLUSIONS:** It appears that intramuscular Wnt signaling proteins, androgen receptor content, serum testosterone, and gastrocnemius masses are inter-related, and decline with aging. Androgen-sensitive mechanisms related to Wnt signaling should be further investigated in skeletal muscle in order to ascertain if these processes contribute to sarcopenia.

1256 Board #4 June 1 8:00 AM - 10:00 AM

A Single Bout Of Cryotherapy Does Not Alter The Transcriptome Or Metabolome Of Human Skeletal Muscle

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(No relationships reported)

Cryotherapy is a commonly used therapeutic modality for skeletal muscle injuries in sports medicine. Despite the widespread use of this modality, there is little known about the biochemical effects of cryotherapy in human skeletal muscle tissue of humans.

PURPOSE: To determine the effects cryotherapy has on the transcriptome and metabolome of skeletal muscle. **METHODS:** Using a paired design, 8 healthy male subjects (mean age 24.7 years, mean BMI 22.2) received ice-cup massage or sham cup massage over a 45 cm² area on each thigh for 15 min. Two hours after application, bilateral biopsies were taken at a depth of 2 cm from the vastus lateralis in the center of the ice or sham area. Muscle biopsies were from each leg were then subjected to microarray or LCMS-based metabolomics analysis. Differences between groups were tested using paired t-tests ($\alpha = 0.05$).

RESULTS: Intramuscular (IM) temperature 2 cm deep to the subcutaneous layer was predicted from regression equations of skin temperature. At the end of the 15 min application, IM temperature was reduced by 29%, and by two hours remained 13% cooler than prior to administration of cryotherapy. Microarray analysis revealed changes in some non-coding RNAs, but no differences were found for protein coding genes. Further analysis by qPCR showed no significant differences in so-called "cold-shock" genes which have been reported to be induced in animals tissues exposed to substantial cooling. Metabolomics analysis of over 60 metabolites involved in glycolysis, oxidative phosphorylation, and amino acid metabolism showed no significant ($p < 0.05$) differences in the hexose sugars and hypoxanthine by 15% and 17% respectively in cooled skeletal muscle tissue. **CONCLUSION:** A clinically relevant administration of cryotherapy does not seem to have a significant impact on the transcriptome nor metabolome of otherwise healthy skeletal muscle. Supported by NIH grant U24-DK097153.

1257 Board #5 June 1 8:00 AM - 10:00 AM

Transcriptional Signatures of Human Skeletal Muscle in Response to Aerobic and Resistance Exercise

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(No relationships reported)

Aerobic and resistance exercise facilitate unique health- and functional-based adaptations in skeletal muscle. The precise cellular mechanisms through which these exercise-mode specific adaptations are realized remain to be completely understood.

PURPOSE: Identify the transcriptional signatures of human skeletal muscle in response to acute aerobic and resistance exercise. **METHODS:** In a counter-balanced, cross over design, six healthy, recreationally active young men (26 ± 1 yr; BMI: 24.9 ± 2.7 kg·m⁻²) completed an acute bout of aerobic (AE, 40 min stationary cycling, 60-70% heart rate max) and resistance exercise (RE, 8 sets of 10 reps, 70% 1RM), separated by ~1 week. Muscle biopsies (*vastus lateralis*) were obtained before exercise and at 1 and 4h after each exercise bout. Whole transcriptome next-generation RNA sequencing (HiSeq2500, Illumina) was performed on cDNA synthesized from skeletal

muscle RNA. Sequencing data were analyzed using HTSeq and differential expression was identified using DESeq2 software. Genes with an adjusted p-value of < 0.05 and ≥ 2 -fold change (log₂) from pre exercise were considered differentially expressed.

RESULTS: At 1h postexercise, AE and RE elicited a similar number of up- (AE, 43; RE, 57) and down-regulated genes (AE, 1; RE, 1), including 36 genes that were common to both exercise modes. However, at 4h postexercise RE elicited a larger number of up- (AE, 156; RE, 353) and down-regulated genes (AE, 27; RE, 54), of which 143 genes were common between exercise modes. Over this postexercise time course 264 genes were preferentially up- (216 genes) or down-regulated (47 genes) only by RE whereas 40 genes were preferentially up- (21 genes) or down-regulated (19 genes) only by AE. **CONCLUSION:** These preliminary data highlight mutual and unique transcriptome responses to aerobic and resistance exercise that are likely to regulate, in part, the specific adaptive responses of skeletal muscle to these exercise modes. Further work is necessary to determine how these transcriptome profiles correlate to exercise-mode specific adaptations in skeletal muscle, and how they are impacted by age, gender, and clinical disease.

Supported by intramural funds from ASU, TGen, and MU

1258 Board #6 June 1 8:00 AM - 10:00 AM

Time-dependent Expression Of Il-6, Irisin And Bdnf In Response To Exercise In Rats

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(No relationships reported)

PURPOSE: Irisin, Bdnf And Il-6 Are Exercise-Induced Myokines Which Exert Their Effects In Driving Brown-Fat-Like Development (Irisin) And Regulating Fat Oxidation. However, Their Dynamic Expression In Response To Exercise Is Not Fully Known. Here We Examined The Level Of Irisin, Bdnf And Il-6 As Well As The Activation Of Ampk And Akt At Different Time Points Following Exercise, In Order To Explore The Pattern Of Their Expression And Biological Functions.

METHODS: Sprague-Dawley Rats Were Subjected To Downhill Running At 17m/Min For 90 Minutes. Serum Creatine Kinase Activity Was Tested At Day 1, 3, 5, 7, And 14 Following Exercise To Evaluate Skeletal Muscle Injury. The Serum Level And Skeletal Expression Of Bdnf, Il-6 And Irisin Were Measured By Elisa And Real-Time Rt-Pcr, Respectively. The Activation Of Ampk And Akt Signaling Pathway Was Confirmed By Western Blot. To Compare The Difference Between Two Groups, T-Test Was Employed Using Spss Software And $P < 0.05$ Was Considered Statistically Significant.

RESULTS: An Increase Of Ck Activity Was Observed At Day 3 And Day 5 Following Exercise, Confirming Exercise-Related Skeletal Muscle Injury. We Didn'T Find Any Increase Of Il-6 In The Rats Following Exercise Compared To Sedentary Group, Although It Is Reported That Il-6 Level Is Elevated Dramatically During Exercise. The Level Of Irisin And Bdnf Was Increased Both In The Serum And In The Skeletal Muscle In Day 1 And Day 3 Following Downhill Running; Then, While Irisin Level Returned To The Baseline, Serum Bdnf Level Was Continuously Elevated. Besides, Ampk Activation Was Found At Day 1 And Day 3, But Akt Was Kept Activated Over All The Time Points.

CONCLUSIONS: Although Il-6, Irisin And Bdnf Are All Exercise-Induced Myokines, Their Expression Is Regulated Differently. Irisin And Bdnf Are Both Reported To Be Involved In The Activation Of Ampk Signaling Pathway. However, We Found That The Increase Of Irisin Was In Accordance With Ampk Activation, While Bdnf Increase Is In Accordance With Akt Activation. Our Results Suggest That Bdnf May Participate In Skeletal Muscle Regeneration Via Akt-Mediated Pathway In Addition To Fat Oxidation. Therefore, Exercise-Induced Myokines Are Regulated Precisely And Sequentially, Which In Turn Exert Different Functions At Different Time Following Exercise.

1259 Board #7 June 1 8:00 AM - 10:00 AM

Methylation Alters Skeletal Muscle Apoptosis Transcription and Myonuclei Morphology Following Resistance-Type Training in Old Rats

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(No relationships reported)

Previously, our lab has shown that modifying the frequency of resistance-type training using stretch-shortening contractions (SSCs) from 3 to 2 days/wk attenuates age-dependent maladaptation and restores muscle quality to a younger phenotype.

Evidence suggests a link between nuclei morphology and epigenomics, but the precise mechanisms and the effects of these responses on myonuclei with aging is unknown.

PURPOSE: To quantify gene expression and methylation for apoptosis in old versus

young skeletal muscle following training at different frequencies, and report concurrent status of nuclei morphology. **METHODS:** Tibialis anterior (TA) muscles of young (3 mo) and old (30 mo) male Fischer 344xBN rats exposed to 80 SSCs for 3 or 2 days/wk for 1 month were harvested 3 days post-training. Gene expression and methylation were quantified via RT² Profiler and Methylation Arrays. Frozen TA sections were stained for β-dystroglycan and DAPI to perform total nuclei and myonuclei morphology via total particle analysis and manual tracings, respectively. Analyses were conducted using Image J. **RESULTS:** Young rats adapted to 3 and 2 days/wk training and differentially ($p < 0.05$) expressed 21 and 7 apoptotic genes, respectively. Old rats maladapted to 3 days/wk training and only expressed 1 apoptotic gene; however, old 2 days/wk expressed 8 apoptotic genes. Methylation increased in SSC trained relative to non-trained control muscles only in old 3 days/wk (0.8 ± 0.004 vs $2.2\% \pm 0.02$, $p < 0.05$). For old 2 days/wk there was no difference in methylation compared to non-trained (0.70 ± 0.004 vs $1.0 \pm 0.01\%$). For nuclei, an age effect ($p < 0.05$) was shown by a higher total count in old relative to young non-trained controls for both total nuclei ($7,708 \pm 181$ vs $6,695 \pm 171$ nuclei per mm^2) and myonuclei ($1,943 \pm 78$ vs $1,483 \pm 74$ nuclei per mm^2). A training effect ($p < 0.05$) resulted in decreased myonuclei count in old 2x/wk relative to both old 3 days/wk and old non-trained ($1,590 \pm 86$ vs $1,888 \pm 86$ vs $1,943 \pm 78$ nuclei per mm^2). **CONCLUSIONS:** Reduced SSC training frequency positively influences aged muscle by decreasing methylation of apoptotic genes, thereby increasing gene expression concomitant with decreases in myonuclei count, which may influence adaptation with aging by eliminating dysfunctional myonuclei, thus aiding in improved muscle size and function.

1260 Board #8 June 1 8:00 AM - 10:00 AM
Effect Of Sprint Interval & Eccentric Training On Gene Expression Levels Of Caspase3 & Bax/bcl-2 In Rat Skeletal Muscle
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 (No relationships reported)

PURPOSE: Apoptosis is a process of programmed cell death that occurs in different stress factors in the body. One of these stresses is exercise, exercise is a strong physiological stimulus which can influence a number of intracellular and extracellular signaling pathways. Till now, few researches shows the effect of sprint interval training and eccentric training on caspase3, bcl2 and bax gene expression changes. This study is exploring the effect of nine weeks of sprint interval training and eccentric training on caspase3, bcl2 and bax expression in soleus and SVL muscles. **METHODS:** twenty four male Sprague Dawley rats purchased from Razi Institute were divided into three groups: control (n=8), sprint interval training (n=8) and eccentric training (n=8). Sprint interval training was included of one minute sprinting on animal treadmill with 2-4 minutes rest, 6-10 sets per session on 5-6 days a week, and eccentric downhill running was included running on -16° slope with 16 m/min for 90 minutes which in both the intensity of the trainings during the nine weeks gradually increased. The evaluation of gene expression was done by Real time PCR method. **RESULTS:** Considering the low number of samples (n=8) and the normality of data rejected by Shapiro-Wilk test, Mann Whitney test for differential between training and control groups were used. Also, caspase3 expression increased in all groups. All of these differences were not significant except for soleus muscle of eccentric training group. Also Bax/bcl-2 ratio increased in all groups and all of these differences were not significant. **CONCLUSIONS:** we conclude that nine weeks of sprint interval training could lead to a small increase in caspase3 expression, Bax/bcl-2 ratio as the influential factor of apoptosis in all groups, except a large increase in caspase3 expression and ultimately strong apoptosis for soleus muscle in eccentric training group. Furthermore, it should be mentioned that the type of training and muscle could influenced the amount of gene expression levels of caspase3, bax/bcl2.

C-14 Thematic Poster - Sex Differences in Cardiovascular Physiology

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
 Room: 505

- 1261 **Chair:** James H. Hull. *Royal Brompton Hospital, London, United Kingdom.*
 (No relationships reported)
- 1262 Board #1 June 1 8:00 AM - 10:00 AM
No Sex Differences in Muscle O2 Delivery-to-Utilization Matching Before or During Contractions in Rats
 Jesse C. Craig, Michael J. Schettler, Trenton D. Colburn, Daniel M. Hirai, David C. Poole, FACSM, Timothy I. Musch, FACSM. *Kansas State University, Manhattan, KS.* (Sponsor: Timothy I. Musch, FACSM)
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 (No relationships reported)

Pre-menopausal women express a reduced arterial blood pressure and risk of cardiovascular disease relative to age-matched men. The mechanism for these outcomes purportedly relate to elevated estrogen levels increasing endothelial nitric oxide (NO) synthase activity and NO-mediated vasorelaxation. **PURPOSE:** Based on the role that NO plays in the relationship between O₂ delivery and utilization, we tested the hypothesis that females would show a fundamentally higher O₂ delivery/utilization ratio; especially during muscle contractions, compared to males. **METHODS:** To test this hypothesis, the spinotrapezius muscle of Sprague Dawley rats (14 total; female = 7, male = 7) was surgically exposed and electrically stimulated at 1 Hz. Oxyphor G4 was injected into the muscle and phosphorescence quenching employed to determine the temporal profile of muscle interstitial space O₂ partial pressure (P_{im}O₂, determined by O₂ delivery/utilization ratio). This was performed under three conditions: control (CON), 300 μM sodium nitroprusside (SNP; NO donor) superfusion, and 1.5 mM L-arginine methyl ester (L-NAME; NOS blockade) superfusion. **RESULTS:** No differences were found for baseline P_{im}O₂ (CON: 21 ± 1 vs 17 ± 2; SNP: 40 ± 3 vs 36 ± 3; L-NAME: 16 ± 2 vs 14 ± 2 mmHg (all $p > 0.05$)); nor ΔP_{im}O₂ during contractions (CON: 13 ± 1 vs 12 ± 2; SNP 20 ± 2 vs 18 ± 2; L-NAME: 11 ± 1 vs 9 ± 1 mmHg (all $p > 0.05$)) between males and females, respectively. The kinetics response (mean response time) to contractions did not differ in any condition (CON: 17 ± 2 vs 16 ± 3; SNP: 21 ± 2 vs 28 ± 5; L-NAME: 15 ± 2 vs 14 ± 1 seconds (all $p > 0.05$)) between males and females, respectively. **DISCUSSION:** In direct contrast to our hypothesis, no sex differences were evident at rest or during contractions under any condition. Therefore, at rest and during muscle contractions, the effect of estrogen on NO bioavailability and vascular control are either insignificant or redundant to other vasodilatory pathways.

- 1263 Board #2 June 1 8:00 AM - 10:00 AM
Sex-specific Differences In Pulse Wave Reflection And Arterial Stiffness After Resistance Exercise
 Erica M. Marshall, Alaina Glasgow, Yu Lun Thai, J. Derek Kingsley. *Kent State University, Kent, OH.* (Sponsor: Ellen L. Glickman, Ph.D., FACSM)
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 (No relationships reported)

Resistance exercise is recommended to improve fitness and to reduce the risk and severity of chronic diseases. Currently, no studies have evaluated sex differences in resistance-trained individuals in response to an acute bout of resistance exercise on pulse wave reflection and arterial stiffness. **PURPOSE:** We sought to determine sex-specific differences after an acute bout of free-weight resistance exercise on pulse wave reflection and arterial stiffness in resistance-trained individuals. **METHODS:** Resistance-trained men (n=14) and women (n=12) volunteered for the study. Aortic hemodynamics, pulse wave reflection and arterial stiffness were assessed in the supine position at rest and 10 minutes after an acute bout of free-weight exercise utilizing 3 sets of 10 repetitions at 75% 1-repetition maximum on the squat, bench press, and deadlift. Two minutes of rest was given between sets and exercises. An ANOVA was used to analyze the effects of sex across condition (acute resistance exercise or control) and time (rest and recovery). Paired t-tests were used for all post-hoc comparisons. **RESULTS:** The sexes had similar values at rest and after the acute resistance exercise such that there were no significant 3-way interactions. There were also no main effects of resistance exercise on brachial or aortic blood pressure. There were significant time by condition interactions for heart rate (rest: 61±9bpm; recovery: 89±13bpm, $p=0.0001$), augmentation index (rest: 12.1±7.9%; recovery: 19.9±10.5%, $p=0.003$), augmentation index at 75bpm (rest: 5.3±7.9%; recovery: 24.5±14.3%, $p=0.0001$), augmentation pressure (rest: 4.9±2.8mmHg; recovery: 8.3±6.0mmHg, $p=0.004$), and pulse wave velocity (rest: 5.3±0.6ms; recovery: 5.9±0.7ms, $p=0.02$) such that they

significantly increased after the acute resistance exercise. There were also significant time by condition interactions for time of the reflected wave (rest: 150±7ms; recovery: 147±9ms, $p=0.02$) and the subendocardial variability ratio (rest: 147±17%; recovery: 83±24%, $p=0.0001$) such that there were reduced after the acute resistance exercise. **CONCLUSION:** These data suggest that an acute bout of resistance exercise alters pulse wave reflection and arterial stiffness similarly between the sexes without significantly altering aortic hemodynamics.

1264 Board #3 June 1 8:00 AM - 10:00 AM

Comparing Two Low-Intensity Resistance Training Modalities on Strength and Wave Reflection in Postmenopausal Dynapenic Women

Salvador J. Jaime, Stacey Alvarez-Alvarado, Jeremiah C. Campbell, Arturo Figueroa, FACSM. *Florida State University, Tallahassee, FL.* (Sponsor: Arturo Figueroa, FACSM)
(No relationships reported)

PURPOSE: Dynapenia, the age-related loss in muscle strength, is emerging as an important risk factor for the development of cardiovascular disease (CVD) and physical disability. Wave reflection (augmentation pressure [AP] and index [AIx]) and central pulse pressure (cPP) have shown to be sensitive markers for CVD and left ventricular afterload. Although resistance training (RT) increases mass and strength, most studies have shown no effect on AP or AIx. The purpose of this study was to investigate two modalities of low-intensity strength training on wave reflection and cPP in postmenopausal dynapenic women.

METHODS: Twenty-one non-obese (body mass index (BMI) ≤ 27 kg/m²) sedentary postmenopausal women were randomly assigned to either whole-body vibration training (WBVT) or low-intensity RT (LIRT) for 12 weeks. We measured AP, AIx, AIx adjusted at 75 bpm (AIx@75), time of reflection (Tr), and central pressures using applanation tonometry. Muscle strength was measured using a handgrip dynamometer for maximal voluntary contraction (MVC) and 1 repetition max for leg press and extension.

RESULTS: At baseline, there were no significant differences between groups in age, anthropometrics, peripheral or central pressures, and muscle strength. LIRT and WBVT similarly increased leg press (10.6 ± 1.8%; 14.8 ± 2.6%, respectively; $P < 0.001$) and leg extension (8.8 ± 2.8 %, $P < 0.05$; 19.2 ± 4.6 %, $P < 0.01$, respectively). There was a group-by-time interaction for the increase in MVC (12.1 ± 2.2 %, $P < 0.01$) in the LIRT group compared to no change in the WBVT group. There was a group-by-time interaction for the reduction of AP (-4 ± 1 mmHg, $P < 0.05$), AIx (-5.0 ± 1.4%, $P < 0.01$), AIx@75 (-5.3 ± 1.7%, $P < 0.05$), and cPP (-5 ± 2 mmHg, $P < 0.05$) in the WBVT group compared to no change in the LIRT group. The reductions in cPP were inversely correlated to the increases in leg extension strength ($r=-.44$, $P < 0.05$). **CONCLUSIONS:** While both LIRT and WBVT significantly increased leg muscle strength, WBVT also reduced markers of left ventricular afterload. Increases in leg muscle strength were related to the decreases in cPP, which may reduce risk of end-organ damage and physical disability. Our data suggest that WBVT may be a beneficial therapeutic modality for the prevention of physical disability and future cardiovascular events.

1265 Board #4 June 1 8:00 AM - 10:00 AM

Sex Differences in the Influence of Leg Strength on Arterial Stiffness.

Georgios Grigoriadis, Alexander J. Rosenberg, Sang Ouk Wee, Elizabeth C. Schroeder, Kanokwan Bunsawat, Bo Fernhall, FACSM, Tracy Baynard, FACSM. *University of Illinois at Chicago, Chicago, IL.* (Sponsor: Tracy Baynard, FACSM)
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(No relationships reported)

INTRODUCTION: Acute resistance exercise has been associated with increased central artery stiffness and muscle strength has been shown to be inversely associated with arterial stiffness. However, many studies have only included males with little research conducted including females. Pre-menopausal females typically have lower resting arterial stiffness, yet the relationship between strength and arterial stiffness responses is unknown for females. **PURPOSE:** To determine the relationship between quadriceps and hamstring strength and the acute arterial stiffness response following resistance exercise. **METHODS:** Eleven males (28 ± 5 yrs; 24.6 ± 2.0 kg/m²) and eight females (26 ± 4 yrs; 22.5 ± 2.3 kg/m²) completed maximal isokinetic knee extension and flexion (3 sets of 10 repetitions) on a force dynamometer. Central pulse wave velocity (PWV) was estimated by brachial oscillometric blood pressure waveforms at baseline and 5 min post-exercise. Bivariate correlations were performed to examine the linear relationship between leg strength and change in PWV. Relative leg strength data was adjusted for lean body mass measured by dual-energy X-ray absorptiometry. **RESULTS:** Only females exhibited positive correlations between changes in PWV and peak flexor torque ($p < 0.05$), relative peak flexor torque ($p < 0.05$), relative flexor power ($p < 0.05$) and relative average power ($p < 0.05$). PWV did not change from rest to 5 min post-exercise in females (5.2 ± 0.2 to 5.2 ± 0.3 m/s) but

did significantly increase in males (5.2 ± 0.6 to 5.4 ± 0.6 m/s). **CONCLUSION:** The results suggest that leg strength is positively associated with changes in arterial stiffness in females, but not males, despite the group mean for females showing no change in stiffness. Therefore, females with higher leg strength have greater changes in stiffness after a bout of resistance exercise.

Leg Strength *Significant correlation: $p < 0.05$	APWV	
	Male	Female
Peak Extensor Torque (ft-lbs)	0.198	0.482
Average Extensor Torque (ft-lbs)	0.250	0.490
Peak Flexor Torque (ft-lbs)	-0.016	0.852*
Average Flexor Torque (ft-lbs)	0.170	0.550
Relative Peak Extensor Torque (ft-lbs/kg)	0.498	0.346
Relative Peak Flexor Torque (ft-lbs/kg)	0.181	0.887*
Relative Extensor Power (Watts/kg)	0.455	0.599
Relative Flexor Power (Watts/kg)	0.488	0.712*
Relative Average Power (Watts/kg)	0.492	0.769*

1266 Board #5 June 1 8:00 AM - 10:00 AM

Blood Flow Responses To Acute Exercise Differ By Menopausal Status

Corinna Serviente, Lauren Richardson, Sarah Witkowski. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Jane A. Kent, FACSM)
(No relationships reported)

Endothelial dysfunction is a subclinical marker for cardiovascular disease and is associated with higher retro- and lower ante-grade blood flow. We have shown lower endothelial function and enhanced activation following acute exercise in late post-menopausal women. It is unknown whether there are differences in blood flow patterns, such as retro- and ante-grade flow and oscillatory shear index (OSI) in response to acute exercise in this population. **PURPOSE:** To evaluate blood flow patterns before and after acute exercise in perimenopausal (PERI) and late postmenopausal (POST) women. **METHODS:** Healthy low-active PERI ($n=7$) and POST ($n=8$) exercised for 30min at 60-64% $\dot{V}O_{2peak}$. Blood flow was analyzed in the brachial artery before and 30min after exercise. Retro- and ante-grade flow were calculated as the average positive and negative shear rate during 2min of baseline, 5min of forearm blood flow occlusion (200mmHg), and during the last 30sec of the 4min recovery. OSI was calculated as retrograde/ (retrograde + antegrade) flow at all time points. Data was analyzed with 2-way repeated measures ANOVA, t-tests and Mann-Whitney rank sum tests and are presented as mean±SEM. **RESULTS:** Before exercise, PERI showed a trend for higher antegrade flow at baseline (pre: 318.4±41.6 s⁻¹ vs. post: 368.9±47.3 s⁻¹, $p=0.09$), with no change in POST (pre: 280.6±35.5 s⁻¹ vs. post: 283.8±31.4 s⁻¹, $p=0.91$). There was a group x exercise interaction for retrograde flow at baseline ($p=0.058$), with a non-significant increase in PERI ($p=0.19$) and a decrease in POST ($p=0.14$). Despite no change in any other parameters, there was a trend for a main effect of exercise ($p=0.062$) and a group x exercise interaction in OSI during occlusion ($p=0.075$), with an increase in POST following acute exercise (pre: -1.54±0.39 vs. post: -4.17±1.87, $p=0.015$) and no change in PERI (pre: -2.02±0.45 vs. post: -2.33±0.73, $p=0.94$). **CONCLUSION:** Low active POST and PERI women demonstrated different vascular responses to acute exercise. The increase in OSI and lack of change in antegrade flow following exercise in POST suggests greater stress on the vasculature and may contribute to impaired endothelial function in this population. Supported by: Research Trust Fund (Witkowski)

1267 Board #6 June 1 8:00 AM - 10:00 AM
Long Term Effects of Menopausal Hormone Therapy on Cerebral Pulsatility Index

Nicole A. Eisenmann¹, Kathleen B. Miller¹, Alexa E. Carl¹, Ronée E. Harvey², Michael J. Joyner, FACSM³, Virginia M. Miller³, Jill N. Barnes¹. ¹University of Wisconsin, Madison, WI. ²Mayo Clinic College of Medicine, Rochester, MN. ³Mayo Clinic, Rochester, MN.
 (No relationships reported)

Menopausal hormone therapy (MHT) is used for management of menopausal symptoms; however, the long-term effects of MHT on the cardiovascular and cerebrovascular system are controversial. Previous studies have shown that pulsatility index (a measure of the variability of blood velocity in a vessel) of the middle cerebral artery (MCA) decreases during the use of MHT, but increases again within months after suspension of MHT; however, these effects have not been studied long term.

PURPOSE: The purpose of this study was to evaluate the long term effects of prior use of MHT on MCA pulsatility index (PI).

METHODS: Fifty-four postmenopausal women were evaluated 3 years after cessation of use of MHT or placebo (as part of a 4 year randomized, placebo-controlled clinical trial). Women had received either a placebo (PLA: n=19; age=59±3 y; BMI=28±3 kg/m²) or MHT (MHT: n=35; age=60±3 y; BMI=27±5 kg/m²). MCA velocity (MCAv), mean arterial pressure (MAP), and end-tidal CO₂ were continuously measured throughout the study. Baseline measurements were recorded then women underwent a stepped hypercapnic protocol inhaling 2%, 4%, then 6% CO₂ at each stage for three minutes. PI was calculated as (systolic MCAv-diastric MCAv)/mean MCAv. **RESULTS:** Baseline MAP and MCAv were similar between groups (PLA: MAP=90±2 mmHg; MCAv=60±3 cm/s; MHT: MAP=91±1 mmHg; MCAv=69±3 cm/s; p>0.05 for both). PI was greater in the MHT group compared to the placebo group at baseline (MHT: PI=0.86±0.02 vs. PLA: PI=0.77±0.02; p<0.05), during 2% CO₂ (MHT: PI=0.85±0.02 vs. PLA: PI=0.76±0.02; p<0.05), and during 4% CO₂ (MHT: PI=0.82±0.02 vs. PLA: PI=0.73±0.02; p<0.05). PI was not different between groups during 6% CO₂ (MHT: PI=0.75±0.02; PLA: PI=0.71±0.02; p=0.28).

CONCLUSIONS: Cerebral PI was higher in women who had taken MHT compared to women who had not taken MHT. The differences between groups persisted until the CO₂ vasodilatory stimulus increased to 6%. Taken together, these results suggest that previous use of MHT alters regulation of the cerebral circulation that has effects at least up to three years after cessation.

Supported by NIH grant AG44170, HL118154

1268 Board #7 June 1 8:00 AM - 10:00 AM
NOS Blockade Reveals No Sex Difference in Contracting Muscle O₂ Delivery-to-Utilization Matching in Rats

Trenton D. Colburn, Jesse C. Craig, Daniel M. Hirai, K. Sue Hageman, Timothy I. Musch, FACSM, David C. Poole, FACSM. *Kansas State University, Manhattan, KS.* (Sponsor: David C. Poole, FACSM)
 (No relationships reported)

Estrogen has been proposed to enhance nitric oxide synthase (NOS) expression and NO bioavailability in females. Importantly, flow-mediated dilation (FMD) is reduced post-menopause when estrogen levels decrease. Thus, FMD in females may rely on the effects of estrogen (mediated via NO) when compared to age-matched males. **PURPOSE:** Where potentially incomplete blockade of NOS may not show sex differences in pre-menopausal FMD, we tested the hypothesis that complete NOS blockade via L-arginine methyl ester (L-NAME) in female rats would exhibit a greater reduction in muscle O₂ delivery-to-utilization matching (assessed via PO₂ in the muscle interstitial space (P_{INT}O₂)) and speed P_{INT}O₂ kinetics following the onset of muscle contractions when compared to age-matched males. **METHODS:** In Sprague Dawley rats (n=5 male, 5 female), the spinotrapezius muscle was surgically exposed and electrically stimulated (~6 V, 1 Hz) for 180 s. Prior to contractions, Oxyphor G4 was injected into the muscle to measure P_{INT}O₂; P_{INT}O₂ was recorded at rest and during contractions in control (CON) and following NOS blockade (intra-arterial (IA) infusion of L-NAME (10 mg kg⁻¹)) conditions. **RESULTS:** NOS blockade revealed no differences in resting P_{INT}O₂ within and between sexes (Male CON: 20 ± 1 vs Male L-NAME: 21 ± 2 mmHg; Female CON: 17 ± 2 vs Female L-NAME: 17 ± 3 mmHg; p > 0.05). Additionally, there were no differences in kinetics (mean response time) following the onset of contractions (Male CON: 18 ± 2 vs Male L-NAME: 12 ± 4 s; Female CON: 15 ± 2 vs Female L-NAME: 15 ± 2 s; p > 0.05). **CONCLUSION:** Contrary to our hypothesis, reducing NO bioavailability via NOS blockade did not have any different effect in females versus males with respect to resting P_{INT}O₂ or P_{INT}O₂ kinetics. These results suggest that estrogen via NO bioavailability does not play a significant role in resting P_{INT}O₂ or P_{INT}O₂ kinetics during muscle contractions in female rats.

C-15 Free Communication/Slide - Aging

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
 Room: 401

1269 **Chair:** Loretta DiPietro, FACSM. *The George Washington University School of Public Health and Health Services, Washington, DC.*
 (No relationships reported)

1270 June 1 8:00 AM - 8:15 AM
Improved Strength and Balance in Older Adults Following an 8-week Eccentric Training Program

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 (No relationships reported)

PURPOSE: The purpose of the current study was to determine changes in balance and strength following an eccentric resistance training program in community-dwelling older adults.

METHODS: Participants (N = 14; 63.5 ± 2.0 years) completed 8 weeks of eccentric training on a commercially-available, seated eccentric step machine. Participants completed 2 training sessions per week, with each session consisting of 5 to 10 minutes of exercise at an intensity ranging from 30 to 50% of maximal eccentric strength. Single leg stance, 30-second repeated chair stand, timed up-and-go, and maximal eccentric strength were assessed at baseline, at week 4 of training, and within one week of the last training session. RPE was also assessed following each training session.

RESULTS: Data are presented as (baseline, week 4, week 8). Negative work completed in training increased approximately three times (20.1 ± 7.7, 52.9 ± 25.0, 79.6 ± 38.4 kJ), while the rating of perceived exertion plateaued at "somewhat hard" (10.2 ± 1.6, 11.9 ± 1.1, 13.1 ± 2.0). Significant improvements were observed in the 30-second repeated chair stand (12.1 ± 3.1, 14.3 ± 4.4, 16.2 ± 5.4 repetitions; p < .001), the timed up-and-go (6.0 ± 0.8, 5.3 ± 0.9, 5.3 ± 0.9 seconds; p < .001), and maximal eccentric strength (489.8 ± 179.4, 612.6 ± 193.6, 685.0 ± 184.7 pounds; p < .001), while there was no significant change in single leg stance time (82.9 ± 78.3, 95.72 ± 102.1, 107.4 ± 99.9 seconds).

CONCLUSIONS: The eccentric training was sufficient to yield improved performance on dynamic balance and strength tasks. These improvements, in individuals not yet classified at high fall risk, indicate eccentric training may be a viable modality for low fall risk, older individuals aiming to minimize future fall risk and prolong physical independence.

1271 June 1 8:15 AM - 8:30 AM
Improvements Following a Speed-Based Go4Life Group Exercise Intervention in Older Adults

Maria Bellumori. *California State University, Monterey Bay, Seaside, CA.* (Sponsor: Kent J. Adams, FACSM)
 (No relationships reported)

Slow movement is common among older adults and has been linked with negative impacts on fall prevention, independent living, and quality of life. Current exercise recommendations from the National Institutes on Aging (NIA Go4Life) include cardiovascular endurance, strength, flexibility, and balance training. While these are sensible, they neglect the movement quality of quickness that is key for many activities of daily living. A growing body of literature supports the safe use of high speed exercise in older adults to improve functional ability. **PURPOSE:** To combine recommendations from the NIA Go4Life program with speed of movement to improve function and health perceptions in older adults. **METHODS:** Fifteen older adults (aged 66-77) participated in two baseline tests during the control period of the exercise intervention. The group intervention included an eight week speed-based exercise program (2 days per week) that included components of endurance, strength, flexibility, and balance. **RESULTS:** No differences were observed in functional measurements between the first and second baseline tests (p>.05). Upon completion of the eight week program, there were improvements in the following tests: simple reaction time (F_(2,43) = 7.5, p<.01), choice reaction time (F_(2,43) = 19.8, p<.01), 10 meter walk (F_(2,43) = 16.7, p<.01), number of steps taken during the 10m walk (F_(2,43) = 9.01, p<.01), timed up and go (F_(2,43) = 7.4, p<.01), nine hole peg test (F_(2,43) = 4.1, p<.05), and SF-36 scores (t₍₁₄₎ = -2.85, p<.05). Functional reach and grip strength did not change. **CONCLUSIONS:** Results from this study support the use of speed-based exercises to improve physical and cognitive function in older adults along with perceived health.

1272 June 1 8:30 AM - 8:45 AM

Age-related Differences in Maximal and Rapid Hamstrings to Quadriceps Strength Capacities and Vertical Jump Power

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 (No relationships reported)

The balance between leg flexor and extensor strength, which is typically assessed using the hamstrings to quadriceps (H/Q) strength ratio, has been implicated as an important factor in the muscle power and functional performance abilities of aging populations. Declines in hamstrings and quadriceps maximal and rapid strength are commonly reported as a consequence of aging; however, few studies have investigated the influence of age on maximal and rapid strength H/Q ratios. **PURPOSE:** To examine age-related differences in maximal and rapid strength H/Q ratios between young and old females and the relationships of these characteristics with vertical jump power. **METHODS:** Fifteen young (age = 21 ± 2 yr) and 15 old (69 ± 7 yr) females performed three countermovement vertical jumps (CMJs) followed by three isometric maximal voluntary contractions (MVCs) of the leg extensors and flexors. Estimated peak power output (Pmax) was measured during the CMJs using a linear velocity transducer. For each MVC, participants sat in an upright position and were instructed to extend or flex the leg "as hard and fast as possible" against a load cell attached to the heel for 3-4 s. Maximal and rapid isometric H/Q strength ratios were determined by taking the quotients between leg flexor and extensor peak torque (PT H/Q) and rate of torque development at 0-200 ms (RTD200 H/Q). **RESULTS:** The old females exhibited lower Pmax (old = 1075.87 ± 376.78 W; young = 3131.07 ± 1426.22 W; $P < 0.001$) and higher PT H/Q (old = 0.71 ± 0.24; young = 0.54 ± 0.13; $P = 0.030$) and RTD200 H/Q (old = 0.85 ± 0.25; young = 0.61 ± 0.22; $P = 0.008$) than the young females. There was a significant relationship between Pmax and RTD200 H/Q in the old females ($r = -0.522$; $P = 0.046$); however, there was no such relationship in the young females ($r = -0.109$; $P = 0.698$) nor were there any relationships between Pmax and PT H/Q for either age group (young $r = 0.029$; $P = 0.918$; old $r = -0.364$; $P = 0.182$). **CONCLUSION:** These findings demonstrated that maximal and rapid strength H/Q ratios increase and muscle power decreases at old age. The significant relationship observed between Pmax and RTD200 H/Q in the old females perhaps suggests that these age-related increases in rapid antagonist muscle strength ratios may play a significant role in the lower muscle power and functional performance abilities observed in older adults.

1273 June 1 8:45 AM - 9:00 AM

Supramaximal-Exercise Training Improves Fitness and Ratings of Perceived-Exertion in Adults Aged 50 Years and Over

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 (No relationships reported)

PURPOSE: Physical activity in elderly persons contributes to prevention and treatment of the negative effects of age on muscle performance and, in turn, increases physical capability and improves muscle function and condition. This pilot study evaluated the effects of six weeks of supramaximal-exercise training (SET) on fitness variables and Ratings of Perceived-Exertion (RPE) in men and women aged 50 years and over.

METHODS: Nine healthy older adults [average age 60(7) years; body mass index = 33.5(3) kg.m⁻²] completed a 6-week SET intervention comprising 18 sessions of 6 repeats of 6-second supramaximal sprints on an electromagnetically braked cycle ergometer, with 2-minute recovery between each repetition. Anthropometry, maximal power output (MPO), mechanical efficiency and RPE were obtained at baseline and at post-intervention. MPO was evaluated using a charge-velocity test. Mechanical efficiency (ME, in %) was computed across stages correspond to 25, 50 and 100% of VO₂max of an incremental maximal cycling test as follows: work produced, in watts • (total - resting energy consumption, in watts)⁻¹ • 100⁻¹. The RPE was rated five minutes following the incremental maximal cycling test. Multiple linear regression with an extended-model approach was subsequently used to document the effects of the fitness variables on RPE changes.

RESULTS: Neither anthropometric variables nor maximal oxygen uptake differed between the baseline and 6 weeks of SET. However, MPO (3.5(1.5) vs 5.5(0.5) W.Kg⁻¹; $p < 0.01$) and ME (12(1) vs 14(2) %; (15(1) vs 17(2) % and 18(3) vs 23(4) %; $p < 0.01$, respectively) increased significantly from baseline at post intervention. RPE index (8.6(0.3) vs 5.1(0.3); $p < 0.01$) were significantly lower at post-intervention than at baseline. In this study, the increases in MPO and in ME were identified as significant predictors of RPE declines over 6 weeks, accounting for 39 and 52 % respectively of the relationship.

CONCLUSIONS: Although there were no changes in the participants' anthropometric and aerobic fitness variables, six weeks of SET are beneficial for lower muscular performance and efficiency and seem to influence positively the RPE index. Consequently, SET can be recommended as a form of strategies aimed at improving muscle efficiency among older adults.

1274 June 1 9:00 AM - 9:15 AM

Maximal Strength Training-induced Neural Plasticity With Age: Cross-limb Effects

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 (No relationships reported)

Cross-limb effects following unilateral strength training is vastly documented in young. However, since the efferent neural drive during strong muscle contractions is attenuated in old, even after lifelong strength training, it is unclear whether contralateral effects persist with age. **PURPOSE:** To investigate whether unilateral strength training induced contralateral strength gain in old. **METHOD:** We assessed the voluntary force-generating capacity along with evoked potentials recordings (V-wave and H-reflex normalized to M-wave) and voluntary activation (VA) in the plantar flexors of the opposite limb following unilateral maximal strength training (MST) with the dominant leg. Twenty-three 73±4 (SD) year old males were randomly assigned to a MST group (exercising three times a week for three weeks, with an intensity of ~90% of one repetition maximum) or a control group (CG). **RESULTS:** MST improved maximal voluntary contraction (1076±270 to 1191±348Nm) and rate of force development (1973±541 to 2328±777Nm·s⁻¹) in the contralateral limb (both $p < 0.05$). These strength gains were associated with ($r = 0.465-0.658$; $p < 0.05$) an enhancement of the V/M-ratio of the soleus muscle (SOL) (0.12±0.09 to 0.21±0.17), and increase in VA (79.5±5.1 to 83.3±5.2%) (both $p < 0.05$). In contrast, the H/M ratio remained unaltered after MST, while no changes were apparent for any of the parameters in the CG. **CONCLUSION:** Our results reveal that cross-limb effects persist with age, and are mediated by an efferent neural drive enhancement. Furthermore, these observations advocate the potential clinical relevance of unilateral MST as an advantageous rehabilitation strategy to improve physical function in old individuals with conditions that prevent them from exercising with both limbs.

1275 June 1 9:15 AM - 9:30 AM

Using The FMSTM To Assess The Degenerative Changes Of Functional Performance In Mid-aged And Older People

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 (No relationships reported)

The Functional Movement Screen (FMS™) is increasingly popular for detecting impairments and limitations in basic functional movements. However, large-sample research is scanty to investigate the degenerative changes in terms of functional symmetry, agility, and stability associated with ageing. **PURPOSE:** To explore functional degeneration associated with ageing, by using the FMS™. **METHODS:** One hundred mid-aged (n=48, mean 54.75 years old, range 50-59) and older (n=52, mean 62.42 years old, range 60-69) community adults volunteered. There functional performance was assessed by using the FMS™. **RESULTS:** (1) The mean (±SD) total FMS score was 13.10 (±1.83) and 45% participants an asymmetry in at least one of the five FMS™ testing items that include bilateral assessments; (2) Pearson's correlation showed that there was a significant and negative relationship between age and the total FMS™ scores ($r = -0.278$, $P = 0.005$); (3) The Mann-Whitney U test showed that the scores for Hurdles and Rotary Stability were significantly worse in older participants, compared to their mid-aged counterparts ($P = 0.013$ and $P = 0.048$, respectively); (4) When a stepwise multiple regression was conducted on the FMS™ total scores, it was found that 85% of the variance in FMS™ scores could be accounted for by four variables: Push-up, Shoulder Mobility, Lunge, and Hurdle, with explained variance cumulating from 40, 56, 74 to 85% as the four variables were added into the equation. **CONCLUSIONS:** (1) The total FMS™ scores from this group of participants was lower than 14, suggesting increased risk of injury. Thus, specific intervention should be carried out to lower the risk; (2) When transferring from mid-aged to older stage, balance with single leg support and core stability may decrease significantly, indicating that these two factors should be taken seriously during intervention; (3) In order to improve total FMS™ score and decrease risk of injury in mid-aged and older individuals, exercises program should involve Push-up, Shoulder Mobility, Lunge, and Hurdle practice. The current study provided valuable information for better understanding of ageing process with regard to functional degeneration, and for developing specific exercise program that targets on these degenerative changes with ageing.

1276 June 1 9:30 AM - 9:45 AM

Physical Activity Intervention In Older Adults: Greater Gains In Functional Performance In Older Adults At Higher Risk For Mild Cognitive Impairment

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 (No relationships reported)

There are well documented positive effects of physical activity on general health and wellbeing throughout the lifespan. Next to it, beneficial effects of physical exercise interventions at improving brain health and functioning in older adults are also well reported whereas individual differences and mechanisms to gain functional capacities related to cognitive baseline level need to be investigated. **PURPOSE:** To investigate the influence of cognitive baseline level on gaining functional performance in older adults after 3-month of physical exercise intervention. **METHODS:** Thirty older adults (68±5y, 27% men) were enrolled in 3-month twice per week physical exercise program and were randomly divided into experimental (EG; N=19) or control group (CON; N=11). For further analysis we took into account EG with low cognitive [LC; Montreal Cognitive Assessment (MoCA) score <23; N=6] and high cognitive (HC; MoCA score >28; N=8) score. Functional performance was assessed by the means of Senior Fitness Test. **RESULTS:** We found a significant interaction of time/group (P=.004). Post hoc comparison showed differences in pre to post measurements between LC and CON in Time Up to Go test (TUG; P=.002), while no differences were found between HC and CON (P=.159) as well as for LC and HC (P=.127). Moreover, the percent of change analysis showed pre to post improvements (P<0.05) for both, LC and HC (-22% vs -10%), except the CON (-1%). Finally, other sub-tests from Senior Fitness Test battery presented tendencies but failed to reach significance level. **CONCLUSION:** Although direct comparison (pre to post change) failed to demonstrate difference between two EG, comparison of both EG with CON, confirmed our hypothesis that older adults with lower baseline cognitive function were able to achieve more functional capacity gains after 3 month of physical training intervention, as compared to those with higher baseline cognitive function.

1277 June 1 9:45 AM - 10:00 AM

Two-Year High-Intensity Aerobic Training Program Prevents Age-Associated Health Risk Factor Development in Sedentary Middle-Aged Adults

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 (No relationships reported)

Sedentary aging results in a gradual decline in fitness characterized by decreased cardiorespiratory function, increased adiposity, and loss of lean mass. Short duration exercise training augments aerobic fitness and improves body composition and hemodynamics in middle-aged adults. However, the extent to which consistent, long-term aerobic exercise training prevents age-associated decrements in body composition and cardiorespiratory fitness remains unclear.

PURPOSE: We investigated the effects of a progressive two-year, high-intensity endurance exercise program on maximal oxygen uptake ($\text{VO}_{2\text{max}}$), fat mass (FM), fat-free mass (FFM), and blood and plasma volumes (BV and PV, respectively) in untrained adults.

METHODS: 52 sedentary, healthy middle-aged adults (24 males; 52 ± 5yrs) were recruited and randomized to one of two study groups: aerobic exercise (EX; n=28) or non-aerobic yoga control (CON; n=24). At baseline and following two years of intervention, all subjects underwent maximal exercise testing, in which $\text{VO}_{2\text{max}}$ [Douglas bags] was measured during incremental treadmill exercise. Additionally, BV and PV were assessed using a 2-min CO -rebreath protocol, and FM and FFM were determined via underwater weighing.

RESULTS: CON participants had a small decrease in $\text{VO}_{2\text{max}}$ (29.6 ± 5.2 to 28.7 ± 5.4 ml/kg/min, p=0.11) and FFM (50.8 ± 11.4 to 49.9 ± 11.6 kg, p=0.13), an increase in FM (25.3 ± 6.9 to 27.5 ± 5.9 kg, p=0.002), and a decrease in both absolute and relative BV (69.5 ± 8.5 to 66.0 ± 8.0 ml/kg, p=0.003) and PV (44.0 ± 6.4 to 40.8 ± 5.7 ml/kg, p<0.001) over two years. EX participants experienced a significant increase in $\text{VO}_{2\text{max}}$ (28.8 ± 4.8 to 34.4 ± 6.2 ml/kg/min, p<0.001) and a significant decrease in FFM (50.4 ± 11.0 to 49.4 ± 11.1 kg, p=0.01). However, exercise training prevented age-associated changes in FM (24.1 ± 5.9 to 24.4 ± 6.3 kg, p=0.51) and both absolute and relative BV (70.3 ± 8.4 to 71.2 ± 7.8 ml/kg, p=0.54) and PV (44.9 ± 5.6 to 44.0 ± 6.5 ml/kg, p=0.52).

CONCLUSION: In addition to improving cardiorespiratory fitness, two years of consistent, high-intensity aerobic training successfully preserved body composition and blood volume measures compared to controls. Thus, long-term aerobic training appears to prevent the development of many age-related health risk factors in middle age.

C-16 Free Communication/Slide - Chronic Disease and Health

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
 Room: 103

1278 **Chair:** Janet Walberg-Rankin, FACSM. *Virginia Tech, Blacksburg, VT.*

(No relationships reported)

1279 June 1 8:00 AM - 8:15 AM

Water Intake And Hydration State Is Associated With Insulin Resistance In Healthy Adults: NHANES 2009-2012

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Epidemiological studies from European cohorts suggest that low water intake is associated with the risk of developing diabetes and/or hyperglycemia. Additionally, data indicate that copeptin, a surrogate marker of vasopressin and low water intake, is associated with diabetic heart disease and death. **PURPOSE:** To examine the association between water intake and hydration state with glucose regulation in healthy individuals in the U.S. **METHODS:** 2,233 adults from 2009-10 & 2011-12 NHANES (National Health and Nutrition Examination Survey) considering participants without diabetes, non-pregnant, and with normal renal function (females: 48.3%, age: 44 ± 1 y, BMI: 27.5 ± 0.2 kg·m²). Insulin resistance was assessed by homeostasis model assessment of insulin resistance (HOMA-IR; 2.77 ± 0.05) and data were divided into tertiles (≤1.77, 1.78-3.45, and >3.45). Hydration status was assessed by urine osmolality (621 ± 7 mmol·kg⁻¹) and urine flow rate (0.96 ± 0.03 ml·min⁻¹). Plain water (1,203 ± 35 mL) and total water intake (TWI; 3,190 ± 43 mL) were assessed by 24 h dietary recall. **RESULTS:** Urine osmolality was highest in the upper HOMA tertile (679 ± 9 mmol·kg⁻¹) compared to lowest tertile (583 ± 1 mmol·kg⁻¹, P<0.001), while urine flow rate was highest in the lowest HOMA-IR tertile (1.03 ± 0.04 ml·min⁻¹) compared to upper tertile (0.92 ± 0.03 ml·min⁻¹, P=0.001). Multinomial logistic regression showed healthy adults with higher levels of daily TWI (≥2,657 mL) had significantly less likely to be in the upper HOMA tertile, compared to adults with a lower level of TWI (≤1,598 mL, OR=1.17; 1.11-2.64), after adjusting for age, gender, BMI, waist circumference, race/ethnicity, education, and physical activity. Similarly, adults who consumed more plain water (≥859 mL) were half as likely to be in the upper HOMA-IR tertile, compared with those who consumed less (≤207 mL, OR=2.00; 1.37-2.93). **CONCLUSION:** Higher plain water (≥859 mL) and total water intake (≥2,657 mL), as well as better hydration state were associated with lower insulin resistance.

1280 June 1 8:15 AM - 8:30 AM

Exercise Training Lowers Postmeal Insulin Concentrations And Cancer-relevant Adipokines In Postmenopausal Breast Cancer Survivors

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Exercise-induced reductions in fasting insulin are modestly associated with lower cancer risk and improved prognosis in breast cancer survivors, however the impact of exercise training on postmeal insulin concentrations (50-80% of daily insulin exposure) and the relationship between postmeal insulin and cancer-relevant biomarkers is unclear. **Methods:** Fifteen postmenopausal breast cancer survivors underwent a supervised, progressive 12-week aerobic exercise program (60 min/day, 2-4 days/week). Baseline and post-intervention concentrations of insulin and cancer-relevant biomarkers (leptin, adiponectin, IGF-1, SHBG and 17-b Estradiol (E2)) were measured during a five-sample oral glucose tolerance test (OGTT) following 24h dietary and physical activity control. Changes in fitness and body composition were assessed by estimated $\text{VO}_{2\text{peak}}$ during a submaximal exercise test and dual energy X-ray absorptiometry (DEXA) respectively. In addition to each OGTT timepoint (30, 60, 90 and 120 minutes), postmeal insulin responses were determined by area under the

insulin curve (iAUC) using the trapezoid method and peak insulin concentration during the OGTT. Intervention effects were evaluated using paired t-tests and linear mixed models with the statistics package R. Data are presented as (mean±SEM). **Results:** Participants averaged 34.8 training sessions over the 12-week intervention. Estimated VO_{2peak} increased (25.2 ± 1.26 vs 27.7 ± 1.36 mL/kg/min, $p < 0.05$) and body weight decreased (75.55 ± 2.3 vs 74.45 ± 2.7 kg, $p < 0.05$) following the intervention. There were significant reductions in leptin (30.8 ± 5.0 vs 23.8 ± 3.4 ng/ml, $p < 0.05$), E2 (12.9 ± 1.7 vs 10.2 ± 1.4 pg/ml, $p < 0.05$) and 120-minute insulin (68.8 ± 9.1 vs 56.2 ± 8.2 uU/ml, $p < 0.05$) as a result of exercise training. There were no significant differences in iAUC or peak insulin, however the change in peak insulin was inversely associated with change in E2 ($r = -0.57$, $p = 0.04$). **Conclusion:** Exercise training lowered adipocyte-derived cancer biomarkers and postmeal (but not fasting) insulin concentrations. The use of fasting insulin alone may underestimate the impact of insulin on cancer recurrence and prognosis following exercise training in breast cancer survivors
Supported by: Rays of Hope Center for Breast Cancer Research, Springfield MA

1281 June 1 8:30 AM - 8:45 AM

Chronic Inflammation, Cardiorespiratory Fitness, Physical Activity, and Dietary Inflammatory Index in Cancer Survivors

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(No relationships reported)

Chronic inflammation has been linked to the development and progression of cancer. Age, body composition, cardiorespiratory fitness, physical activity, and dietary factors are associated with a global marker of inflammation, c-reactive protein (CRP), in healthy populations. However, few studies have explored the relationship between these variables with physically active cancer survivors. **PURPOSE:** To examine differences in fitness, daily activity levels, and dietary characteristics of active cancer survivors when grouped according to serum CRP (Low vs. Moderate to High). **METHODS:** Cancer survivors ($N = 14$, mean age = 66 ± 15 years) were evaluated for body mass index (BMI), body composition, and cardiorespiratory fitness (VO_{2peak}). Physical activity was measured via an accelerometer over a 7-day span. Diet logs (3 day) were analyzed and the dietary inflammatory index (DII) for each subject was obtained. Serum CRP was evaluated with an enzyme linked immunosorbent assay (ELISA). Subjects were assigned to one of two groups based on their serum CRP concentrations: Low CRP (≤ 1 mg/L) (LO) ($N = 7$) or Moderate to High (CRP > 1 mg/L) (MH) ($N = 7$). A t-test was used to compare LO and MH groups. Data are presented as mean \pm SD. **RESULTS:** MH had significantly higher BMI (kg/m^2) (30 ± 5.2 vs. 24 ± 8.8 , $p = 0.02$), higher body fat percentage (40.3 ± 7.77 vs. 32.4 ± 5.34 , $p = 0.05$), and lower VO_{2peak} values (mL/kg/min) (19.4 ± 5.54 vs. 31.8 ± 2.70 , $p = 0.0002$). There were no significant differences between LO and MH with respect to age, physical activity levels, caloric intake, or DII. **CONCLUSION:** Cancer survivors with moderate to high serum concentrations of CRP had higher BMI, more body fat and lower cardiorespiratory fitness. However, there were no differences between the groups with respect to daily physical activity, caloric intake, or DII when compared to survivors with low serum concentrations of CRP. These data suggest that interventions aimed at reducing body fat and improving cardiorespiratory fitness may be useful in controlling chronic inflammation as defined by serum CRP concentrations in cancer survivors. Supported by the Provost Fund for Faculty Scholarship and Professional Development, University of Northern Colorado.

1282 June 1 8:45 AM - 9:00 AM

Eight Week Passive Heat Exposure Improves Cardiometabolic Health in Obese Women

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(No relationships reported)

Obese individuals are at an increased risk of developing cardiovascular and metabolic disease, secondary to blood flow impairments in adipose tissue and a meta-inflammatory state. Repeated heat exposure through hot tub or sauna bathing shows great promise for improving cardiovascular and metabolic health, in part through improvements in blood flow profiles and reductions in systemic inflammation. **PURPOSE:** To examine changes in cardiometabolic health in obese women undergoing 8 weeks of chronic passive heat exposure (CPHE). **METHODS:** Six obese women (Age: 28 ± 8 y; BMI: 41.5 ± 3.5 kg/m²) underwent CPHE, consisting of 30 one-hour hot tub sessions over 8-10 weeks (3-4 per week) in 40.5°C water. Measures of cardiovascular health (blood pressure, pulse wave velocity, flow-mediated dilation

[FMD]) and metabolic function (fasting glucose, 2-hr oral glucose tolerance test [OGTT]) were made before (0wks) and after (8wks) of CPHE. **RESULTS:** Following CPHE, resting mean arterial pressure was reduced (0wks: 89 ± 2 vs 8wks: 83 ± 2 mmHg; $p = 0.05$), with both systolic (0wks: 122 ± 4 vs 8wks: 112 ± 3 mmHg; $p = 0.06$) and diastolic (0wks: 73 ± 2 vs 8wks: 68 ± 2 mmHg; $p = 0.07$) pressure tending to decrease. Arterial stiffness, measured by brachial-ankle pulse wave velocity, was lower (0wks: 870 ± 30 vs 8wks: 797 ± 37 cm/sec; $p = 0.04$), and FMD trended toward increasing, albeit variably (0wks: 6.9 ± 1.1 vs 8wks: $9.1 \pm 1.3\%$; $p = 0.25$). Fasting glucose was significantly reduced (0wks: 104 ± 7 to 8wks: 92 ± 7 mg·dl⁻¹; $p = 0.04$) in all subjects, and OGTT area under the curve (AUC) and glucose at the 2-hr timepoint decreased substantially in subjects who began the study with impaired glucose tolerance (2-hr glucose > 140 mg·dl⁻¹). In these three pre-diabetic individuals, 2-hr glucose decreased from 0wks: 181 ± 10 to 8wks: 139 ± 20 mg·dl⁻¹ and OGTT AUC decreased from 0wks: $21,323 \pm 2,273$ to 8wks: $17,695 \pm 2,890$ mg·dl⁻¹·min. **CONCLUSIONS:** These preliminary data suggest a therapeutic benefit of CPHE for improving cardiometabolic health in obese women, with blood pressure and glucose parameters showing clinically significant decreases. Additionally, these data support previous work in healthy sedentary individuals showing improvements in blood pressure, arterial stiffness, and endothelial function following CPHE.

1283 June 1 9:00 AM - 9:15 AM

Skeletal-muscle To Pancreatic Beta-cell Crosstalk: The Influence Of Interleukin-6

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(No relationships reported)

Exercise improves pancreatic-beta cell (β -cell) function in type 2 diabetic patients, however mechanisms of such effects are currently unclear. Given the fact that interleukin-6 (IL-6) is secreted by contracting muscle, causing a spike in circulating IL-6 levels, muscle-derived IL-6 has been implicated as an important endocrine factor in skeletal-muscle to β -cell crosstalk. However, studies of IL-6 on β -cell function have been inconsistent to date making it difficult to draw conclusions on the effect of IL-6 in the β -cell. Moreover, direct effects of physiologically relevant IL-6 concentrations on β -cell insulin secretion in cells pre-exposed to diabetic conditions such as glucolipotoxicity and/or proinflammatory cytokines are sparse. Since IL-6 appears to augment the effect of interleukin-1 β (IL-1 β) on β -cell apoptosis, understanding the interaction between a transient IL-6 response to acute exercise and effects on β -cell function under diabetic conditions is crucial for optimizing the therapeutic benefit of exercise in T2D.

PURPOSE: To explore the extent by which an exercise-induced concentration of IL-6 influences pancreatic β -cell function under glucolipotoxic and/or proinflammatory conditions.

METHODS: Insulin-secreting INS-1 832/3 cells exposed to BSA \pm palmitate at 5, 11 or 20 mM glucose or IL-1 β for 48 hours were treated with IL-6 (10 pg/ml) for 1 hour. The effects of these conditions on insulin secretion were determined. Values are means \pm SEM from four experimental repeats. Statistical differences between conditions were tested for by two-way ANOVA.

RESULTS: Exposure to 20 mM glucose \pm palmitate decreased glucose-stimulated insulin secretion (GSIS) by 2-fold (2.2 ± 0.5 to 1.1 ± 0.1 ng insulin $\cdot 10^{-4}$ cells, $P < 0.05$) and 2.6-fold (2.6 ± 0.6 to 1.0 ± 0.1 ng insulin $\cdot 10^{-4}$ cells, $P < 0.01$), respectively. Moreover, IL-1 β completely blunted GSIS from 3.0 ± 1.1 to -0.14 ± 0.17 ng insulin $\cdot 10^{-4}$ cells ($P < 0.05$). IL-6 treatment had no effect on GSIS under normal conditions (3.4 ± 0.17 ng insulin $\cdot 10^{-4}$ cells, $P = 0.77$), and did not prevent the suppression of GSIS by 20 mM glucose \pm palmitate or IL-1 β (all, $P < 0.05$).

CONCLUSIONS: Insulin secretory defects in pancreatic β -cells exposed to diabetic-like conditions are neither improved nor worsened by a direct exposure to IL-6 at an exercise-induced relevant concentration.

1284 June 1 9:15 AM - 9:30 AM

Exercise Or Reduced-calorie Diet Attenuates Overnutrition-induced GLUT4 Carbonylations In Adipose Tissue

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Obesity, caused in part by overnutrition and lack of physical activity, has been well-established to be a risk factor for insulin resistance. One mechanism for insulin resistance is decreased or dysfunctional glucose transporter type 4 (GLUT4), which plays a central role in skeletal muscle glucose uptake. Recently, we showed as little as 3 to 14 days of overnutrition results in oxidative damage to GLUT4 via carbonylations and subsequent insulin resistance in adipose tissue of both mice and humans. However,

it is unknown if these carbonylations of GLUT4 in adipose tissue are permanent or potentially reversible. **PURPOSE:** To determine if physical activity or a reduced-calorie diet can reduce GLUT4 carbonylations following overnutrition in mice. **METHODS:** Mice (n=4) were fed an overnutrition (60% high fat diet) for 14 days and then then switched to a 30% reduced calorie diet for 3 days or given access to a voluntary running wheel for 7 days. To determine if adipose GLUT4 carbonylations could be reversed the 'control' group consisted of time matched mice kept on the high fat diet with no intervention. At the end of each experimental condition mice were sacrificed and white adipose tissue (WAT) was collected. GLUT4 carbonylations were measured in WAT using a validated mass spectroscopy-based multiple reaction monitoring (MRM) method via a Quantum Ultra TSQ. All experimental procedures were approved by Temple University's IACUC. **RESULTS:** Following 14 days of overnutrition reducing caloric intake by 30% for 3 days reduced WAT GLUT4 carbonylations ~58% compared to time matched mice maintained on the overnutrition diet ($p < .05$). Further, wheel-running exercise for 7 days following overnutrition reduced WAT GLUT4 carbonylations ~81% ($p < .05$). **CONCLUSION:** Overnutrition-induced GLUT4 carbonylations in mouse WAT are not permanent and can be reversed by exercise or a reduced-calorie diet. Supported by NIH GM087239

1285 June 1 9:30 AM - 9:45 AM

High Intensity Interval Training Improves Endurance Performance and Increases Brown Adipose Mass in Diet-Induced Obese Mice

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(No relationships reported)

Inadequate diet and inactivity are associated with several metabolic diseases, mainly obesity. High intensity Interval Training (HIIT) is a promising exercise strategy for obese but its effects deserve further investigation. **PURPOSE:** To evaluate the effects of HIIT training on endurance and fat mass in diet-induced obese mice. **METHODS:** Fifteen C57BL/6 mice were randomly assigned to Control group (CC, n=5), Hipercaloric diet group (HC, n=5) and HIIT training plus Hipercaloric diet group (IH, n=5). Food and water were administered *ad libitum*. Hipercaloric diet was composed of 60%fat, 30%carbs and 10%protein. Control diet was composed of 30%fat, 60%carbs and 10%protein. Every group underwent a ramp test (RT) before and after intervention, on a mice treadmill (AVSprojects®) to determine maximal speed and maximal distance. RT initiated at 6m/min with a 2m/min increase every 2min (at 25°), until exhaustion. HIIT lasted for 8 wk, 5 days/wk. Each session lasted 45 min with 4-min high intensity bouts at 90% of the reached speed on first RT, followed by 3-min moderate intensity bouts at 70%. Animals were sacrificed after intervention and tissues were collected and weighed. One-way ANOVA (Tukey post hoc test) was used for comparison between groups, 5% level of significance. **RESULTS:** Baseline mean values of body weight before intervention were similar between groups ($p=0.57$). Hipercaloric diet groups gained more weight (IH: 26.6±3.1 g; CH: 23.9±3.2 g) than control group (CC: 15.1±4.6 g) after diet protocol/before intervention ($p=0.001$). After 8-wks intervention, CC (6.3±2.2 g) gained more weight than IH (3.7±0.9 g) ($p=0.03$). IH improved endurance performance (209.8±80.2 m), more than CH (54.8±30.3 m) and CC (118.2±28.5 m) ($p=0.002$) groups. Brown adipose tissue mass of IH (434.7±94.1 g) was higher than CC (214.5±65.6 g) ($p=0.04$). **CONCLUSIONS:** Eight-weeks HIIT improved endurance performance on diet-induced obese mice and attenuate the weight gain as compared with no exercise control diet group. The weight gain in non-exercising lean animals highlights the importance of being physically active to prevent obesity, with HIIT being a time-effective strategy. Brown adipose tissue is associated with more efficient thermogenesis and seems to mediate the effects of HIIT. Supported by CNPq/pro-centro-oeste grant 564658/2010-3

1286 June 1 9:45 AM - 10:00 AM

Short-Term Interval Training Increases Fat Utilization During Exercise in Adults With Prediabetes

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(No relationships reported)

PURPOSE: Individuals with prediabetes have impaired fat metabolism. Interval exercise is thought to lower type 2 diabetes risk, but the mechanism is unclear. We tested the hypothesis that interval training would enhance fat oxidation during exercise and relate to lower disease risk to a greater extent than continuous exercise training. **METHODS:** Thirteen obese, sedentary adults with prediabetes (Age: 57.9±2.2y, BMI: 34.5±1.4 kg/m², VO₂max: 21.1±1.2 mL/kg/min, FPG: 100.1±2.1 mg/dL, 2-hr glucose: 147.7±8.1 mg/dL) were screened using a 75g OGTT. Subjects were randomized to 12 days of interval (INT, n=7; 3min 90%HR_{max}, 3min 50%HR_{max}) or isocaloric continuous (CONT, n=6; 70%HR_{max}) cycle ergometry exercise for 60 min/d. Body

weight, VO₂max, and substrate oxidation via indirect calorimetry during exercise at the same absolute (30W) and relative (70%HR_{max}) intensities were measured before and after training. Data were analyzed using a 2-way mixed model ANOVA and Pearson's correlation, and reported as mean±SEM. **RESULTS:** Although there was no statistical change in body weight, VO₂max increased after both INT and CONT training ($P=0.05$). Exercise training also increased fat oxidation at 30W ($P=0.02$) and 70%HR_{max} ($P=0.03$). INT training tended to increase fat oxidation more than CONT at 30W (+0.07±0.02 vs. +0.03±0.03 g/min, $P=0.22$) and 70%HR_{max} (+0.11±0.03 vs. +0.03±0.04 g/min, $P=0.17$), although these did not reach statistical significance. The rise in fat oxidation during exercise at 70%HR_{max} correlated with decreased body weight after training ($r=-0.69$, $P=0.01$). **CONCLUSIONS:** Short-term INT training increases fat oxidation during exercise in people with pre diabetes. This preliminary change in fat metabolism is associated with decreased body mass and may contribute to lower diabetes risk.

C-17 Clinical Case Slide - Knee II

Thursday, June 1, 2017, 8:00 AM - 10:00 AM
Room: 507

1287 **Chair:** Mark E. Lavallee, FACSM. *Wellspan York Hospital, South Bend, IN.*

(No relationships reported)

1288 **Discussant:** Wayne E. Derman. *Stellenbosch University, Cape Town, South Africa.*

(No relationships reported)

1289 **Discussant:** Peter Gerbino, FACSM. *Monterey Joint Rep and Sports Medicine, Monterey, CA.*

(No relationships reported)

1290 June 1 8:00 AM - 8:20 AM

Knee Pain: An Uncommon Presentation

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(No relationships reported)

HISTORY: 54yo female with a history of small cell lung cancer metastatic to brain s/p Gamma Knife radiosurgery with 8 years of remission who presented with left posterior knee pain radiating to the calf. She had 5 days of severe "Charley horse" pain worse in the morning rated an 8 on a 1 to 10 scale. This pain had woke her up at night. Symptoms were worsened by flexing the knee and with weight bearing. Acetaminophen and ibuprofen were minimally helpful. No symptoms of popping, locking, or giving way. She denied trauma. No numbness, tingling, or weakness. **PHYSICAL EXAM:** No obvious deformity, erythema, effusion, or ecchymosis of left knee. Normal ROM from 0-115°. Moderate tenderness to palpation of popliteal fossa, medial joint line, and along medial gastrocnemius tendon distally. No masses noted in popliteal fossa. Knee stable to varus and valgus stress at 0° & 30°. McMurray's, patellar grind, anterior/posterior drawer, and Lachman negative. Antalgic gait on the left. 5/5 strength in all planes. Sensation intact to light touch in all five lumbar nerve distributions. Palpable pedal pulse. **DIFFERENTIAL DIAGNOSIS:**Hamstring/popliteus/gastroc tendinopathy; Medial meniscal injury; Thrombosis;Neoplasm;Baker's Cyst;Tibial stress fracture;Avascular necrosis of femur/tibia;Osteochondritis dissecans;Osteomyelitis **TESTS AND RESULTS:** **Left knee xray:** Subtle posterolateral proximal tibial sclerosis; **Labs:**WBC: 6.3k/uL (ref 3.7-10.3); ESR: 39mm/hr (ref 0-20); CRP: 2.2mg/dL (ref 0-0.9); D Dimer: 0.36mg/L (ref <0.51); **MRI:**See picture; **FINAL WORKING DIAGNOSIS:**Spontaneous avascular necrosis of the femur and tibia **TREATMENT AND OUTCOMES:**1. Quadriceps and hamstring strengthening with physical therapy; 2. NSAIDs and cane to assist with ambulation; 3. Orthopedic consult - agree with conservative management; 4. Patient reported minimal improvement in symptoms after 2 weeks of physical therapy; 5. Close follow up every 2-4 weeks to manage/monitor symptoms and expectations

THURSDAY, JUNE 1, 2017



1291 June 1 8:20 AM - 8:40 AM
Bilateral Knee Pain: Day #1 Of Training From Couch To 5k

Jennifer Gourdin¹, Matthew Sedgley². ¹The University of Maryland, Baltimore, MD. ²MedStar, Westminster, MD.
 (No relationships reported)

HISTORY:

A 40 year old female presents with bilateral knee pain. The pain is localized to the anteromedial side of her knees, and it started on day 1 of training for a 5k race. She is a couch to 5k runner. Her knee pain is 10/10 and worse when she rises from a seated position. She is barely able to walk and needs to use a walker. Her pain is better with sitting. OTC analgesics are ineffective. She went to urgent care where she had negative x-rays. She denies a history of swelling, bruising, and trauma to the knees. Of note, she has a history of GERD for which she has been taking dexlansoprazole 30 mg BID "for years."

PHYSICAL EXAMINATION: Vital signs: Pulse is 89 and regular, respirations 14 and regular, blood pressure 120/90; Pain 10/10

General: Well-developed, well-nourished 40 year old, white female in acute distress. **Lower extremities:** No peripheral edema, bruising, or swelling. She is neurovascularly intact. There is tenderness to palpation of the tibial plateau in both knees. Straight leg raise intact. Normal range of motion with flexion and extension of the knees, but it is very painful. The patient cannot walk without assistance. Ligament and strength testing were deferred due to pain.

DIFFERENTIAL DIAGNOSIS: 1. Bilateral lower extremity stress fractures

2. Metabolic bone disease

3. Vascular pathology

TEST AND RESULTS: MRI RIGHT KNEE WITHOUT CONTRAST - Extra-articular incomplete stress fracture involving the medial tibial cortex with intense associated marrow and paraosseous edema.

MRI LEFT KNEE WITHOUT CONTRAST- Incomplete extra-articular stress fracture involving the medial tibial cortex with intense associated paraosseous edema.

DEXA SCAN-

Lumbar Spine BMD: 0.857; T-score: -1.7; Z-SCORE: -1.7

Left Hip (Total) BMD: 0.826; T-score: -1.0; Z-SCORE: -0.9

Left Hip (Femoral Neck) BMD: 0.634; T-score: -1.9; Z-SCORE: -1.8

FINAL WORKING DIAGNOSIS: Bilateral lower extremity stress fractures presumed to be secondary to prolonged PPI usage

TREATMENT AND OUTCOMES: The patient was referred to rheumatology. She used a wheelchair for 3 weeks, and progressed to crutches with toe touch weight bearing. She transitioned to full weight bearing at 7 weeks. Her knee pain flared up, and a CT scan was ordered to evaluate for non-union. The CT showed healing of the bone, and her pain improved. She later moved away and was lost to follow-up.

1292 June 1 8:40 AM - 9:00 AM
Posterior Knee Pain in a Cyclist

Allison Schafer. UCONN, Hartford, CT. (Sponsor: Jeffery Anderson, M.D., FACSM)
 (No relationships reported)

HISTORY: A 51-year-old avid female cyclist presents with a 1.5 year history of right posterior knee and leg pain. This pain started following a hyper-extension type injury after a fall down multiple steps. Prior to being evaluated in our clinic a MRI was done showing a low-grade gastrocnemius strain and the patient completed physical therapy reporting 90% improvement in her pain. Unfortunately, her knee pain returned and

was easily aggravated by climbing steps and walking. At this time she was sent for an ultrasound guided injection of her distal hamstring. Initial anesthetic provided relief however, over the next few months her pain returned and localized over her distal hamstring. Another ultrasound guided injection of the semi-tendinosus sheath was ordered. Again, she experienced only temporary relief. Given her persistent pain she was referred to an orthopedic office for further evaluation. At this time her pain had become more localized to her posterior knee and was described as deep pain radiating anteriorly to her pes anserine.

PHYSICAL EXAM: Examination of the right knee was without effusion or erythema. There was considerable tenderness along the posterior proximal gastrocnemius and distal hamstring along with the pes anserine. There was no joint line tenderness. Full range of motion from 0 to 130 degrees of flexion. Special testing including Lachman, McMurray, varus and valgus stress was negative.

DIFFERENTIAL DIAGNOSIS: Distal hamstring tear, proximal gastrocnemius tear, medial collateral ligament injury, medial meniscus injury, pes anserine bursitis

TESTING/RESULTS:

-At her initial visit a repeat MRI was ordered. This showed progression of a partial tear of the medial gastrocnemius with multiple intramural cysts and a small Baker's cyst.

FINAL WORKING DIAGNOSIS: Gastrocnemius tear

TREATMENT AND OUTCOMES:

-After the new MRI showed a worsening intramural gastrocnemius tear with multiple cysts it was concluded that her pain was generated from this location deep within her posterior knee.

-She was referred to interventional radiology for a therapeutic corticosteroid injection

-Patient continues to attend spin class throughout this work up and will follow-up in clinic after the injection with interventional radiology.

1293 June 1 9:00 AM - 9:20 AM

Acute Knee Pain in a Professional Baseball Player

Ryan C. Wennell. Wellspan York Hospital, Red Lion, PA.
 (Sponsor: Mark Lavallee, MD, FACSM)

(No relationships reported)

32 year old AA professional baseball player who hit the ball and ran towards first base. As he decelerated to touch first base, he felt his knee buckle and fell face first to the ground. He proceeded to hop on one foot around the bases as he was unable to bear weight on the affected limb. **History:** Patient is healthy other than ADHD on Adderall. No history of steroid or antibiotic usage. No surgery to affect leg. **Physical Exam:** Significant swelling and edema in the right knee compared to the contralateral side. Both his thigh compartments as well as his calf compartments were soft. There was a palpable defect directly inferior to the patella. Inability to extend knee or do straight leg raise. Ligaments were intact with good endpoints. He had 5/5 strength in dorsiflexion, plantar flexion as well as his EHL. He had 2+ dorsalis pedis and posterior tibial pulses and sensation were intact throughout the L3-S1 dermatomes. Unable to ambulate. **Broad Diagnosis:** ACL rupture, quadriceps tendon tear, patellar tendon repair, meniscal tear, collateral ligament tear, muscular strain (grade I or II), patellar subluxation/ dislocation, fracture of the patella, severe patellar tendinosis, acute sickle cell crisis, gouty arthritis, septic joint. **Studies:** Three radiographs of the right knee do not demonstrate any fracture of dislocation. There is a notable patellar alta. **Contralateral side intrasubstance calcific tendinosis.** **Consultations:** orthopedic surgery **Working Diagnosis:** Complete rupture of the right patellar tendon from anterior pole of the patella. The left knee exhibited intrasubstance patella tendinosis **Treatment:** Repair of acute right patellar tendon rupture **Outcome:** Acute inpatient rehabilitation with transition to home rehab. Expect 6-12 months to full recovery. **Author's Comments:** The question for debate is in the follow-up... This case entails a common injury with uncommon presentation. In this case, the baseball athlete was healthy without prodrome complaints when he ruptured his patellar tendon during eccentric loading as he decelerated towards first base. His sport, as well as, his lack of prodrome complaints makes this case unique. Given that the patient has tendinosis on the other side the question remains if he requires therapies given it has now been identified that he is at risk for future injury.

1294 June 1 9:20 AM - 9:40 AM

Complicated Synovial Cyst Tibiofibular Joint - Squash

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(No relationships reported)

HISTORY: A 47-year old male veteran squash player presented with intermittent left knee pain and swelling below the knee joint. He also complained of back pain and reduced sensation in his left foot. He had no history of trauma and has been treated for gout for 5 months prior to consultation.

PHYSICAL EXAMINATION: He had tenderness on his medial joint line and 3 separate masses on the lateral aspect of his lower leg. The masses were soft, compressible and not tender to the touch. He also had reduced sensation in the L5 distribution, but no weakness of ankle dorsiflexion, toe extension or ankle eversion.

DIFFERENTIAL DIAGNOSIS: 1. Space occupying lesion (Benign, malignant) 2. Nodule (Gout, Rheumatoid arthritis) 3. Common peroneal nerve involvement vs L5 radiculopathy
TEST AND RESULTS: Blood investigations: Uric acid 0.33 mmol/l (previously elevated at 0.59 mmol/l). Rheumatoid Factor was negative. *Anti-citrullinated protein antibodies* was negative. Imaging: *Ultrasound lower leg:* Anterior proximal in the left lower leg a cyst of 44.5 X19.9 mm. A second synovial cyst of 59.8 x 26 mm and a third synovial cyst measuring 17.5 x 5.4 mm were also visualised. All cysts were connected with small tracts. *X-rays of the knee:* Narrowed medial tibiofemoral joint space. Erosions of the tibiofibular (TF) joint. *X-rays lumbar:* L4-S1 disc spaces narrowed. Grade 1 degenerative anterolisthesis of L4 in relation to L5. *MRI lower leg:* Cysts not in relation to peroneal nerve, well circumscribed, homogenous content with pressure effect on muscles. Intra-osseous cysts TF joint. *MRI lumbar:* Confirmed listhesis identified on X-ray. Paravertebral joint osteo-arthritis (OA) L4,5 with degenerative cyst lateral recess of L5 and pressure effect on left L5 root.
FINAL WORKING DIAGNOSIS: 1. Multi-locular synovial cyst TF joint ± peroneal nerve involvement 2. Gout 3. L5 facet joint OA with nerve root radiculopathy
TREATMENT AND OUTCOMES: This was the patient's first consultation. Keeping the possible double pathology in mind (i.e. L5 root pressure and/or peroneal nerve involvement) an EMG will shed more light on future treatment. Surgical excision of the cyst will probably be needed. In the mean time gout treatment was continued. Conservative management and re-assessment of the lumbar pathology were advised.

1295 June 1 9:40 AM - 10:00 AM
Hyperextension Knee Injury in College Football Player
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 (No relationships reported)

HISTORY: A 19-year-old college football player sustained a right knee hyperextension injury after taking a direct blow to the anterior knee. Mechanism concerning for a multi-ligament knee injury, though no reduction required on field. On field eval with R foot paresthesia, intact distal pulses and MCL/PCL laxity. He was transported to the local ED emergently by ambulance for further evaluation. In ED, noted significant pain and swelling. Motor/sensory findings in peroneal nerve distribution improved en route. However, his R DP/PT pulses were non-palpable and distant on Doppler. No coolness on palpation of RLE on initial eval in ED. ABIs and a CTA ordered for further work up. **PHYSICAL EXAMINATION:** -Swelling of the thigh, anterior compartments firm but compressible, LE compartments soft, nontender, compressible, no pain with passive ankle ROM -Large effusion -Diffusely TTP -Guarding with Lachmans test, too painful for detailed ligament exam-Sensation intact to light touch in tibial, saphenous, sural, superficial/deep peroneal nerve distributions -5/5 ankle plantar/dorsiflexion, great toe flex/extension -DP/PT pulses not palpable, faint on doppler -Toes cool, sluggish cap refill. **DIFFERENTIAL DIAGNOSIS:** 1. Knee Dislocation: Multi-ligamentous Injury. 2. Popliteal Artery Injury. 3. Common Peroneal Nerve Injury. 4. Fracture. **TEST/RESULTS:** 1. ABIs: Right Brachial Press 155; Ankle PT Press 114, Index 0.74; Ankle DP Press 114, Index 0.63. 2. XR: Moderate knee joint effusion with fluid-fluid level. Concerning for occult fracture, although no fracture identified. Normal alignment. 3. CTA: 5 cm segment of popliteal artery occlusion. Mildly depressed R anterolateral tibial plateau fracture. Vastus intermedius intramuscular hematoma. **FINAL DIAGNOSIS:** Right Popliteal Artery Occlusion. **TREATMENT AND OUTCOMES:** 1. Heparin Drip started for therapeutic anticoagulation. 2. Urgently sent to operating room for popliteal exploration. 3. Right fem-pop artery bypass using contralateral great saphenous vein. 4. Right lower extremity 4-compartment fasciotomy. 5. Ligamentous repair of knee planned 4-6 weeks post vascular repair.

C-18 Clinical Case Slide - Medical Issues I
 Thursday, June 1, 2017, 8:00 AM - 9:40 AM
 Room: 402

1296 **Chair:** Steven D. Stovitz, FACSMM. *University of Minnesota, Minneapolis, MN.*
 (No relationships reported)

1297 **Discussant:** Kathryn E. Ackerman, FACSMM. *Children's Hospital Boston, Cambridge, MA.*
 (No relationships reported)

1298 **Discussant:** John Mark MacKnight, FACSMM. *University of Virginia, Charlottesville, VA.*
 (No relationships reported)

1299 June 1 8:00 AM - 8:20 AM
Parkinson's Disease: Eccentric Training To Reduce Symptoms
 Jeffrey A. Bauer, Irena Vincent, Philip J. Buckenmeyer, Mark Sutherland, Erik Lind, Kevin Dames, Alexander Generali, Brandon Schrom, Maura Mills. *SUNY Cortland, Cortland, NY.*
 Email: jeff.bauer@cortland.edu
 (No relationships reported)

HISTORY:
 A 46 year old female, mother of two, had begun experiencing motor and sensory changes a few years earlier. These included unbalanced gait, a slight left-hand tremor with reduced and slower range of motion, a loss of smell, and excess saliva accumulation. A life-long athlete and otherwise healthy, she sought medical help as she did not attribute her difficulties to aging.
PHYSICAL EXAMINATION:
 Along with self-reported symptoms, a physical examination identified left-sided bradykinesia and rigidity and mask-like facial appearance. An MRI ruled out a brain tumor, and a diagnosis of Parkinson's disease (PD) was made and subsequently confirmed by a second source.
DIFFERENTIAL DIAGNOSIS:
 1. Motor/Neurological impairment
 2. PD

TEST AND RESULTS:
 The study examined the effects of eccentric lower body exercise on PD symptoms. During exercise, the participant stood upright on a solid platform that moved in an elliptical path in the sagittal plane while she absorbed all motion with the lower extremities. She completed two training phases: Phase 1 biweekly exercise for six weeks and Phase 2 once-a-week exercise for eleven weeks at higher workload intensity. All sessions consisted of three 45-second exercise bouts at an RPE of ~13 with two minutes of standing rest. Biomechanical and physiological data were recorded pre- and post-exercise during each session, and speech data five times throughout the study. Over the course of the study gait values showed improvement: gait speed (+6.9%), step duration L (-4.1%), step duration R (-3.6%), stride length L (1.8%), and stride length R (3.1%). Heart rate and blood pressure increased from rest to exercise but did not differ as a function of exercise workload. Surprisingly, RPE was lower (-11.9%) during Phase 2 than Phase 1 despite higher workloads. Speech data revealed adequate intelligibility and articulation precision as well as steady voice free of tremor. Speech rate and voice pitch and loudness ranges were mildly reduced.
FINAL/WORKING DIAGNOSIS:
 PD with improved gross motor function
TREATMENT AND OUTCOMES:
 1. Continued eccentric lower body training
 2. Expansion and increase intensity of physical activities
 3. Continued monitoring of functional parameters
 4. Reduction in prescription use of Sinemet

1300 June 1 8:20 AM - 8:40 AM
Alcohol Addiction - Improving Brain Oxygenation and Cognition Through a Three-Month Running Program
 Daniel A. Cabral, Kell G. Costa, Adolfo M. Costa, Alexandre H. Okano, Hassan M. Elsangdy, Vanessa P. Rachetti, Eduardo B. Fontes. *Federal University of Rio Grande do Norte, NATAL, Brazil.*
 Email: daniel_aranha13@hotmail.com
 (No relationships reported)

HISTORY: A 46-year-old male psychiatric Hospital patient, having 33 years of alcohol alcohol dependence with more than 20 hospitalizations was selected. According to the DSM-V, the patient had a chronic disorder related to alcohol consumption. In addition, he scored 37 on ASSIST questionnaire which recommends a severe therapeutic intervention.
PHYSICAL EXAMINATION: The volunteer performed psychosocial questionnaires, fitness and cognitive tests (stroop), and had pre-frontal cortex oxygenation and heart rate variability measurements pre- and post-running program.
DIFFERENTIAL DIAGNOSES:
 1. Impaired cognition
 2. Decreased function of the autonomic nervous system
 3. Impaired quality of life and sleep
 4. Decreased pre-frontal cortex oxygenation
TEST AND RESULTS
 Low prefrontal cortex oxygenation during rest and exercise
 - Low reaction time during cognitive test
 - High sympathetic activation
FINAL/WORKING DIAGNOSES
 Severe alcoholic dependence with lack of executive functions, autonomic nervous system dysfunction and pre-frontal cortex damage.

TREATMENT AND OUTCOMES

1. Running program with three sessions per week during three months. In the first week, the volunteer ran from two to five minutes. The volume of exercising minutes was increased by two to four minutes every week.
2. Resistance training in the first half of the program.
3. The patient increased his running time by 260% and his VO₂max by 24%.
4. His sleep quality improved 31% and his anxiety, stress and depression levels decreased by 37%, 78% and 50%, respectively.
5. On the quality of life questionnaire, the subject improved his psychological and social domains by 200% and 6570%, respectively, and his general quality of life by 183%.
6. His reaction time during the cognitive test decreased 23%, and the number of correct answers increased 8% at rest and 266% during exercise.
7. His R-R interval increased by 33% and 31% both at rest and during exercise, respectively; also, parasympathetic control measured by the RMSSD increased by 132% at rest and by 145% during exercise.
8. An increase in the pre-frontal cortex oxygenation during exercise was found, being 921% in ventilatory threshold, 604% in respiratory compensation point and 76% in VO₂peak.
9. The need for therapeutic intervention decreased from severe to moderate.

1301 June 1 8:40 AM - 9:00 AM

Lower Extremity Rash - Soccer

Ryan Matthiesen DO, Jennifer Mitchell MD, Jordan McDermott ATC. *Texas Tech University, Lubbock, TX.*
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(No relationships reported)

History: 19-year-old Caucasian college soccer player complained to her athletic trainer of a bilateral lower leg rash that was painful when putting on her shin guards. During the prior week, multiple 2-4cm in diameter lesions had appeared on both of her legs from her knees down to her ankles. The lesions began as a faint red color and were asymptomatic, but as time went on became a darker red and in some instances purple in color, as well as becoming slightly raised and tender to the touch. The patient denied any recent new exposures or recent travel, but did report that 2 months prior over summer break she had experienced several weeks of pharyngitis like symptoms along with fever, fatigue, and cervical lymphadenopathy. The patient was empirically treated for presumed strep pharyngitis. No laboratory evaluation was performed at the time of treatment for the pharyngitis.

PMH: uncomplicated

Meds: OCP

NKDA

Physical Examination: Lower Extremities: multiple nodular lesions varying, in color from faint red to dark red to a light purple [photo documentation is available]; they ranged from just proximal to her knees to her ankles bilaterally; warm, palpable and tender to the touch. Lower extremity strength was 5/5 bilaterally, sensation to light touch was intact and equal, pulses present and equal bilaterally.

Differential Diagnosis:

1. Nodular Vasculitis
2. Erythema Mutiforme
3. Superficial Thrombophlebitis
4. Subcutaneous Bacterial Infection
5. Sarcoidosis

Test and Results:

CBC -

WBC: 10.0

Hemoglobin: 12.2

Hct: 35.8

• CRP: 11

• ASO titer: 423

• Epstein Barr VCA IgM: Positive

• Epstein Barr VCA IgG: Positive

Final/Working Diagnosis:

1. Erythema Nodosum secondary to recent mononucleosis and/or streptococcal pharyngitis

Treatment and Outcomes:

1. Pre-game NSAID administration and post-game ice bath for pain control
2. Protection of area with shin guards
3. Close monitoring of lesions for resolution to assure no other testing needed to look for source other than recent pharyngitis infection
4. Patient continued to play with moderate discomfort during contact with shins. Over an 8-week period of observation, the lesions decreased in number and tenderness, but a few non-tender palpable lesions remained through the end of season at 5 months since the original illness.

1302 June 1 9:00 AM - 9:20 AM

Hepatotoxicity Associated With Frozen Shoulder In A 47 Year Old Tennis Player; What's The Link?

Michael J. Murphy, Brian Keisler. *Palmetto Health Richland - University of South Carolina, Columbia, SC.*

(No relationships reported)

HISTORY: A 47 year-old female recreational tennis player with no past medical history presented with 4 months of increasing shoulder pain and stiffness. She was diagnosed with adhesive capsulitis and started on diclofenac sodium 75mg BID. Over the next month she started having abdominal pain and stopped taking diclofenac. Her pain continued to worsen and she developed intractable vomiting and jaundice and went to the hospital at that time.

PHYSICAL EXAMINATION: Alert and oriented. Scleral icterus and jaundice present. No spider telangiectasias or angiomas. No JVD. Lungs were clear. Heart regular rate and rhythm, no murmur, rub, or gallop. Abdomen soft with minimal RUQ tenderness and no ascites. Right shoulder with full ROM and normal strength. Left shoulder had severely restricted ROM in all directions with significant pain. Her neurologic exam was normal including no asterixis.

DIFFERENTIAL DIAGNOSIS: Primary Biliary Sclerosis, Viral Hepatitis, Wilson's Disease, Hemochromatosis, Medication Hepatotoxicity, Malignancy, Autoimmune Hepatitis, α_1 -Antitrypsin Deficiency, Porphyria, Granulomatous Liver Disease, Idiopathic Portal Fibrosis

TEST AND RESULTS: Bilirubin 24.4 (Direct 20.3), AST 650, ALT 859. Lipase, iron studies, ceruloplasmin, IgG, IgA, IgM, ANA, viral hepatitis panel, PT, INR, CBC, chem-7, alkaline phosphatase, and total protein all within normal limits. PPD negative. RUQ US: cholelithiasis without evidence of cholecystitis. CT Abdomen/pelvis with contrast: hepatosplenomegaly without any masses or ascites.

FINAL WORKING DIAGNOSIS: Diclofenac induced hepatotoxicity

TREATMENT AND OUTCOMES: 1. Cessation of diclofenac. 2. In addition to inpatient GI consult and outpatient follow up, she also saw hepatology who agreed with diagnosis and treatment. 3. Initially followed LFT's daily, which was spaced to bi-weekly at discharge and continued to be spaced as she improved. Her transaminases decreased and normalized within a week. Her bilirubin increased to 30.6, and then gradually decreased until normalizing 8 months later. 4. Her adhesive capsulitis gradually improved, although she continued to have decreased ROM at last follow up which continued to restrict her ability to play tennis. 5. NSAIDs are now completely contraindicated for her. 6. She has annual follow up with GI for labs.

1303 June 1 9:20 AM - 9:40 AM

Pancreatic Cancer - Preoperative Exercise During Neoadjuvant Treatment

Nicole L. Klochak, Rebecca A. Ruiz, Ryan J. Marker, John C. Peters, W. Thomas Purcell, Catherine M. Jankowski. *University Of Colorado Anschutz Medical Campus, Aurora, CO.* (Sponsor: Catherine M. Jankowski, FACS)

Email: nicole.klochak@ucdenver.edu

(No relationships reported)

HISTORY: Neoadjuvant chemotherapy and radiation (NEO) is prescribed to patients with borderline-resectable pancreatic cancer prior to tumor resection to improve postoperative outcomes. Physical fitness and muscle mass are positively associated with improved postoperative outcomes, but are decreased during NEO. Exercise during NEO may counteract these changes. The patient, a 70 year old male who engaged in regular exercise, was diagnosed with borderline-resectable pancreatic adenocarcinoma. He reported an approximate 8kg weight loss and declining fitness prior to diagnosis. He received two months of NEO (four cycles of FOLFIRINOX and five treatments of stereotactic body radiation therapy) during which he participated in a supervised exercise program, prior to an open Whipple procedure.

PHYSICAL EXAMINATION: The patient performed a series of physical function tests and body composition (total, fat, and lean tissue mass) was measured with dual-energy x-ray absorptiometry. Assessments were at baseline (Base), preoperative (PreOp; 17 weeks after Base), and six weeks after hospital discharge (PostOp).

DIFFERENTIAL DIAGNOSIS: General muscle wasting and weakness associated with pancreatic cancer.

TEST AND RESULTS:

- 400 m Walk Test (s) - Base: 211, PreOp: 188, PostOp: 195

- Grip Strength (kg) - Base: 45, PreOp: 46, PostOp: 44

- 30 s Sit-to-Stand (reps) - Base: 13, PreOp: 20, PostOp: 14

- Total Body Mass (kg) - Base: 64, PreOp: 72, PostOp: 65

- Total Lean Mass (kg) - Base: 50, PreOp: 57, PostOp: 51

FINAL WORKING DIAGNOSIS: General muscle wasting and weakness associated with pancreatic cancer.

TREATMENT AND OUTCOMES: The patient attended 28, hour-long, supervised exercise sessions during NEO. Each session consisted of a 10-min warmup followed by aerobic, resistance, and flexibility exercises. Intensity was progressed or regressed when ability was impacted by training, chemotherapy, or radiation. All physical

function measures were improved at PreOp. The patient gained 8 kg of body mass including 7 kg of lean mass. All measures decreased from PreOp to PostOp, but most were slightly improved from Base. There were no adverse events related to exercise. Supervised, mixed modal exercise during NEO did not prevent postoperative changes in function and lean mass but was protective against further declines in these outcomes.

C-19 Clinical Case Slide - Wrist and Hand

Thursday, June 1, 2017, 8:00 AM - 9:40 AM
Room: 504

1304 **Chair:** Suzanne S. Hecht, FACSM. *University of Minnesota, Minneapolis, MN.*

(No relationships reported)

1305 **Discussant:** Hallie Labrador. *NorthShore University HealthSystem, Chicago, IL.*

(No relationships reported)

1306 **Discussant:** Brian A. Davis, FACSM. *University of California-Davis, Sacramento, CA.*

(No relationships reported)

1307 June 1 8:00 AM - 8:20 AM
Finger Injury-Flag Football

Leon M. Bathini Jr¹, Inola Mello¹, Jeff Paxton¹, Karl Pankratz².
¹Texas Tech University Health Sciences Center, Lubbock, TX.
²Covenant Medical Center, Lubbock, TX.
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(No relationships reported)

HISTORY: A 24 yo M law student was playing intramural flag football and sustained a finger injury. He was attempting to grab the flag of an opposing player when the patient accidentally collided with him and landed on him. Patient does not recall the specifics of the injury mechanism. After the injury, he had pain along his entire ring finger and especially over the distal phalanx. He also has swelling over his ring finger. He has not been able to flex his L ring finger normally. He iced it and was seen in clinic the next day and took Tylenol and Ibuprofen for pain.

PMH: L ring metacarpal fracture otherwise uncomplicated

PHYSICAL EXAM:

Musculoskeletal: L hand-> Mild swelling over the ring finger with more swelling over the volar proximal phalanx. No bruising. TTP over the volar aspect of the distal proximal phalanx and proximal aspect of the distal phalanx. Loss of active flexion at the DIP joint of the ring finger when making a fist. Intact passive flexion and extension at the DIP joint. Normal sensation and good perfusion

DIFFERENTIAL DIAGNOSIS:

- Flexor digitorum profundus rupture
- Flexor digitorum superficialis rupture
- Phalanx fracture
- Phalanx subluxation
- Volar plate disruption

TEST AND RESULTS

X-ray L hand: Irregularity of the neck of the proximal phalanx of the ring finger along the ventral aspect. Soft tissue swelling about the finger more pronounced in the proximal phalanx.

Ultrasound of L ring finger: tear of the flexor digitorum profundus over the distal proximal phalanx (images available)

FINAL WORKING DIAGNOSIS:

Zone 1 flexor digitorum profundus rupture of L ring finger

TREATMENT AND OUTCOMES:

1. Prompt referral for hand surgery for repair to prevent retraction of the tendon, muscle contracture and permanent finger dysfunction
2. RICE treatment and splinted ring finger in slightly flexed position
3. Successful surgical retraction of flexor digitorum profundus tendon
4. Hand physical therapy starting with passive ROM and then strengthening exercises

1308 June 1 8:20 AM - 8:40 AM

Chronic Hand Deformity in a Boxer

Clark Madsen, Joshua Goldman. *UCLA, Los Angeles, CA.*
Email: cmadsen@mednet.ucla.edu

(No relationships reported)

History:

A right-handed 27 year old former boxer presented with a chronic deformity of his right 3rd finger noting that it does not straighten correctly. He has had 3 previous fractures in the right hand from boxing-related injuries. The most recent fracture was 10 years ago after hitting a TV. He denies any recent hand trauma. He presents with pain over the dorsum of the 3rd finger, worsened with gripping and extensive use of the hand. No numbness or tingling.

Physical Examination:

Examination showed an ulnar deviated 3rd finger in extension that resolved with flexion. No rotation deformity or extension deficit seen. The contour of the patient's third knuckle is flattened in flexion. Normal range of motion and strength in all fingers. No laxity noted with medial and lateral stresses. Non-tender throughout.

Differential Diagnosis:

- 1.Sagittal band disruption
- 2.Metacarpophalangeal joint collateral ligament injury
- 3.Juncture tendinosis
- 4.Central slip rupture of extensor tendon
- 5.Previous metacarpal fracture with malunion

Tests and Results:

X-ray series right hand (3 views)

-Normal read

MRI right hand

-Chronic sagittal band disruption at the third MCP with subluxation in the ulnar direction. Extensor tendon is grossly intact.

Final Working Diagnosis

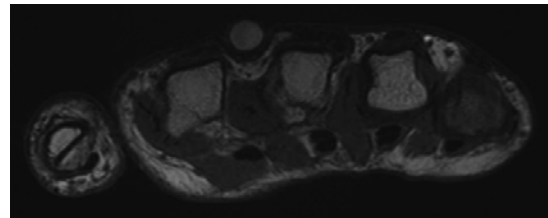
Traumatic sagittal band disruption (Boxer's Knuckle)

Treatment and Outcomes

-The patient underwent surgical reconstruction of his sagittal band and realignment of the extensor tendon. Due to attenuation of the chronic rupture a tendon graft was created from the extensor digitorum communis.

-Patient was subsequently placed in a short arm splint.

-Good functional and cosmetic improvement to date



1309 June 1 8:40 AM - 9:00 AM

Wrist Injury - Go karting

Jonathan T. Napolitano, Anastasia Fischer, FACSM. *Nationwide Children's Hospital, Columbus, OH.*

(No relationships reported)

HISTORY: A 15 year old right handed female basketball player presented to the sports medicine clinic of a pediatric hospital four months after a go-karting accident. The go-kart rolled and landed on her right wrist. With no significant pain or disability after the injury she did not seek immediate medical attention. Four months later she presented with increased pain and swelling in the wrist. She was immobilized with a cock-up splint and instructed to follow up after further imaging and occupational therapy. Her pain improved with bracing and she was lost to follow-up, attending only one occupational therapy visit. She presented again eight months later with improved pain and swelling but severe loss of range of motion. **PHYSICAL EXAMINATION:** Inspection of the right upper extremity revealed atrophy of right forearm, wrist, and hand, and a volar angular deformity of the wrist. No tenderness to palpation. Active and passive range of motion was severely limited in all directions. No soft tissue swelling or effusion. No temperature or skin texture changes. **DIFFERENTIAL DIAGNOSIS:** Post-traumatic arthritis, complex regional pain syndrome, juvenile idiopathic arthritis. **TEST AND RESULTS:** X-ray attached. MRI: Diffuse infiltrative process suggestive of ongoing inflammatory process. 3 Phase Bone Scan: Increased uptake along the right wrist and carpal joints. Sedimentation Rate: 45mm/h. Anti-CCP: 160 U. Rheumatoid Factor: 250 IU/mL. X-Rays of bilateral elbows reveal possible joint effusions. Ankle x-ray with irregular dorsal contour of the navicular. **FINAL WORKING DIAGNOSIS:** Rheumatoid factor positive, polyarticular, juvenile idiopathic arthritis. **TREATMENT AND OUTCOMES:** The patient was referred to rheumatology for further workup and close follow-up, started on methotrexate,

etanercept, and prednisone, and subsequently referred to orthopedic surgery for evaluation for wrist fusion, and to physical and occupational therapy for joint range of motion and preservation.



1310 June 1 9:00 AM - 9:20 AM

Decreased Thumb Rom In A Soccer Player

Robert Bogart¹, Kathryn Vidlock, FACSM². ¹*Sky Ridge Medical Center, Lone Tree, CO.* ²*Colorado Orthopaedics, Lone Tree, CO.*
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(No relationships reported)

HISTORY: A 17-year-old male presented to the office c/o inability to extend thumb after experiencing a popping sensation earlier in the morning. Past history of falling on outstretched hand while playing soccer 5 weeks prior. X-rays of left wrist at that time demonstrated a mature skeleton with a nondisplaced distal radius fracture. Patient was placed in a cast and instructed to use sling as needed. 4 weeks s/p injury, the fracture was healed and patient exhibited full range of motion and strength on exam. Subsequently, he was allowed to return to activities as tolerated. 10 days later patient presented to the office with the inability to extend his thumb.

PHYSICAL EXAMINATION: No erythema, ecchymosis, edema or gross deformities. Non-tender to palpation along 1st MCP joint, thumb IP joint or along any carpal, metacarpal or phalangeal bony prominences. No palpable masses. Inability to actively initiate or maintain extension of the thumb at the MCP and IP joints. Full passive ROM of thumb. No laxity at MCP joint at 30 degrees of flexion.

DIFFERENTIAL DIAGNOSIS

1. Ruptured extensor pollicis longus tendon
2. Ulnar collateral ligament avulsion
3. Distal intersection tenosynovitis
4. Radial nerve neuropraxia/posterior interosseous syndrome
5. Stenosing tenosynovitis

TESTS AND RESULTS

Left wrist AP, lateral, oblique, scaphoid radiographs (initial):
-Fusion of the metaphyseal-epiphyseal junction without presence of growth plate
-Non-displaced fracture of the distal radius, with intraarticular extension involving the medial dorsal epiphysis without presence of step-off
Left wrist AP, lateral, oblique (final)
-Healed, non-displaced distal radius fracture
Ultrasound left dorsal wrist (s/p thumb weakness)
-Fluid filled 3rd compartment at the level of Lister's tubercle and intact EPL tendon distally
Left wrist MRI (s/p thumb weakness)
-Torn and retracted proximal EPL tendon
-Stump of tendon seen at the level of mid trapezium

FINAL/WORKING DIAGNOSIS

-Ruptured EPL tendon s/p non-displaced distal radius fracture

TREATMENT AND OUTCOMES

1. Patient underwent tendon transfer using EIN to EPL and is recovering.

1311 June 1 9:20 AM - 9:40 AM

Wrist Pain - Fish Cutter with Acute Joint Pain and Swelling

Lauren Nadkarni. *Maine Medical Center, Portland, ME.*
(Sponsor: Heather Gillespie, FACSM)

(No relationships reported)

History:

A 52 year old male smoker presents with 3 days of left wrist pain. His past medical history is significant for hypertension, hyperlipidemia, stroke, renal calculi, gout, ganglion cyst of his left wrist, previous left wrist sprains, and left wrist fracture resulting in prior surgery without hardware. Although he works as a fish cutter, he

denied any recent injuries or puncture wounds. He reports he had started wearing a wrist brace over the past 1-2 days due to swelling and pain, but this had not improved his symptoms. He reports some possible subjective chills, but denies fever.

Physical Exam:

Office examination of his left wrist revealed erythema, warmth, tenderness, and tense edema extending from the base of his fingers to his mid forearm with a 3 cm fluctuant area on his dorsal wrist, associated with low grade fever and tachycardia. Aside from a well healed scar on his posterior wrist, no other skin lesions were present. His wrist was tender to palpation and painful with movement in all directions. Active and passive range of motion were limited by pain and swelling in all directions. Distal neurovasculature was intact.

Differential diagnosis:

- Cellulitis
- Fasciitis
- Myositis
- Abscess
- Septic arthritis
- Gout
- Fracture/dislocation
- Tendonitis
- Ganglion cyst

Tests and results:

Left wrist x-ray:

- No acute fracture or dislocation
- Chronic deformity of ulnar styloid and persistent 5mm cyst within the lunate, unchanged from prior imaging

Left wrist arthrocentesis per hand surgery consultation:

- Monosodium urate crystals, no bacteria
- Other tests:
- Complete blood count - no leukocytosis
- Negative blood and synovial fluid cultures

Final/working diagnosis:

- Gout

Treatment and Outcomes:

- IV antibiotics and oral antibiotics for 48 hours
- Prednisone and ibuprofen for 5 days
- Pain and swelling significantly improved
- Did not initiate allopurinol/colchicine

C-30 Free Communication/Poster - ACL Injury

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1326 Board #1 June 1 8:00 AM - 9:30 AM

Impulsive Loading During Running Following Anterior Cruciate Ligament Reconstruction

Derek N. Pamukoff, Michael N. Vakula, Tyler J. Moffit, Kevin Choe, Melissa M. Montgomery. *California State University, Fullerton, Fullerton, CA.* (Sponsor: Lee E. Brown, FACSM)
(No relationships reported)

Individuals with anterior cruciate ligament reconstruction (ACL) are at greater risk for knee osteoarthritis due to aberrant walking biomechanics, but limited data are available on running gait. **PURPOSE:** To compare impulsive loading characteristics during running between the injured and uninjured limb of individuals with unilateral ACLR, and to a control limb. **METHODS:** 22 individuals with unilateral ACLR (age=22.3±3.3 years; body mass index=23.8±3.4; time since ACLR=44.9±22.8 months; 16 females; 13 patellar tendon; 6 hamstring tendon; 3 allograft) and 22 control participants without injury (age=22.6±3.1 years; body mass index=22.9±2.6; 16 females) participated in this study. Participants completed 5 running trials per limb in a random order at a self-selected speed while ground reaction force characteristics (peak impact force (PIF), average loading rate (ALR), and instantaneous loading rate (ILR)) were evaluated using a force plate. PIF, ALR, and ILR were normalized to body weight (BW) for analysis. Separate one-way ANCOVAs were used to compare each dependent variable between the injured, uninjured, and control limbs, using running speed as a covariate ($\alpha=0.05$). *Post hoc* comparisons were evaluated using a Bonferroni adjustment ($\alpha=0.017$). **RESULTS:** PIF ($F_{2,62}=4.55$, $p<0.01$) and ALR ($F_{2,62}=3.22$, $p=0.03$) differed between limbs, and a trend was observed towards a difference in ILR between limbs ($F_{2,62}=2.56$, $p=0.07$). *Post hoc* analyses indicated that PIF (1.84±0.48 vs. 1.45±0.34 BW, $p<0.01$), ALR (67.1±26.2 vs. 46.4±15.9 BW/sec, $p=0.01$), and ILR (90.2±18.8 vs. 73.2±16.9 BW/sec) were greater in the injured compared to control limb. PIF (1.68±0.44 vs. 1.45±0.34 BW, $p=0.01$) and ALR (60.6±25.7 vs. 46.4±15.9 BW/sec, $p=0.016$) were greater in the uninjured compared to the control limb. No differences were observed between the injured and uninjured limbs. **CONCLUSIONS:** Our findings indicate that the injured limb in individuals with unilateral ACLR experience greater PIF, ALR, and ILR compared to control limbs, and that the

uninjured limb also experiences greater PIF and ALR compared to control limbs. High loading rates and impact forces in individuals with ACLR may influence cartilage degradation, and should be considered a factor for knee osteoarthritis prevention.

1327 Board #2 June 1 8:00 AM - 9:30 AM
Aberrant Gait Biomechanics Are Not Associated with Aberrant Landing Biomechanics in Those with ACL Reconstruction

Steven Pfeiffer, Troy Blackburn, Brittney Luc-Harkey, Matthew Harkey, Laura Stanley, Stephen Marshall, Jeffrey Spang, Brian Pietrosimone, Darin Padua. *University of North Carolina at Chapel Hill, Chapel Hill, NC.*
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High knee joint loading during walking gait and jump-landing (JL) may influence the development of post-traumatic osteoarthritis (PTOA) and increase the risk of a second anterior cruciate ligament (ACL) injury, respectively, following anterior cruciate ligament reconstruction (ACLR). It remains unknown if individuals who demonstrate higher lower extremity loading during walking gait also demonstrate higher loading during JL. **PURPOSE:** To determine associations between peak vertical ground reaction force (vGRF) and vGRF instantaneous loading rate during walking gait and JL in individuals with an ACLR. Secondly, we sought to determine if limb symmetry indices (LSI = ACLR limb/uninvolved limb) for the kinetics variables associated between the gait and JL tasks. **METHODS:** Thirty-five individuals (74% female, 45.5±38 months post-ACLR, 22.1±3.4 years old, 169.4±10.8 cm, 73.4±17.9kg) with a unilateral ACLR were recruited for this cross-sectional study. Participants performed 5-trials of self-selected walking gait (over 6m walkway) and JL (30 cm box placed 50% of height from force plates), respectively. Kinetics were extracted from the first 50% of the stance phase of walking gait and the first 100ms of landing for JL. Pearson product-moment (r) and Spearman's Rho (ρ) analyses were used to determine associations between the same outcome measures collected during walking gait and JL. Significance was set *a priori* at $P \leq 0.05$. **RESULTS:** Greater vGRF instantaneous loading rate during gait (51.27±12.56% bodyweight per second (BW/s)) associated with greater vGRF instantaneous loading rate during JL (180.12±119.27 BW/s; $\rho=0.389$, $P=0.021$) in the uninvolved limb. All other associations between walking gait and JL kinetics and LSI were negligible (range $\rho = -0.289$ to 0.209) and non-significant. **CONCLUSION:** No systematic associations were found between gait and JL kinetics for either limb or LSI's in people with unilateral ACLR. Individuals who demonstrate high or low loading during dynamic activities may not be the same people that demonstrate high or low magnitude loading during gait. Therefore, individuals who may be at risk for PTOA onset, due to aberrant repetitive lower extremity loading, may not be the same people who are at risk for a second ACL injury, which is more likely to occur during a dynamic movement.

1328 Board #3 June 1 8:00 AM - 9:30 AM
Quadriceps Function is Associated with Running Kinetics Post Anterior Cruciate Ligament Reconstruction

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 (No relationships reported)

PURPOSE: Individuals with anterior cruciate ligament reconstruction (ACLR) are at greater risk for knee osteoarthritis (KOA), partially due to chronic quadriceps dysfunction. Impaired quadriceps function contributes to higher loading rates during gait, and may exacerbate cartilage breakdown. The purpose of this study was to examine the association between indices of quadriceps function and ground reaction forces (GRF) characteristics linked to KOA development during running in individuals with ACLR.

METHODS: Quadriceps function and running biomechanics were assessed in 20 individuals (5 M, 15 F) with unilateral ACLR (age=22.3±3.3 years, height=1.73±0.09m; mass=71.8±15.3kg). Indices of quadriceps function included isometric peak torque (PT) and rate of torque development (RTD), and isokinetic peak torque measured at 180°/s and 240°/s. Kinetic data included peak vertical impact force (PIF), average vertical loading rate (ALR), and instantaneous vertical loading rate (ILR) acquired from the ACLR limb while running at a self-selected pace. Partial correlations were used to assess the relationship between quadriceps function and running kinetics after accounting for self-selected running speed.

RESULTS: Quadriceps RTD was negatively correlated with PIF ($r=-0.40$, $p=0.04$) and ALR ($r=-0.48$, $p=0.03$). A trend was observed between quadriceps RTD and ILR ($r=-0.36$, $p=0.07$). Neither isometric PT nor isokinetic PT at 180°/second or 240°/second were associated with any running biomechanics variable.

CONCLUSIONS: Slower quadriceps RTD were associated with larger PIF and ALR during running. The ability of the quadriceps to generate rapid force prior to heel contact is necessary for GRF attenuation during gait. Since larger PIF and ALR have

been linked to cartilage degradation in individuals with knee pathologies, the current results emphasize the role of quadriceps dysfunction in KOA development following ACLR. Improving quadriceps RTD may reduce loading characteristics that negatively influence cartilage health.

1329 Board #4 June 1 8:00 AM - 9:30 AM
Objectively Measured Physical Activity in Patients after ACL Reconstruction

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Return to a healthy level of physical activity is a common clinical goal for patients recovering from anterior cruciate ligament reconstruction (ACLR). Objective measures of physical activity may provide useful information regarding achievement of rehabilitation goals in patients with ACLR. **PURPOSE:** To investigate differences in the average minutes per day (min/day) spent in moderate-to-vigorous physical activity (MVPA) as well as the total number of steps per day (steps/day) between individuals with ACLR and matched controls. A second purpose was to investigate relationships between MVPA and steps/day subjective activity scales Tegner and Marx activity scales. **METHODS:** Physical activity was assessed using ActiGraph accelerometers in 33 participants (22 females; 20.3±1.8 years; 171.8±10.5cm; 69.9±11.3kg; 27.8±17.5 months from surgery) with a history of primary unilateral or bilateral ACLR as well as 33 healthy controls (CON) (20.8±1.6 years; 172.9±8.5cm; 70.2±13.5kg) (matched on age, sex, and Tegner activity level). Participants wore the accelerometer for 7 consecutive days and completed the IKDC 2000 subjective form and the Tegner and Marx activity scales. Independent t-tests were used to examine between group differences. Bivariate correlation coefficients were calculated between objective and subjective activity levels. **RESULTS:** Patients with ACLR participated in less MVPA per day (ACLR: 78.3±26.6 min/day; CON: 94.2±26.6 min/day; $P=0.02$) and less steps/day (ACLR: 7,982±3,020 steps/day; CON: 9,945±2,885 steps/day; $P=0.02$) compared to healthy matched controls. Only 25% of participants with ACLR met the 10,000 steps/day guidelines compared to 42% of controls. However, Marx (ACLR: 10.2±4.8; CON: 10.8±3.8; $P=0.63$) and Tegner (ACLR: 6.2±2.1; CON: 6.7±1.7; $P=0.11$) activity levels did not differ between groups. No relationships were observed between objectively measured physical activity and scale measures ($P>0.05$). **CONCLUSIONS:** Patients with ACLR accumulate less MVPA and fewer steps/day compared to highly matched controls despite reporting similar subjective activity levels. These findings highlight the importance of objective monitoring of physical activity level following return to activity due to the potential risk associated with reduced levels of physical activity.

1330 Board #5 June 1 8:00 AM - 9:30 AM
Hop Distance Symmetry Does Not Reflect Biomechanical Symmetry in Adolescents Post-ACL Reconstruction

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PURPOSE: To assess symmetry and biomechanics of young athletes with anterior cruciate ligament reconstruction (ACLR) during a single-leg hop. **METHODS:** 39 patients with unilateral ACLR (62% female; age 13-18 years; 5-12 months post-surgery) and 29 controls (58% female) performed a single-leg hop for distance and were classified as asymmetric if hop distance on the operative or control limb with the shorter distance was <90% of the contralateral limb. Lower extremity landing biomechanics were compared among operative, non-operative and control limbs. **RESULTS:** 10/29 controls (34%) and 12/39 patients (31%) were classified as asymmetric. Asymmetric patients hopped a shorter distance on the operative side compared with non-operative and symmetric control limbs (op: 1.3 leg lengths, non-op and control: 1.6 LL, $p \leq 0.04$). Symmetric patients tended to hop a shorter distance on both sides (1.4 LL, $p=0.17$) with lower peak ground reaction force (op and non-op: 2.8 body weights; control: 3.1 BW, $p < 0.10$). Compared to controls, asymmetric patients landed more plantarflexed (op: -18°, control: -2°, $p=0.002$) with greater pelvic drop (op: -13°, control: -10°, $p=0.06$) and less knee varus (op: 0°, control: 3°, $p=0.05$). Operative limbs had lower knee flexion moments ($p=0.004$) and greater power absorption at the ankle ($p=0.05$) with a trend of higher dorsiflexion moments ($p=0.08$). Symmetric patients had greater bilateral hip flexion compared with controls

(op: 71°, non-op: 68°, control: 55°, $p \leq 0.001$) and less varus at initial contact on the operative side (op: 1°, control: 3°, $p = 0.03$). This resulted in higher hip flexion moments ($p \leq 0.002$) and power absorption ($p \leq 0.02$) and lower knee valgus moments on both sides compared with controls, as well as lower knee flexion moments on the operative side ($p < 0.001$). **CONCLUSIONS:** A similar percentage of patients and controls were classified as asymmetric based on single-leg hop distance suggesting hop distance symmetry may not reflect single leg function and return to sport readiness. Both symmetric and asymmetric patients demonstrated biomechanical differences compared with controls but employed different movement strategies. Asymmetric patients offloaded the knee to the ankle, while symmetric patients offloaded the knee to the hip and decreased task performance on the non-operative side.

1331 Board #6 June 1 8:00 AM - 9:30 AM
Contribution of the Sensorimotor System to Landing Demand and Risk Factors For ACL Injury

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The sensorimotor system is known to be important for injury prevention, however, it is unknown how these characteristics contribute to known risk factors for ACL injury. **PURPOSE:** To examine the contribution of sensorimotor characteristics on landing biomechanics related to ACL injury and how they may change with task difficulty. **METHODS:** Fifty-three healthy females (Age: 23.2±4.3 years; Height: 166.6±7.5 cm; Mass: 65.0±9.5 kg) participated. Dominant knee proprioception and strength was assessed using threshold to detect passive motion (TTDPM), time to peak torque (TTPT), and peak torque (PT) in both knee extension (ext) and flexion (flex). Kinematic and kinetic analyses were performed during a double-leg stop-jump (DLSJ) task to evaluate knee flexion and knee abduction angle at initial contact (KFIC, KABIC) and peak vertical and posterior ground reaction force (vGRF, pGRF), knee flexion angle (KF), knee abduction angle (KAB), knee abduction moment (KABm), and proximal anterior tibial shear force. Jumps were performed at distances of 20%, 40%, 60%, and 80% of their body height to assess the influence of landing demand. Multiple linear regression was used to determine the contribution of these sensorimotor characteristics to predict biomechanical risk factors.

RESULTS: Sensorimotor characteristics did not account for a significant amount of the variance of either vGRF or pGRF. Sensorimotor characteristics accounted for little to moderate amount of variance of KFIC ($R^2 = 0.08 - 0.27$, $p = 0.038 - 0.002$), KF ($R^2 = 0.03 - 0.08$, $p = 0.196 - 0.035$), and KABm ($R^2 = 0.04 - 0.22$, $p = 0.171 - 0.007$). Regression models showed that the best sensorimotor contribution occurred at a jump distance of 40% with TTDPM and TTPT-flex accounting for 30.4% ($p < 0.001$) of the variance of the square-root of KABm.

CONCLUSIONS: Although knee proprioception and strength do significantly contribute to some risk factors for ACL injury, more research is needed to determine other contributing features to develop more directed prevention methods. Researchers and clinicians need to be aware that proprioception and strength at the knee are most related to knee flexion at initial contact, peak knee flexion, and peak knee abduction moment and have the strongest relationship at mid-range landing demand.

1332 Board #7 June 1 8:00 AM - 9:30 AM
Comparison Of Post-ACLR Kinematics Between Landings Of A Drop Vertical Jump: Implications For Re-injury Risk

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 (No relationships reported)

The drop vertical jump (DVJ) task is used to assess functional recovery after an anterior cruciate ligament reconstruction (ACLR). A DVJ has two distinct phases, and while the 1st landing is more commonly analyzed, the 2nd landing follows a maximal jump and may better represent higher-risk sport situations. Comparing the kinematics of each landing in subjects after an ACLR would provide insights into the specific qualities of each landing to inform clinical examination and future research.

Purpose: To compare hip and knee kinematics of the reconstructed limb between the 1st and 2nd landing of a DVJ in patients after ACLR.

Methods: 22 subjects (10 F, age 20.6±5 y, H 1.7±0.1 m, M 71±12 kg) 6 months post-ACLR performed a DVJ. Subjects were asked to step off of a 30.5 cm box, land (1st landing), maximally jump, and land once more (2nd landing) during an instrumented data collection. Visual 3D was used to calculate hip and knee kinematics at initial contact. Paired sample t-tests were used to compare between landings.

Results: The ACLR limb demonstrated less knee flexion but greater knee abduction and internal rotation angles during the 2nd landing (Table 1). The hip exhibited less flexion and internal rotation motion. No differences were observed in frontal plane hip motion.

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Conclusion: The 1st and 2nd landings of a DVJ require distinct kinematics of the ACLR limb. Less knee flexion combined with greater knee abduction and internal rotation of the ACLR limb during the 2nd landing suggests that this landing better detects abnormal mechanics associated with subsequent injury risk. Thus, the 2nd landing could warrant additional study to identify patients who may be at greater risk for re-injury after ACLR.

Table 1: Kinematic variables at foot strike during 1st and 2nd landings of a drop vertical jump

Joint	Motion	First Landing	Second Landing	P-Value
ACLR Knee	Flexion	-36.7±5.8°	-31.0±9.4°	.007
	Adduction	3.0±4.8°	0.2±3.9°	.000
	External Rotation	-11.4±9.9°	-8.3±9.2°	.001
ACLR Hip	Flexion	45.5±12.9°	27.3±12.9°	.000
	Adduction	-2.9±4.2°	-3.6±4.3°	.419
	Internal Rotation	8.7±7.2°	4.6±6.8°	.002

Data significant at $p < 0.05$ and presented as Mean ± SD. ACLR = anterior cruciate ligament reconstructed limb. All data reported in degrees.

1333 Board #8 June 1 8:00 AM - 9:30 AM
Kinetics and Kinematics During the Cutting Maneuver Weight Acceptance - Relevance for ACL Injury Prevention

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Purpose: Prospective studies have identified high valgus moment (VM) and vertical ground reaction forces (vGRF) as risk factors for anterior cruciate ligament (ACL) injury which involves multiplanar forces within 100 ms of initial contact (IC). Our aim was to describe the timing and magnitude of peak knee power (PKP), as quadriceps contributes to anterior tibial translation, and rate of loading as quicker loads contribute to ACL injury due to viscoelastic properties of ligaments, in relation to high VM and high vGRF peaks.

Methods: N=129 athletes aged 9-12 performed a cutting maneuver 5 times per limb. Motion data were captured with an 8 camera Qualisys system and an AMTI force plate. Using data reported previously three sub-groups were defined: high VM (≥ 32 Nm, N=89), high vGRF (≥ 1200 N, N=40), and high valgus angles (VA; ($\geq 5^\circ$, N=129) respectively. A paired t-test was used to test if time-points represented discrete events, and a mixed models repeated measures ANOVA was used to test for interactions between kinetics and kinematics.

Results: From IC, the mean time to PKP was 25 ms; to peak VM was 30 ms; to peak vGRF was 35 ms. Significant differences were found between all time-points ($p < .001$). Within-attempt sequence variability was seen in the time to peak indicating significant temporal overlap.

Mean (SEM) PKP values were greater for VM than vGRF or VA groups (3.2 (0.25) Nm/kg vs 1.34 (0.54) Nm/kg; $p = .009$, and 1.79 (0.30) Nm/kg; $p < .001$, respectively). Rate of loading differed between the High VA group and VM (44382 N/s (2724 N/s) vs 35062 N/s (2281 N/s); $p < .009$) but not from the high vGRF group (39864 N/s (4615 N/s), $p = .78$).

Conclusions: Considerable variability was seen in the timing of events. The timing of the specific risk factors investigated rarely coincided, although this did happen. Such an occurrence may reflect a possible scenario predisposing an athlete to ACL injury. Different subgroups may require tailored approaches for ACL injury prevention.

1334 Board #9 June 1 8:00 AM - 9:30 AM
Altered Brain Activity During Joint Loading After Anterior Cruciate Ligament Reconstruction

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Following an anterior cruciate ligament rupture, many patients that undergo surgical intervention (ACLR) fail to return to pre-injury levels of physical activity due to repetitive "giving-way" episodes. This functional joint instability may result from an insufficient neural processing responsible for neuromechanical links between the ACL and central nervous system. It remains unclear how the brain of the ACLR patients perceives mechanical loading compared with healthy controls. **PURPOSE:** To examine brain activity differences between ACLR patients and healthy controls during knee loading. **METHODS:** Seventeen healthy control (CON: 26.9±5.6yrs, 69.6±1.2kg, 166.3±7.7cm) and seventeen ACLR patients (ACLR: 22.29±3.8yrs, 67.8±18.7kg,

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164.5±10.4cm) volunteered. Somatosensory cortical activity was measured using event-related desynchronization (ERD: % decreased power; ERD1, ERD2, ERD3) from electroencephalography (EEG) during each second of an anterior knee loading (3sec) at constant force (45N/sec). Comparisons were made using 2-way ANOVAs with one within factor (limb, 2 levels) and one between factor (group, 2 levels). **RESULTS:** A significant limb by group interaction was observed for ERD1 ($F_{[1,32]} = 8.280, p = .007$). The reconstructed knee in the ACLR showed greater increased cortical activity than the matched limb in the CON (36.4±11.5 vs. 25.3±13.2%, $p = .013$), while the uninjured knee in the ACLR was similar to the CON's matched limb (25.1±14.2 vs. 28.0±11.5%, $p = .506$). Additionally, the ACLR showed greater increased ERD1 in the reconstructed limb when compared to the uninjured limb (36.4±11.5 vs. 25.1±14.2%, $p = .006$). No significant interactions or main effects were observed for ERD2 and ERD3. **CONCLUSION:** Following an ACL rupture, the injured leg exhibits increased brain responses during early loading compared to the uninjured knee, as well as the matched limb of healthy controls. This may indicate protective neural adaptation in the brain to compensate the altered proprioceptive input from the injured knee, such that reorganized somatosensory cortex activity can optimize neuromuscular control needed for maintaining functional joint stability. Future studies should explore whether this neural adaptation improves joint health and junction after an ACL injury.

1335 Board #10
Abstract Withdrawn

1336 Board #11 June 1 8:00 AM - 9:30 AM
Quadriceps Force Control and Motor Cortex Organization Following Anterior Cruciate Ligament Rupture

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Diminished quadriceps force control following ACL rupture may reflect quadriceps dyskinesia, which may be attributed to modulation or reorganization within the motor cortex. Reorganization within the motor cortex may be characterised by changes in the cortical motor representation of a muscle. Alterations in the cortical motor representation position is associated with dysfunctional motor control in a number of musculoskeletal conditions, but has not been examined following ACL rupture.

Purpose: To determine the association between quadriceps cortical motor representation position and accuracy of quadriceps force output following ACL rupture.

Methods: Eighteen individuals (12M/6F; 29.8 ± 8.7years; 69.5 ± 42.5 days post-injury) with a unilateral isolated ACL rupture. While seated in a dynamometer, participants performed an isometric quadriceps contraction to match a fluctuating force target between 5% to 25% body weight (BW). The root mean square error (RMSE) of participants force relative to target force was used to determine accuracy. Motor representation of the quadriceps was determined using transcranial magnetic stimulation. Four stimuli at 120% of motor threshold were given 5s apart while participant contracted their quadriceps at 10% BW, starting at the identified optimal site moving in 1cm steps in anterior, then posterior directions until a motor evoked potential could no longer be elicited. This pattern was repeated for lateral, then medial sites until all map borders had been determined. Pearson product moment correlations ($P < 0.05$) were used to assess associations between RMSE and motor representation position in the x- and y-axes.

Results: There were no significant associations between RMSE and y-axis center position of the motor representation in either limb of the ACL group ($r = 0.28, P = 0.31$ INV; $r = 0.30, P = 0.32$ UNIV). Also, no significant associations between RMSE and x-axis center position in either limb of the ACL group ($r = 0.099, P = 0.73$ INV; $r = -0.36, P = 0.27$ UNIV).

Conclusions: Quadriceps force control following ACL rupture was unrelated to cortical motor representation position. Alternatively, impaired quadriceps force control following ACL rupture may relate to alterations in spinal reflex excitability, or altered connectivity with higher brain centers.

1337 Board #12 June 1 8:00 AM - 9:30 AM
Relationship between Patient Reported and Objective Measures of Physical Activity in Individuals with ACL Reconstruction

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(No relationships reported)

Individuals with a history of ACLR participate in significantly less objectively measured moderate-to-vigorous physical activity (MVPA); however, it is unclear if these findings agree with common patient reported measures. **Purpose:** To quantify the relationship between patient-reported and objective measures of MVPA among those with a history of ACLR. **Methods:** 32 participants with a history of ACLR (Sex = 21F/11M, Age = 20.3 ± 1.7 years, BMI = 23.3 ± 2.8kg/m², Time since surgery = 28.2 ± 17.1mo) enrolled in this study. Participants completed the International Knee Documentation Committee subjective knee evaluation (IKDC) form to assess knee related function. The International Physical Activity Questionnaire (IPAQ) was used to assess patient reported MVPA (min/week) and MET-minutes (min/week). Objective MVPA (min/day) was assessed with an ActiGraph GT3X-BT accelerometer worn on an elastic belt at the hip over a period of 7 days with a minimum of 4 days of wear with ≥10 hours per day. Wear time (min/day) was validated using recommendations of Choi et al. Freedson Adult VM3 cut points were then utilized to categorize physical activity as light, moderate, vigorous, or very vigorous based on the number of activity counts that occurred per minute during periods of wear time. Relationships between objectively measured and patient reported measures of physical activity were assessed using Pearson's product moment correlations (r). In addition the dynamics of the relationship between patient reported and objectively measured MVPA was further investigated using Bland Altman plots to estimate the mean difference (MD) and limits of agreement (LOA) between assessment types. **Results:** There were positive relationships between IPAQ MET-minutes and both objectively measured MVPA ($r = 0.496, p = 0.01$) and step-count ($r = 0.471, p = 0.01$). Objectively measured and patient reported MVPA were not significantly related ($r = -0.177, p = 0.33$). Analysis of the Bland Altman plot revealed an average MD of 58.9 min/day and broad LOA (Upper LOA = 110.7min/day, lower LOA = 7.0 min/day). **Conclusion:** The relationship between objective and patient reported measures of MVPA among participants with a history of ACLR is limited due to the potential for over-report in the volume and intensity of physical activity within this patient population.

1338 Board #13 June 1 8:00 AM - 9:30 AM
Quadriceps Strength is More Associated with Disability than Rate of Torque Development Following ACL Reconstruction

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(No relationships reported)

Quadriceps muscle function, specifically maximal isometric strength (MVC) has been associated with disability in individuals with an anterior cruciate ligament reconstruction (ACLR). In addition, rapid strength, or the rate of torque development (RTD), is reduced following ACLR when compared to healthy controls. It is unknown if quadriceps RTD explains unique variance in self-reported disability after accounting for MVC in individuals with an ACLR. **PURPOSE:** Determine separate associations between MVC and RTD in the ACLR limb with self-reported disability (International Knee Documentation Committee Index [IKDC]) in individuals with a unilateral ACLR. Secondly, we evaluated the unique amount of variance explained by RTD after accounting for MVC for self-reported disability. **METHODS:** Forty-one individuals (29.3% male, 22.1±3.2 years old, 25.2±3.8 kg/m² BMI, 49.5±39.6 months post ACLR) completed the IKDC, as well as a maximal and rapid knee extension MVC to determine maximal strength and RTD. All isometric assessments were performed at 90° of knee flexion on a HUMAC Norm dynamometer. MVC was determined as the highest peak torque value, and RTD was assessed at early (RTD_{0-100ms}) and late (RTD_{100-200ms}) phases over the MVC torque-time curve. Both MVC (Nm) and RTD (Nm/s) were normalized to body mass. Separate Pearson product moment correlations were conducted between outcomes of quadriceps function (MVC and RTD) and IKDC. For significant associations between RTD and IKDC, a hierarchical linear regression was used to determine the unique variance in IKDC explained by RTD after accounting for MVC. Statistical significance was set a priori ($\alpha = 0.05$).

RESULTS: Greater RTD_{100-200ms} (4.25±1.79 Nm/s/kg; $r = 0.346, P = 0.031$) and MVC (2.04±0.67Nm/kg, $r = 0.418, P = 0.008$) of the ACLR limb significantly associated with better IKDC (87.02±9.69%). RTD_{0-100ms} (5.13±2.79 Nm/s/kg; $r = 0.170, P = 0.300$) was weakly and non-significantly associated with IKDC. MVC accounted for 17.5% of the variance in IKDC, and RTD_{100-200ms} accounted for an additional 0.5% of the variance.

CONCLUSIONS: Greater MVC and late phase RTD, but not early RTD, were related to better IKDC. Rehabilitation protocols that prioritize the improvement of quadriceps strength over RTD may be more likely to improve perceived disability following ACLR.

1339 Board #14 June 1 8:00 AM - 9:30 AM
The Relationship between Knee Related Function and Objectively Measured Physical Activity after ACL Reconstruction

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 (No relationships reported)

Persistent quadriceps weakness and knee dysfunction have been reported after ACL reconstruction (ACLR). It is unclear if these clinical findings are related to physical inactivity among those with a history of ACLR. **PURPOSE:** To investigate the relationship between patient reported knee function, knee extension strength, and objectively measured physical activity in individuals with and without a history of ACLR. **METHODS:** 17 ACLR participants (Sex = 10F/7M, Age = 20.5 ± 1.9 yrs, BMI = 23.4 ± 3.5kg/m², Time since surgery = 39.3 ± 18.7mo) and 17 matched controls (Sex = 10F/7M, Age = 20.5 ± 2.5 years, BMI = 23.1 ± 3.5kg/m²) enrolled. Participants completed the International Knee Documentation Committee (IKDC) form to assess knee function. Involved limb knee extension maximal voluntary isometric contraction (MVIC) strength (Nm/kg) and isokinetic knee extension strength (Nm/kg) was assessed at 60 and 180 deg/s using a multi-mode dynamometer. Moderate-to-vigorous physical activity (MVPA, min/day) was assessed with an ActiGraph GT3X-BT accelerometer worn on an elastic belt at the hip over a period of 7 days with a minimum of 4 days of wear with ≥10 hours per day. Wear time (min/day) was validated using recommendations of Choi et al and Freedson Adult VM3 cut points were used to categorize physical activity. Relationships between MVPA, knee extension strength, and IKDC score were assessed for all participants as well as within the ACLR group using Pearson's product moment correlations (*r*). **RESULTS:** Overall, IKDC score (mean = 93.42 ± 6.95) was positively correlated with isokinetic knee extension strength at 180 deg/s (mean = 1.30 ± 0.45Nm/kg, *r* = 0.41, *p* = 0.02). In the ACLR group, IKDC score (mean = 90.19 ± 7.21) was positively correlated with knee extension MVIC strength (mean = 2.28 ± 0.78, *r* = 0.48, *p* = 0.05) as well as isokinetic knee extension strength at 180 deg/s (mean = 1.21 ± 0.55, *r* = 0.57, *p* = 0.02). There were no significant correlations between IKDC score, knee extension MVIC strength, or isokinetic knee extension strength and MVPA. **Conclusions:** MVPA is an important clinical outcome that may not be related to traditional patient reported or functional outcome measures after ACLR. Understanding the factors contributing to physical inactivity after ACLR may guide clinical intervention strategies aimed at promoting MVPA.

C-31 Free Communication/Poster - Activity Trackers and Smartwatches

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1340 Board #15 June 1 9:00 AM - 10:30 AM
Children's Physical Activity Cadence Measures: Video Direct Observation vs. Research and Commercial Grade Activity Trackers

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 (No relationships reported)

Measuring children's free-play physical activity (PA) to ensure they meet the recommended daily dose is key to slowing the childhood obesity epidemic. While activity trackers (ATs) are common in the commercial market, few have been validated for measuring children's free-play PA. **Purpose:** To compare the cadence of children's play, sport and locomotive PA recorded by five ATs vs. video direct observation (ViDO) and to assess the relationship among AT and ViDO cadence and PA intensity. **Methods.** Healthy weight (HW) and overweight (OW) children (N=31; 15 girls) participated in 3 play/sport, 2 locomotive, and 1 stationary PA. Prior to playing, anthropometrics and resting metabolic rate (RMR) were measured using standard procedures. While playing, children wore a portable metabolic unit to measure PA energy expenditure [PAEE (METs) = energy expenditure ÷ RMR], plus 2 research and 3 commercial ATs to record cadence (steps/min) for each activity. All activities were self-paced and played in random order. ANOVA was used to assess differences in PAEE and cadence across sex and weight status and RMANOVA was used to

assess differences between AT and ViDO cadence. Regression analyses assessed the relationships among AT and ViDO cadence and PAEE. **Results.** Overall, PAEE was higher in boys than girls (6.9±0.3 vs. 6.2±0.3 METs), with no difference between HW and OW children. There was no effect of sex or weight status on AT or ViDO cadence. Four of the five ATs recorded significantly higher cadence for all activities combined (range: 71±5 to 173±15 steps/min) compared to ViDO (37±4 steps/min). When activities were classified by PA intensity (moderate vs. vigorous) or type (sport, play or locomotive), one AT recorded consistently higher cadence than ViDO. Each AT recorded higher cadence (range: 6.5±2.0 to 141.5±69 steps/min) during stationary squats compared to ViDO (1.8±0.7 steps/min). A weak relationship existed among cadence and PAEE (range: *r*=0.21 to 0.31), with a stronger relationship between ViDO and AT cadence (range: *r*=0.32 to 0.67). **Conclusion.** None of the ATs consistently recorded an accurate cadence of children's play, sport, and locomotive PA. With the tendency to inflate cadence, caution should be exercised when using activity trackers to determine if children are meeting the recommended dose of daily physical activity.

1341 Board #16 June 1 9:00 AM - 10:30 AM
Accuracy Of Steps, Energy Expenditure, And Distance In Nine Activity Trackers

Michael A. Smith. University of Central Oklahoma, Edmond, OK.
 (No relationships reported)

Purpose: To evaluate the accuracy of the step counts, energy expenditure (EE), and distance measured from 9 consumer grade activity trackers. **Methods:** Twenty participants completed 1 mile of walking followed by 1 mile of running on a treadmill in the lab. Participants completed 3 sessions of exercise while wearing as many as 4 devices set up for their height, weight, and age in addition to an Actigraph GT3X (GT3X) accelerometer. Devices included in the study were (1) the Fitbit Surge (FBS), Charge (FBC), and Charge HR (FBH); (2) the Garmin Vivoactive (GVA) and Vivosmart HR (GVS); (3) the Jawbone UP2 and UP3; (4) the Polar Loop and; (5) the Microsoft Band 2 (MSB). Data from the devices were compared to the GT3X for steps and American College of Sports Medicine metabolic equations (ACSMME) for estimated EE. Distance recorded by the devices was compared to the 1-mile treadmill completed distance. **Results:** The GVA and GVS performed best with accurate measures for running steps counted, walking EE, running EE, and walking distance (*p* < .05). The FBH and UP3 performed worst with only accurate step counts for running (*p* < .05). The FBH and FBS underestimated walking steps by 370 steps (*p* < .000) and 318 steps (*p* = .002) respectively. Only the PL and UP2 were accurate for steps counted at a walking pace; however, both devices underestimated steps at 48 steps (*p* = .227) and 86 steps (*p* = .06) respectively. **Conclusion:** Few devices accurately measured steps at speeds lower than 4.5mph when compared to a validated accelerometer; however, most devices may accurately measure steps taken at speeds greater than 4.5mph. Few devices accurately measured EE for a 1-mile walk or run when compared to ACSMME. Few devices accurately measured distance for a walk, and none of the devices accurately measured distance for a run. It is recommended that accuracy should be considered when using activity tracking devices for the measurement of daily physical activity.

1342 Board #17 June 1 9:00 AM - 10:30 AM
Assessing the Feasibility of Wearable Activity Tracker with Individual vs. Group Users

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Wearable activity monitors are gaining popularity in individuals who want to track their physical activity (PA). The potential use of wearable monitor technology as a tool to facilitate behavior changes represents promising opportunities to promote healthy lifestyles, particularly the key feature of sharing individual's daily activity with others. **PURPOSE:** To compare individual and group users' PA by examining step measurement. **METHODS:** A convenience sample of 78 adults were recruited in this research across two groups: individual users (n=38) and group users, including their partners (n=32). A Jawbone UP 24 (JU) tracker was provided to track the participants' PA, and worn on their wrist for 8 weeks. Only the group users shared their PA information with their partners by using the JU application. After 8 weeks, participants' step counts recorded by the JU were evaluated to examine the change in PA. Participants' weight (WT, kg), body mass index (BMI, kg·m⁻²), waist circumference (WC, cm), blood pressure (systolic blood pressure: SBP and diastolic blood pressure: DBP, mmHg), self-efficacy (SE), and exercise motivation (EM) survey were measured before and after wearing the tracker. Repeated-measured ANOVA was performed to examine the difference of PA between the weeks, comparing individual and group users' PA. The change in WT, BMI, WC, SBP, DBP, SE, and EM were analyzed by performing dependent sample t-test. **RESULTS:** Significant differences in PA were observed at baseline (7308.6 ± 5023.5 steps/day) vs. week 1 (8558.6 ± 5128.6 steps/day, *p*=0.001), baseline vs. week 2 (8645.2 ± 5343.7 steps/day, *p*=0.001),

baseline vs. week 3 (8600.1 ± 4747.5 steps/day, p=0.001), and baseline vs. week 7 (9033.4 ± 6604.3 steps/day, p=0.001) in the group users, but only baseline (7110.4 ± 4225.9 steps/day) vs. week 7 (8587.3 ± 4887.7 steps/day, p=0.001) in the individual users. WC (p=0.01), SBP (p=0.02), and DBP (p=0.001) were significantly decreased in the individual users. Self-efficacy was improved in the group users (p=0.04). **CONCLUSION:** WC, SBP and DBP were decreased in the individual users, and self-efficacy was increased in the group users. PA was increased at week 1, 2, 3, and 7 in the group users, but individual users showed increased PA only at week 7 from the baseline.

1343 Board #18 June 1 9:00 AM - 10:30 AM
Energy Expenditure and Step Count Analysis of the Fitbit Flex Activity Tracker

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 (No relationships reported)

PURPOSE: To investigate energy expenditure (EE) and step count (SC) measurements of the Fitbit Flex (FF) activity tracker during two walking protocols. **METHODS:** 49 volunteers (male, N=26, female N=23; age (years) 23.43±6.57; height (m) 1.72±0.11; mass (kg) 76.15±18.46 walked protocol one and 46 (male, N=24, female N=22; age (years) 23.39±6.69; height (m) 1.72±0.11; mass (kg) 76.52±18.73 walked protocol two. 31 (male, N=18, female N=13; age (years) 24.39±7.59; height (m) 1.73±0.10; mass (kg) 77.95±21.52 were used for reliability. Subjects walked for 3 minutes at 1.5, 2.5, and 3.5mph at 0% grade for each protocol. EE and SC values for each speed were compared to a MOXUS respiratory cart and a manual count of steps respectively. **RESULTS:** EE@1.5mph (r=0.52, p<0.01; α=0.56; FF:19.43±7.12 Kcal, MOXUS:11.9±3.09 Kcal, p<0.01), 2.5mph (r=0.53, p<0.01; α=0.72; FF:25.0±7.3 Kcal, MOXUS:14.43±3.67 Kcal, p<0.01), 3.5mph (r=0.61, p<0.01; α=0.67; FF:27.2±7.55 Kcal, MOXUS:19.43±4.76 Kcal, p<0.01). SC@1.5mph (r=0.4, p<0.01; α=0.55; FF:231.05±58.75 steps, Observed:268.95±25.17 steps, p<0.01), 2.5mph (r=0.37, p<0.01, α=0.50; FF:322.64±42.74 steps, Observed:331.6±21.22 steps, p=0.03), 3.5mph (r=0.53, p<0.01; α=0.66; FF:366.02±31.35 steps, Observed:379.83±21.58 steps, p<0.01). **CONCLUSIONS:** Because of the popularity of activity trackers such as the Fitbit Flex, it is important to evaluate their accuracy and consistency. By underestimating steps taken and overestimating the caloric cost associated with it, the Fitbit Flex may be hindering people from reaching the recommended levels of daily exercise that have shown to provide minimum health benefits.

1344 Board #19 June 1 9:00 AM - 10:30 AM
Accuracy of Fitbit Activity Trackers During Walking in a Controlled Setting

Jose L. Gamez¹, Jesus Gonzalez¹, Perla Leyva¹, Ivan A. Figueroa¹, Naomi Lucio¹, Vanessa E. Salazar¹, Cindy Salazar², Miriam Garcia², Merrill D. Funk¹. ¹University of Texas Rio Grande Valley, Brownsville, TX. ²University of Texas School of Public Health Health Science Center at Houston Brownsville Regional Campus, Brownsville, TX.
 (No relationships reported)

BackgroundActivity trackers are widely used to measure daily physical activity. Many devices have been shown to measure steps more accurately at higher intensities, however, it is also important to determine accuracy at a walking pace. **Purpose**To assess 6 popular activity trackers at measuring steps while walking on a treadmill. **Methods**Twenty-six college students (Mean±SD; 22.1±3.7yrs; 25.1±4.0kg/m²; 13 male) walked 500 steps at 3mph on a treadmill while wearing 6 different activity trackers (Pedometer, Fitbit Blaze, Charge HR, Alta, Flex, Zip, One). The Charge HR was placed two fingers above the right wrist while the Flex was next to the wrist bone. The Blaze was placed two fingers above the left wrist while the Alta was next to the wrist bone. The Fitbit Zip and the One were aligned with the hip bone on the left and right waistband respectively. A trained researcher using a hand tally counter counted the steps. Missing values were replaced with the mean value for that device. Step counts were correlated between Fitbit devices and the pedometer and tally counter using Pearson correlations. Significance was set at p<0.05. Mean bias scores were calculated between the step counts for each device and the tally counter. Mean Absolute Percent Error (MAPE) values were also calculated for each device relative to the tally counter.

Results Fitbit Zip and One were significantly correlated with the tally counter (r=0.50, p<0.05; r=0.68, p<0.01, respectively) while the other devices were not significantly correlated. Mean bias and MAPE values were as follows:

Device	Mean Bias (Mean±SD)	MAPE (Mean±SD)
Pedometer	-0.2±39.2	3.8±6.8
Blaze	-34.5±67.1	9.9±11.3
Charge HR	-12.6±61.5	7.0±10.3
Alta	-85.0±70.8	17.1±14.1
Flex	49.5±242.4	19.7±45.3
Zip	1.8±3.4	0.4±0.6
One	0.2±2.1	0.3±0.3

Fitbit Zip and One were within one half percent of actual steps while wrist-worn Fitbits ranged from 7.0-19.7% from actual step counts.

Conclusion

Consistent with previous research, activity trackers worn at the waist provide the most accurate step counts compared to wrist-worn models. Differences found in wrist-worn models may result in significant over- or underestimation of activity levels when worn for long periods of time.

1345 Board #20 June 1 9:00 AM - 10:30 AM
Accuracy And Reliability Of The Fitbit Charge™ Activity Tracker Among Older Adults

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Wearable technology, including activity trackers, remains a top fitness trend worldwide; however, the ability of individual activity trackers to accurately and consistently record physical activity remains unknown. **Purpose:** To evaluate the accuracy and reliability of step counts from the Fitbit Charge™ among older adults. **Methods:** Thirteen participants with a mean age of 70.38 ±4.27 years volunteered to participate and completed all testing. Participants completed a 96 meter walk around a gymnasium while wearing the Fitbit Charge™ activity tracker. Step counts on the activity tracker were recorded before and after the walk to determine the step count. The walk was also video recorded to determine the actual number of steps taken during the walk. Step counts from video analysis were confirmed by two researchers. The same procedures were repeated on a second, non-consecutive day of testing to determine the reliability of the activity tracker. Accuracy of the activity tracker was determined by comparing step counts to the observed step counts from each testing session. The reliability of the activity tracker was determined by correlation analysis and comparison of step counts from the first testing session to the second testing session. **Results:** The activity tracker significantly underestimated observed steps at both testing sessions by 21.31 steps and 22.62 steps, respectively (p < .05). No difference in step count from the activity tracker was seen from session one to session two (151.85 steps vs. 152.54 steps, p > .05); however, the correlation between the two sessions was only moderate, r = .55, p = .05. **Conclusion:** Among older adults, the Fitbit Charge™ appears to underestimate steps taken even over a short distance. The reliability of the Fitbit Charge™ is questionable given only a moderate correlation between sessions. While preliminary, these results call into question the accuracy and reliability of daily step counts from the Fitbit Charge™. It is suggested that all new activity trackers to hit the market are given careful study to determine their ability to accurately measure daily activity.

1346 Board #21 June 1 9:00 AM - 10:30 AM
Examination of a Wearable Activity Tracker to Assess Children's Physical Activity.

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Newer wearable activity monitors have the capability to measure heart rate (HR) from the user's wrist using an optical blood flow sensor (i.e., photoplethysmography techniques), and none of the previous studies examining children's free-living activity utilizing a newly developed wearable activity tracker which includes built-in HR sensor. **PURPOSE:** To examine PA intensity using the wearable HR monitor. **METHODS:** a total of 43 children (girls = 18, boys = 25), aged 8 - 12 years, participated in the study. Participants were asked to wear the Fitbit Charge HR (FHR) on their left (FHRL), right wrist (FHRR) and Polar HR (PHR) monitor on their chest, while completing 11 different activities lasted 48 mins, monitoring their HR. Oxygen consumption was measured throughout the routine with the Cosmed K4B² metabolic analyzer. 10 min average values of the resting metabolic rate were used as one metabolic equivalent of task (MET) to categorize children's PA intensity. Activity intensities using HR from the FHR were classified by calculating children's target HR between 50 and 75% of their maximum HR as moderate intensity activity and

greater than 75% of their maximum HR as a vigorous intensity activity. An estimate of children's maximum age-related HR was obtained from the 208 - 0.7 (age) equation. Each intensity classified by the MET determined by HR was compared to the intensity classified by the MET determined by resting metabolic rate (i.e., criterion measure) to examine the measurement agreement. McNemar's test was used to examine the measurement agreement for paired intensity frequency. **RESULTS:** After setting PA intensity classification with 50% and 75% of HR, the frequency determined by measured MET from the Cosmed K4B² were 1002, 407, and 120 for light, moderate, and vigorous intensity. The frequency determined by HR monitor and FHR were as follows: 1076, 394, and 58 by PHR, 1393, 127, and 9 by FHRL, 1393, 129, and 7 by FHRR. The values of weighted Kappa statistics from the McNemar's test were 0.40 (95% CL: 0.36-0.44) for the intensity by PHR, 0.21 (95% CL: 0.18-0.25) for the intensity by FHRL, 0.19 (95% CL: 0.16-0.23) for the intensity by FHRR. **CONCLUSIONS:** The agreement of PA intensity classified by the wearable activity tracker to the intensity classified the metabolic analyzer showed fair agreement.

1347 Board #22 June 1 9:00 AM - 10:30 AM
Validation of Caloric Expenditure Using the Apple Watch and the Fitbit Zip

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 (No relationships reported)

PURPOSE: Physical activity trackers have become popular devices to monitor daily exercise and caloric expenditure. However, the validity of these devices is still being investigated. The purpose of this study is to compare estimates of caloric expenditure during exercise using an Apple Watch Sport and Fitbit Zip to values calculated from direct measurement of oxygen consumption. **METHODS:** The study included seven healthy participants (3 male and 4 female), 20 - 22 years of age. Participants completed six 6-minute bouts of sitting and treadmill walking and jogging (sitting, 2.5, 3.5, 4.2, and 5.5 mph, followed by 2.5 mph cool-down) while wearing an Apple Watch and a Fitbit Zip. Oxygen consumption (VO₂) was measured using the Cosmed Quark CPET. Data is presented as mean ± SD. **RESULTS:** Caloric expenditure values for the Fitbit Zip were significantly higher than values calculated from VO₂ for all walking and jogging speeds (p<0.05). In contrast, caloric expenditure values for the Apple Watch were not significantly different than values calculated from VO₂ for all walking and jogging speeds (p>0.05). Total caloric expenditure values were also significantly higher for the Fitbit Zip (296.3±33.0 kcals) compared to estimates calculated from VO₂ (195.8±30.4 kcals) and the Apple Watch (201.1±41.5 kcals) (p<0.05). **CONCLUSION:** The results of this study suggest that the Fitbit Zip may overestimate caloric expenditure compared to values calculated from VO₂ measurements. In contrast, caloric expenditure values from the Apple Watch are not different from the values calculated from VO₂. This information may be important for exercise professionals to consider when recommending physical activity trackers to their clients.

1348 Board #23 June 1 9:00 AM - 10:30 AM
How Accurately The Smartwatch Measures Steps?
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 (No relationships reported)

Wearable activity trackers are getting popular in the fitness market to track individual's activity level and several research studies have examined the validity of popular wearable activity trackers. However, there is still limited research regarding the validity of smart watch. **PURPOSE:** The present study was to systematically examine the validity of the Apple watch for measuring steps. **METHODS:** Healthy individuals (mean ± SD; age = 23.5 ± 13.4 years; body mass index = 26.8 ± 4.2 kg·m⁻²) participated in the study. The participants were asked to wear the apple watch while normal walking, fast walking and running for one lap on an indoor track (i.e., 200-meter track). The actual steps were manually tallied by researchers using a hand tally counter and the steps on the watch were recorded before and after each test, step counts from the apple watch were compared with manually counted steps. Pearson correlation was calculated to identify the measurement relationship between the counted steps and the recorded steps from the apple watch. Mean absolute percentage error (MAPE) were calculated to examine the measurement error of the Apple watch steps. A dependent t-test was performed to the significant mean differences between counted steps and recorded steps from the apple watch. **RESULTS:** Total step counts (means ± SD) for counted steps were 222.3±82.5 for normal walking, 198.2±55.7 for fast walking, and 185.9±35.7. Recorded steps from the apple watch were 216.9±77.7 for normal walking, 198.2±55.7 for fast walking, and 188.4±37.9 for running. Pearson correlations were r=.96 (p=.001) for normal walking, r=.83 (p=.000) for fast walking, and r=.93 (p=.000) for running, respectively. Corresponding mean absolute error rates (computed as the average absolute value of the individuals' errors) were 6.1 ±6.6%, 8.8±11.2%, and 4.3±5.8%, for normal walking, fast walking, and running, respectively. Dependent sample t-tests indicated that there is no significant difference (t(35)=.989, p=.359) between the counted steps and the recorded steps from apple

watch. **CONCLUSION:** The results demonstrate that the apple watch accurately measures steps on normal walking and running conditions compared to the manually counted steps. However, further research is needed to with more sample size and various populations.

Words: 1972/2000

1349 Board #24 June 1 9:00 AM - 10:30 AM
Validating iWatch in Measuring Energy Expenditure during Different Levels of Physical Activity

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Both consumers and researchers have become increasingly interested in using wearable fitness devices to monitor and measure physical activity (PA). iWatch was designed to track individual's PA using a built-in exercise application, "Workout App" estimating user's energy expenditure and exercise duration. Even though iWatch was described as a useful wearable fitness technology, the validity of its PA measures is unknown. **PURPOSE:** The purpose of the study was to investigate the validity and reliability of the energy expenditure estimation of Apple Watch among college students. **METHODS:** A total of 30 college students (17 males and 13 females) from a state public university in Pennsylvania participated into the study. All participants completed two sets of three 10-minute treadmill walking and running trials while wearing three randomly positioned iWatches while also being connected to indirect calorimetry. The two sets of measurement were arranged on two separate days with a randomization and > 48-hour rest in between. The three walking trials were at speeds of 54, 80, and 107 m·min⁻¹ while the running trials were at speeds of 134, 161, 188 m·min⁻¹. Resting Metabolic Rate was collected by the indirect calorimetry along with a familiarization trial prior to the execution of the exercise protocol. Energy expenditure comparisons was made using Two-way ANOVA with repeated measures. Reliability was analyzed by Intraclass Correlation. **RESULTS:** There was no significant device x speed interactions ($F_{(15, 696)} = 1.113, p > 0.05$) between the indirect calorimetry (criterion) and iWatch. Bonferroni post hoc analysis revealed no significant differences between the criterion energy expenditure estimates (76.91±39.69 calories) and iWatch (81.53±36.69, p > .05). The reliability analysis: Overall, a moderate to high agreement among the three apple watches examined in this research, with coefficients increasing once speed surpassed the 2 MPH level. The Inter-Class Correlation (ICC) scores were 0.49 (95%CI) at 2mph, 0.66 (95%CI) at 3mph, 0.72(95%CI) at 4mph & 5mph, 0.71(95%CI) at 6mph & 7mph. **CONCLUSION:** iWatch demonstrated a moderate to high level of validity and reliability on measuring physical activity.

1350 Board #25 June 1 9:00 AM - 10:30 AM
"How 'bout Them Apples??" Validating Step Counts From The Apple Watch

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 (No relationships reported)

Purpose: To evaluate the validity of step counts detected by the Apple Watch (Series 1) during nineteen laboratory-based activities. **Methods:** Fifteen participants (mean ± SD: age = 28.2 ± 6.2 years; BMI = 23.6 ± 3.6 kg/m²) wore the Apple Watch on the dominant wrist and performed 19 different activities for 2 to 3 minutes each. The Apple Watch was calibrated for each participant prior to commencing the experiment and the protocol included ambulatory activities on the treadmill and various simulated free-living activities that occur in day-to-day life. Start and stop times were recorded along with step counts displayed on the Apple Watch before and after each activity. Manually counted steps were obtained from video-recordings of the activities and used as the criterion for comparison. A step was defined as each instance the foot was completely raised off and put down on the floor. Paired sample t-tests (p<0.05) were conducted between the Apple Watch and the criterion variable for each activity to determine the validity of the Apple Watch in detecting steps. **Results:** There was statistically significant difference between mean step counts from the Apple Watch and the criterion for the following activities: sitting and talking while gesturing (0 vs. 2.5 ± 3.9 steps; p=0.025), standing and stacking books (54.5 ± 61.4 vs. 8.9 ± 7.5 steps; p=0.014), walking on the treadmill at 3 mph at a flat rate (244.5 ± 111.1 vs. 342.4 ± 24.4 steps; p=0.008), standing and folding towels (48.3 ± 42.5 vs. 11.9 ± 11 steps; p=0.007), riding the stationary bicycle at 600 kpm/min (47.2 ± 54.1 vs. 0 steps; p=0.004), and vacuuming (47.7 ± 42.6 vs. 134.8 ± 44.8 steps; p=0.000). **Conclusion:** It was observed that the Apple Watch was able to disregard extraneous hand movements (e.g. gesturing) and not count those as steps during light intensity activities of daily living. These activities did not involve rhythmic and exaggerated arm movements similar to that during unsupported walking. Conversely, increasing the intensity of hand movement during stacking books and folding towels while standing yielded

spuriously high step counts. Interestingly, despite gripping the handlebars, bicycling at 600 kpm/min may have generated rhythmic wrist movements that were sufficient to be detected as steps. Thus, the Apple Watch was not consistent when tracking step counts.

1351 Board #26 June 1 9:00 AM - 10:30 AM
Validation Of A Wrist Worn Consumer Physical Activity Monitor
 Monroe J. Molesky, Joe R. Mitrzyk, Alexander H.K. Montoye.
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 (No relationships reported)

Despite the popularity of consumer-based physical activity monitors (AMs), many of these AMs have little data examining their accuracy.
PURPOSE: Our study's purpose was to determine the validity of a popularly used, wrist-worn AM to estimate Calories (kcal), steps, and heart rate (HR) during laboratory and semi-structured protocols.
METHODS: Participants (n=32) aged 18-51 completed two protocols while wearing one AM on their non-dominant wrist. In the laboratory protocol, participants performed 11 activities including lying, sitting, standing, walking at various speeds (2.0, 3.0, 3.5-4.0 miles/hr) and elevations (0%, 5%, 10%), jogging, and cycling for 5 min each. For the semi-structured protocol, participants were taken to an indoor track to perform 3 activities (2 walking for 200 m, 1 jogging for 400 m). The variables measured by the AM were recorded during each activity and compared to criterion measurements (kcal assessed via metabolic analyzer, steps via hip-worn pedometer, and HR via pulse oximeter) using paired samples t-tests. Additionally, overall and activity-specific percent differences (%) were calculated between estimated kcal, steps, and HR from the AM and criterion measures.
RESULTS: Overall % errors for steps, kcal, and HR were 9.7%, 50.2%, and 6.6%, respectively. The AM underestimated steps during most of the slow walking activities ($\geq 11.7\%$, $p < 0.05$), whereas kcal were significantly overestimated ($\geq 9.9\%$, $p < 0.05$) during higher intensity activities (jogging, inclined walking and cycling). HR was not significantly different from the criterion for any activity except standing (underestimated by 4.1%, $p < 0.05$). Steps and HR estimates by the AM were poorer for the semi-structured activities, underestimating both steps ($\geq 12.1\%$, $p < 0.05$) and HR ($\geq 6.9\%$, $p < 0.05$).
CONCLUSIONS: The AM had low overall error ($\leq 10\%$) for estimating steps and HR in the laboratory protocol. However, accuracy was notably worse for kcal estimates in the laboratory and in steps and HR estimates in the semi-structured protocol, and steps were less accurate during the low speed activities. This study indicates that caution should be used when making health and wellness decisions based on information from AMs since accuracy varies widely among different activities and activity variables.

1352 Board #27 June 1 9:00 AM - 10:30 AM
Accuracy of Wrist-Worn Activity Monitors during Treadmill and Elliptical Ergometry
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 (No relationships reported)

Wrist-worn activity monitors, designed to register daily activity, are used during many types of aerobic activity. **PURPOSE:** To assess the accuracy of wrist-worn activity monitors during treadmill and elliptical exercise. **METHODS:** Forty-two subjects (age=26.1±4.9 yrs, ht=166.2±9.5 cm, wt=81.6±26.7 kg) wore six wrist activity monitors (FF, FC, and PL on the right wrist, GV, MV, and LT on the left wrist, and a pedometer (HJ) on the right wrist. After walking for two minutes at 53.6 m/min (2.0 mph), 80.5 m/min (3.0 mph), and 107.3 m/min (4.0 mph), and exercising on the elliptical at 40 rpm and 60 rpm, monitor counts and actual step counts from a hand tally (AC) were recorded. Repeated measures ANOVA was used to determine significant differences between the counts. Pedometer error was calculated as [(monitor counts-actual counts)/actual counts]*100. **RESULTS:** FF, LT, PL, and FC was significantly lower ($p < .05$) than AC at 53.6 m/min (35.4±52.6, 67.6±72.5, 53.5±49.9, and 34.8±43.5 counts, respectively). FF, MV, PL, and FC was significantly lower than AC during 80.5 m/min (15.9±27.7, 29.6±32.3, 21.5±38.3, and 18.8±24.1 counts, respectively). During 107.3 m/min, FF, MV, GV, PL, and FC was significantly lower than AC ($p < .05$), 22.4±27.7, 56.7±47.9, 42.0±49.2, 44.2±44.5, and 23.9±27.9 counts, respectively. HJ was not significantly different than AC at any speed ($p > .05$). On the elliptical at 40 and 60 rpm, all monitors except HJ were significantly lower ($p < .05$) than AC. Of the wrist-worn monitors, LT had greatest error at 53.6 m/min (33.9%), followed by PL (26.6%). At 80.5 m/min, MV was highest at 12.5%, followed by PL (9.3%) and LT (8.7%). Error was greatest in MV at the fastest walking speed (21.2%), followed by PL (16.8%). While error during elliptical was high in all monitors, FF was least during 40 rpm (28.8%) and PL (14.2%) at 60 rpm. At 40 rpm, error was greatest in LT (96.3%), MV (53.1%), and FC (33.9%). At 60 rpm, MV (52.1%), FF (29.4%), and LT (24.4%) exhibited the greatest error. HJ registered the least percent error across all trials. **CONCLUSION:** The hip-worn pedometer (HJ) provides the most accurate step count across all speeds and modalities. One should account for type and intensity of activity when considering use of wrist-worn activity monitors.

1353 Board #28 June 1 9:00 AM - 10:30 AM
Fitbit And Actigraph: A Comparison Of Physical Activity And Sedentary Time In Overweight/obese Adults
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There is limited information regarding the validity of consumer targeted wearable physical activity (PA) trackers, such as the Fitbit, to assess PA in free-living adults. **PURPOSE:** To compare daily minutes of sedentary time, and moderate-to-vigorous (MVPA) collected using two types of activity trackers, in a sample of overweight and obese adults (n = 12, BMI= 37±4 kg/m², age = 48±12 yrs.) who completed a 6-mo. weight loss intervention (diet + self-directed PA) delivered using Facebook. **METHODS:** Participants wore a Fitbit Flex™ on their non-dominant wrist continuously over 6 mos. They were also asked to wear an ActiGraph GTX1™ on their non-dominant hip for 7 consecutive days at both baseline and 6 mos. Fitbit and ActiGraph data for a minimum of one 10-hr. day at baseline and 6 mos. was required for inclusion in this analysis. Categorization of sedentary time and MVPA was derived from the Fitbit algorithm or using NHANES Actigraph cut-points (Troiano, 2008). **RESULTS:** Sedentary time was significantly lower and MVPA was significantly higher when assessed with the Fitbit compared with the ActiGraph at both baseline (sedentary time: Fitbit = 427 ±168, ActiGraph = 639 ±132 min/d, $p < 0.001$; MPVA: Fitbit= 128 ±49, ActiGraph = 18 ±19 min/d, $p < 0.0001$) or 6 mos. (sedentary time: Fitbit = 459 ±168, ActiGraph = 613 ±103 min/d, $p = 0.001$; MPVA: Fitbit= 123±53, ActiGraph= 14 ±10 min/d, $p < 0.0001$). Change in both sedentary time and MVPA from baseline to 6 mos. was not statistically significant measured either with the Fitbit (sedentary time = +63 ±46, $p = 0.16$; MVPA = -8±13 min/d, $p = 0.72$) or the ActiGraph (sedentary time = - 49±52, $p = 0.39$; MVPA = -2±13 min/d, $p = 0.48$). **CONCLUSIONS:** The Fitbit significantly underestimated sedentary time and overestimated MVPA when compared with the ActiGraph in a small sample. Changes in sedentary time and MVPA over 6 mos. were non-significant when assessed by either the Fitbit or ActiGraph. These observations suggest that the Fitbit, which is relatively inexpensive when compared with the ActiGraph, may be useful for assessing changes in sedentary time and MVPA in response to an intervention. However, the absolute values for sedentary time and MVPA assessed by the Fitbit are questionable, and worthy of additional investigation in larger samples of free-living adults. Funded by Kansas City Life Sciences Institute

1354 Board #29 June 1 9:00 AM - 10:30 AM
Sources of Error with Wearable Step Counters
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PURPOSE: To investigate sources of error with 11 wearable step counting devices, during common types of physical activities. **METHODS:** 20 participants performed 15 activities for 2 min each, while wearing 11 step counters on the waist, ankle, or non-dominant wrist. Arm activities included: snacking, brushing hair, folding laundry, sweeping, brushing teeth, and meal preparation. Overground activities included: walking holding onto backpack strap, walking with umbrella, walking with hands in pockets, and pushing stroller. Treadmill activities included: walking at 1 mph, walking at 2 mph, walking at 3 mph, walking at 3 mph holding onto bars, and jogging at 6 mph. Wrist-worn devices included: Garmin Vivofit 2, Fitbit Charge, Polar A360, Withings Pulse Ox, and ActiGraph GT3X. Waist-worn devices included: Yamax Digi-Walker SW-200, Fitbit Zip, Omron HJ-322U, and ActiGraph GT3X (without low-frequency extension). Ankle-worn devices included: two StepWatch 3 devices, one with preprogrammed, default settings and one with modified cadence and sensitivity settings. A researcher hand-counted steps during each activity; this served as the criterion. The step counts reported from each device compared to the hand count using a 1-way (1x12) repeated measured ANOVA. If the overall effect for an activity was significant, the outputs from individual devices and the criterion were analyzed using planned contrasts. Devices with significant contrasts ($p \leq 0.05$) and observed power greater than 0.8 were considered to be significantly different than the criterion. **RESULTS:** During arm activities, the wrist-worn devices overcounted steps while hip-worn devices slightly undercounted steps. The ActiGraph GT3X on the wrist greatly overcounted steps during arm activities, while other devices had smaller errors. During treadmill walking at 1 mph, all wrist and hip-worn devices undercounted steps. The ankle-worn device (StepWatch 3) had the smallest error across all activities, especially when programmed with the modified setting.

CONCLUSIONS: Individuals using step counting devices should be aware of sources of error in step counts. Contributing factors to error are the wear location, the algorithms used to count steps, and the activities performed.

- 1355 Board #30 June 1 9:00 AM - 10:30 AM
Step Count Filters in Wearable Step Counters
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Manufacturers of step counting devices apply filters to their step counting algorithms to prevent accumulation of steps when none are taken (i.e. false positives). However because filters prevent steps from being recorded during short, intermittent walking bouts, it is possible that these filters may be a source of error. Since few manufacturers disclose the type of filter they use, we decided to investigate this topic. **PURPOSE:** To determine whether the devices used in this study have a filter, and to describe the effects of the filter on short, intermittent walking bouts with varied walk and pause durations.

METHODS: In Parts A and B, 20 participants performed intermittent walking bouts for 2 min, at a cadence of 100 steps/min. In Part A participants were instructed to walk a certain number of steps (i.e. 4, 6, 8, 10, and 12) followed by a 10-sec pause and repeat this until the trial ended. In Part B participants were instructed to walk four steps followed by various pause intervals (i.e. 8, 6, 4, 2, and 1 sec) and repeat this. A researcher counted steps using a hand-tally device (criterion). "Percent of actual steps taken" was used for statistical analysis. A one-way repeated measures ANOVA was completed for both parts. In the case of significant overall effects ($p < 0.05$), the results were further examined using planned contrasts to see which conditions differed from the criterion.

RESULTS: In Parts A and B the multivariate results for ActiGraph GT3X (AG) (without low frequency extension) worn at the wrist, StepWatch 3, and Yamax Digi-Walker SW-200 were not significantly different from the criterion, indicating absence of a step count filter. Walking bouts shorter than 4 steps (AG at the hip), 6 steps (Withings), 8 steps (Omron and Garmin Vivofit 2), and 12 steps (Polar A360), resulted in a significant decrease in the number of steps counted, indicating presence of a filter. The minimum pause needed to break up a walking bout was 1 sec (Fitbit Charge, Fitbit Zip, and Withings), and < 1 sec (Omron HJ-322U). For both the Polar and Garmin, the longer the pause, the less likely they were to record steps.

CONCLUSIONS: Devices with step count filters will contribute to error in daily step counts because steps taken during short, intermittent walking bouts (e.g., meal preparation, and housework) are not registered.

- 1356 Board #31 June 1 9:00 AM - 10:30 AM
The Effect of Wearable Devices and Tailored Engagement on Physical Activity in College Students
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 (No relationships reported)

Wearable devices have been used to track physical activity in clinical interventions and within the general population with an attempt to improve physical activity. The success of wearable devices that track physical activity alone is limited. The pairing of wearable devices with tailored engagement has been suggested to enhance compliance and outcomes.

PURPOSE: To measure the effect of activity tracking devices with and without tailored engagement on physical activity in college-aged students measured daily over twelve weeks. **METHODS:** Thirty-five college-aged participants ($n = 11$ male and $n = 24$ female) were recruited based upon surveyed stage of change corresponding to contemplation or preparation for physical activity who self-reported obtaining ≤ 60 min of structured physical activity per week. Participants were randomly assigned to 1 of 4 treatment groups: Actigraph GT3X accelerometer without engagement or step count (C) ($n = 8$), pedometer without engagement (P) ($n = 9$), pedometer with engagement (PE) ($n = 10$), or commercially-available iliac crest tracker with engagement (FBE) ($n = 8$). After enrollment, all groups were instructed to attempt to obtain 10,000 steps per day. Group C served as control and received no step data. Groups P, PE, and FBE reported daily steps through a digital form with all participants reminded to wear the device daily via text message. Engaged groups received additional motivational text messages. The PE and FBE groups were engaged via digitally administered self-directed SMART objectives with feedback each week. **RESULTS:** The average steps per day over twelve weeks for group C (6698 + 2870) was found to be significantly lower than all other groups. There was no significant difference in the average steps per day between group P (7201 + 3037) and group FBE (7653 + 3190). Group PE achieved the highest average steps per day (8103 + 3699) which was significantly higher than C and P, but not significantly greater than

FBE. There was no significant difference when examining group by day of the week interaction. **CONCLUSIONS:** All groups failed to meet the goal of 10,000 steps per day. However, engagement increased steps per day when administered digitally. Over twelve weeks, receiving feedback on the number of steps taken per day increases the average number of steps taken in all groups compared to control.

- 1357 Board #32 June 1 9:00 AM - 10:30 AM
Does Wearable Technology Provide Accurate Heart Rate Measures While Playing Pickleball Doubles?
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The sport of pickleball is increasing in popularity throughout the United States, especially in middle-aged, and older adults. Research investigating the physiological demands of pickleball is limited. The use of wearable technology is also gaining popularity, however, the accuracy of such devices is under question. **PURPOSE:** The purpose of this study was to determine if wearable technology provide valid heart rate (HR) measures during pickleball doubles in middle aged adults. **METHODS:** 8 female, intermediate level pickleball players (IFP = 3.0 ± 0.8 ; age = 47 ± 11 years; mass = 72.5 ± 12.8 kg; height = 1.70 ± 0.08 m) participated in this study. All subjects played pickleball doubles for 30 minutes. HR was measured using two devices (Fitbit HR, worn on the dominant wrists, and Polar HR monitor, worn at the xiphoid process level). Peak and mean HR were determined for each device. A paired sample *t*-tests was used to determine differences in HR between devices for each dependent variable (HR max and HR mean). A Pearson product-moment correlation coefficient was used to evaluate the concurrent validity between the gold standard (Polar HR system) and the wearable technology (Fitbit HR). **RESULTS:** Peak HR measured by the Polar system (151.9 ± 15.9 beats/min) was not significantly different from the peak HR measured by the Fitbit HR (149.6 ± 18.0 beats/min; $p = 0.69$). Similarly, mean HR measured by the Polar system (127.9 ± 17.9 beats/min) was not significantly different from the mean HR measured by the Fitbit HR (121.0 ± 18.2 beats/min; $p = 0.23$). Concurrent validity between the Polar HR system and the Fitbit HR for both peak ($r = 0.6$) and mean HR ($r = 0.66$) was also nonsignificant ($p > 0.05$). **CONCLUSIONS:** On average, peak and mean HR was similar between the two devices. These results support the validity of wearable technology; the Fitbit HR was moderately valid in peak and mean HR compared to the Polar HR system. These results are promising for those who own wearable technology and are using it to monitor HR during physical activities such as pickleball doubles. We acknowledge our small sample size and admit that further investigation of the validity of wearable technology on physiological measures during pickleball and other racket sports is warranted.

- 1358 Board #33 June 1 9:00 AM - 10:30 AM
Effect of Wearable Devices With and Without Engagement on Weight and Fitness in College-Aged Students
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Wearable devices are rapidly growing in popularity as individuals attempt to improve their health behaviors as they become more aware of their physical activity. Even with the adoption of wearable devices, many individuals are not achieving activity guidelines. The pairing of activity monitors with tailored engagement has been suggested to enhance compliance and outcomes. **PURPOSE:** To measure the effect of activity tracking devices with and without tailored engagement on weight and YMCA 3-Minute Step Test score in college-aged students, measured before and after a 12-week intervention.

METHODS: Thirty-four college-aged participants were randomly assigned to 1 of 4 treatment groups: Actigraph GT3X accelerometer without engagement or step count (C) ($n = 8$), pedometer without engagement (P) ($n = 9$), pedometer with engagement (PE) ($n = 10$), or commercially-available iliac crest tracker with engagement (FBE) ($n = 7$). Participants were in the contemplation or preparation stage of change at recruitment and self-reported obtaining ≤ 60 min of structured physical activity per week. After baseline measurements of weight and cardiorespiratory fitness as evaluated by YMCA 3 minute step test, all groups were instructed to attempt to obtain 10,000 steps per day and how to wear the device properly. Participants were reminded to wear the device daily via text message and reported daily steps through a digital form. **RESULTS:** The overall difference in weight from baseline (171.5 ± 45.2 lbs) to post intervention (172.9 ± 44.5 lbs) was found to be not statistically significant between groups. There was no statistically significant difference regarding cardiorespiratory fitness from baseline 1 minute heart beat count 129.97 ± 14.1 BPM to post-intervention 126.15 ± 16.5 BPM. All groups produced a mean score in the 'poor' category at baseline. Group PE produced a mean score category of 'average' after the intervention.

CONCLUSIONS: The use of wearable devices with or without engagement did not have a statistically significant effect on weight or cardiorespiratory fitness after a 12-week intervention. However, some individuals improved within YMCA fitness scores post-intervention, which may have clinical significance.

1359 Board #34 June 1 9:00 AM - 10:30 AM
Increased Habit Strength and Self-Efficacy Promote PA with Wearable Fitness Monitors

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In the US, less than 5% of adults obtain the recommended 150 minutes of physical activity (PA) per week, contributing to the onset of preventable chronic disease. Wearable fitness monitors are increasingly popular, with the goal of increasing PA levels; however, usage trends show that 75% of users stop wearing the devices after 1 month, limiting their potential benefits. Increasing self-efficacy (SE) (one's belief in their ability to succeed at a specific task) and developing habits (automatic behaviors that occur in response to environmental cues) related to usage could improve engagement with monitors and further promote changes in PA. **PURPOSE:** Our purpose was to determine if change in SE and habit formation predict PA levels over a 3-month intervention using a wearable fitness monitor. **METHODS:** Ninety-four healthy adults (52% female; age 41.6 ± 18.4) were randomly assigned to receive a commercial fitness monitor alone or in combination with motivational interviewing and education on successful development of habits. Prior to receiving the monitors, participants completed the Self-Efficacy and Exercise Habit Survey and wore ActiGraph GT3X+ and activPAL3 accelerometers for 7 days to assess baseline physical activity levels. One week later, they were introduced to and provided with a fitness monitor to utilize at their discretion for three months. Participants returned for a follow up visit three months later, completing all baseline measures as well as the Self-Reported Habit Index (SRHI). The SRHI measured HS for wearing the monitor, checking data on the monitor and using the computer software and mobile app. A linear regression analysis was performed to assess the influence of change in SE and HS on PA levels at follow-up. Age, gender, group, and baseline PA levels were also included as predictors in this model. **RESULTS:** The overall model was significant ($F_{(7,67)} = 5.681, p < 0.001$). Significant predictors were change in SE ($\beta = 0.278, p = 0.039$), HS ($\beta = 0.296, p = 0.009$), and age ($\beta = 0.247, p = 0.018$). **CONCLUSION:** Our results demonstrate that improving SE and HS may be key contributors to success when using fitness monitors for promoting PA. Interventions utilizing fitness monitors may benefit by including components to improve these constructs.

1360 Board #35 June 1 9:00 AM - 10:30 AM
Accuracy of Fitbit Charge 2 Worn at Different Wrist Locations During Exercise

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Many newly released activity monitors use heart rate measured at the wrist to estimate exercise intensity, however, where the device is placed on the wrist may affect accuracy of the measurement.

Purpose: To determine whether the Pure Pulse technology on the Fitbit Charge 2 will show different heart rate readings when placed on the recommended exercise position compared to the all-day wear position at various exercise intensities.

Methods: Thirty five participants (MEAN \pm SD; 22.0 ± 2.9 yrs; 23.9 ± 2.6 kg/m²; 18 male) consented to participate in a single visit where two Fitbit Charge 2 devices were placed on the non-dominant wrist. Fitbit A was placed 2-3 fingers above the wrist bone. Fitbit B was placed directly above the wrist bone. The treadmill was set at 3 mph with 0% grade. Participants remained at this speed for 4 minutes. Heart rate measurements were taken at the last 10 seconds of each stage from both Fitbits and a polar heart rate monitor (chest strap). The same procedure was followed for 5 and 6 mph. Statistical analyses were performed using IBM SPSS 23.0. A Two-way (speed x location) Repeated Measures ANOVA was used to examine mean differences. Pairwise comparisons with Bonferroni correction were used in post-hoc analysis. Pearson correlations and mean bias between polar heart rate monitor and activity monitors were also calculated for each speed.

Results

Repeated Measures ANOVA found significant differences between speeds ($p < 0.01$) and location ($p < 0.01$), but not for the interaction ($p = 0.234$). Pairwise comparisons indicated significant differences between each speed ($p < 0.01$) and between the polar monitor and Fitbit B ($p < 0.05$), but not between the polar monitor and Fitbit A ($p = 0.608$). Pearson correlations indicated strong correlations between each Fitbit and the polar monitor ($r = .58-.91$; all $p < 0.01$). Mean bias decreased as speed increased for Fitbit A (mean bias bpm \pm SD; -1.1 ± 5.4 ; -1.9 ± 9.5 ; -0.4 ± 6.9 ; -0.3 ± 7.3 for resting,

3mph, 5mph, 6mph respectively) while mean bias for Fitbit B increased as speed increased (-2.8 ± 8.8 ; -3.1 ± 11.1 ; -3.9 ± 14.6 ; -6.7 ± 14.3 for resting, 3mph, 5mph, 6mph respectively).

Conclusion

Wrist-worn heart rate monitors appear to provide values adequate for recreational use, however, following recommended guidelines on wear-position may impact heart rate readings.

1361 Board #36 June 1 9:00 AM - 10:30 AM
Determining the Validity and Accuracy of Multiple Activity Tracking Devices in Controlled and Free-Walking Conditions

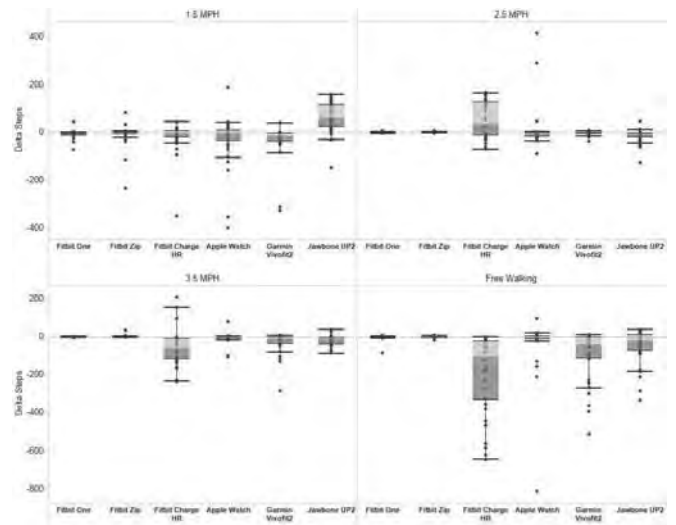
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 (No relationships reported)

Purpose: This study aimed to compare commercially-available activity tracking devices worn at both the hip and on the wrist for step and distance accuracy. Current research has investigated activity tracking devices for step and/or distance accuracy, but few studies have done this level of investigation with the depth and breadth of data collection found in this investigation.

Methods: Thirty-two subjects completed five trials: three treadmill, one free-walking, and one stair climbing activity. The treadmill protocols were five minutes in duration at 1.5, 2.5, and 3.5 mph, respectively. Free-walking trials consisted of a one-mile indoor or outdoor (weather-permitting) walk at a self-selected pace. Stair trials took place indoors, with subjects completing two flights of stairs. Researchers counted steps for all trials and compared hand-calculated steps to device-collected steps.

Results: Please refer to the images uploaded for detailed results.

Conclusions: Hip-based activity tracking devices perform better than their wrist-based counterparts when looking at step and distance accuracy.



	Free Walking (N=32)	1.5 MPH (N=32)	2.5 MPH (N=32)	3.5 MPH (N=32)	Stairs (N=32)
Garmin VivoFit2	-98.06 ± 157.493 (-515, 12)	-37.25 ± 77.126 (-328, 41)	-5.09 ± 8.383 (-38, 7)	-31.66 ± 58.788 (-286, 9)	-4.56 ± 9.069 (-22, 16)
Jawbone UP2	-53.16 ± 90.928 (-332, 39)	64 ± 66.315 (-149, 160)	-16.19 ± 29.141 (-126, 48)	-21.54 ± 27.103 (-85, 38)	-2.19 ± 19.783 (-54, 62)
Fitbit Charge HR	-195.06 ± 207.937 (-645, 1)	-21.81 ± 67.076 (-350, 45)	51.84 ± 78.845 (-71, 167)	-56.28 ± 96.291 (-235, 211)	-3.66 ± 11.932 (-26, 45)
Apple Watch	-39.44 ± 151.813 (-815, 99)	-32.69 ± 107.751 (-401, 188.99)	12.69 ± 93.14 (-90, 417)	-7.56 ± 29.609 (-105, 81)	-4.03 ± 17.73 (-66, 20)
Fitbit One	-2.53 ± 15.498 (-85, 11)	-5.44 ± 17.225 (-73, 44)	0.93 ± 2.403 (-4, 9)	-0.13 ± 1.809 (-4, 4)	-2.09 ± 5.701 (-15, 2)
Fitbit Zip	1.09 ± 5.044 (-19, 10)	-11.25 ± 49.822 (-236, 84)	0.88 ± 2.268 (-2, 9)	2.13 ± 6.399 (-2, 36)	-1.97 ± 4.068 (-13, 2)

Mean difference for each Device by Condition

1362 Board #37 June 1 9:00 AM - 10:30 AM

Test-Retest Reliability of Smartphone Apps While Walking on a Treadmill

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The development of devices that measure physical activity has increased over the last decade. Research is needed to determine the accuracy of these devices at providing useful information that may affect behavior and health.

Purpose: To determine the accuracy and reliability of current smartphone fitness applications at measuring steps while walking on a treadmill. **Methods:** Fifty participants (18-40 years) consented to perform testing on two separate visits. On the first visit participants walked on a treadmill at 3mph for 500 steps, while using a pedometer and 5 smartphone fitness applications: Moves, Google-Fit (G-Fit), Runtastic, Accupedo, and S-Health using an android smartphone placed in the pocket. The second visit was held on a different day and followed the same procedures as the first visit. Zero and negative values were replaced with the mean value for that trial. Mean bias scores were calculated between the step count for each app and the respective tally count for each trial. Mean Absolute Percent Error (MAPE) values were calculated for each app for both trials and mean bias scores were compared between trials for each app using Pearson correlations. Significance was set at $p < 0.05$. **Results:** Fifty participants were included (Mean±SD; Age 22.9±4.3yrs; BMI 24.7±3.8kg/m²; 22 Male). G-Fit recorded 3 zero values and 4 negative values and Moves recorded 1 zero value. Pearson correlation coefficients indicated that step bias between trials was significantly correlated for the pedometer, Runtastic, and S-Health ($r=0.42$, $p < 0.01$; $r=0.507$, $p < 0.01$; $r=0.862$, $p < 0.01$; respectively). Correlations for Moves, G-Fit, and Accupedo were not significant ($r=-0.080$, $p=0.581$; $r=0.125$, $p=0.389$; $r=0.191$, $p=0.184$; respectively). The MAPE values for trial 1 demonstrated that the apps with the smallest deviation from the tally counter were also the ones with best test-retest reliability, with S-Health being the most accurate (bias, MAPE; 2.28 steps, 1.31%) followed by the pedometer and Runtastic (-3.26 steps, 2.86%; -8.02 steps, 3.70%, respectively). Moves, Accupedo, and G-Fit deviated farther from the tally counter. **Conclusion:** Some smartphone fitness applications consistently and accurately measure steps while walking at a normal pace while other apps may have more variation.

1363 Board #38 June 1 9:00 AM - 10:30 AM

<Validity of Wrist-worn Physical Activity Monitors to Measure Heart Rate>

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Numerous physical activity monitors exist and are used to track and improve fitness levels. Due to the increasing popularity of these devices, newer products have been developed that measure heart rate (HR) at the wrist. Little is known about how accurate these devices are at measuring HR at the wrist and how they compare to each other. **PURPOSE:** To determine how accurately HR was measured by three different wrist-worn physical activity monitors.

METHODS: Recreationally active men (n=9) and women (n=3) participated in this study. The average age and weight of participants was 22 ± 3 years and 73.9 ± 12 kg. TomTom Cardio (TT), Fitbit Surge (FB) and Microsoft Band (MB) physical activity monitors were used. The TT, FB, and MB were randomly assigned to the right or left wrist for each participant. The testing procedure included speeds of 2, 3, 4, 5, and 6 mph with each speed lasting three minutes. HR was measured by electrocardiography (ECG) using standard limb lead II and by the three different physical activity monitors. HR was recorded from each device every minute throughout the duration of the procedure. Pearson product moment correlations and bias between electrocardiography (ECG) and physical activity monitors with 95% limits of agreement (Bland-Altman analysis) were calculated. Repeated measures ANOVA [Speed x Device] were also calculated. Statistical significance was set at $p < 0.05$.

RESULTS: At 2 mph and 3 mph, only TT HR was significantly correlated with ECG heart rate ($r=0.693$, $p=0.012$ and $r=0.592$, $p=0.043$). At 4 mph and 6 mph TT was significantly correlated with ECG ($r=0.911$, $p < 0.001$ and $r=0.853$, $p < 0.001$). Significant correlations were calculated between FB and ECG at 4 mph ($r=0.691$, $p=0.013$), 5 mph ($r=0.953$, $p < 0.001$) and 6 mph ($r=0.924$, $p < 0.001$). Only FB had a significantly different HR than the ECG at 2 mph (99 vs 85 bpm, $p=0.037$). The largest mean bias was found between ECG and FB at 2 mph [-13 bpm ± 24 bpm (95% limits of agreement)], while the smallest mean bias was found between TT and ECG [-2 bpm ± 12 bpm (95% limits of agreement)].

CONCLUSIONS: With increasing speeds, physical activity monitors more accurately measure HR but individuals should be aware that these devices may overestimate HR during slower walking speeds.

1364 Board #39 June 1 9:00 AM - 10:30 AM

Effect of Smartphone Carrying Location on Accuracy of Popular Pedometer Apps

Merrill D. Funk¹, Jesus P. Gonzalez¹, Perla Leyva¹, Cindy Salazar², Miriam Garcia², Murat Karabulut¹. ¹University of Texas Rio Grande Valley, Brownsville, TX. ²University of Texas Health Science Center at Houston, Brownsville, TX.
(No relationships reported)

A variety of locations on the body are suggested for where a smartphone should be carried throughout the day to measure physical activity, however, there may be significant differences in daily activity levels depending on where the phone is carried. **PURPOSE:** To determine if smartphone location has a significant impact on the accuracy of popular smartphone pedometer applications at measuring steps while walking on a treadmill. **METHODS:** Fifty-two participants (Mean±SD; 22.9±4.2yrs; 24.8±4.1kg/m²; 22 Male) consented to perform testing on one visit. Participants walked on a treadmill at 3mph for 500 steps, while using a pedometer and 4 smartphones placed in commonly used locations (pocket, armband, waistband, hand). All smartphones were simultaneously running 5 applications throughout the trial: Moves, Google-Fit (G-Fit), Runtastic, Accupedo, and S-Health. Steps were verified using a hand tally counter. Zero, negative, and significant outlier values were replaced with the mean value for that app. A separate one-way Repeated Measures ANOVA was used for each app with the pedometer and tally counter. Significance was set at $p < 0.05$. Pairwise comparisons with Bonferroni corrections were used for post-hoc analysis. Mean bias scores were calculated between the step count for each app and the tally counter. **RESULTS:** Repeated Measures ANOVA's showed significant differences between apps and the step counter for all apps ($p < 0.05$ for all). Using pairwise comparisons, Moves and G-Fit showed significant differences with the tally counter only for the hand ($p < 0.01$). Runtastic showed significant differences with the tally counter for the arm, hand, and waist (all $p < 0.01$). Accupedo and S-Health showed significant differences with the tally counter for the hand and waist ($p < 0.01$). Lowest bias values for each app were as follows: Moves, pocket (mean bias ± SD; 20.0 steps ± 107.8 steps); G-Fit, arm (40.8 ± 109.8); Runtastic, pocket (7.9 ± 36.4); Accupedo, arm (-9.3 ± 71.6); S-Health, pocket (-2.1 ± 17.3). **CONCLUSION:** Using smartphone apps to measure steps at a normal walking pace while carrying the phone in the hand or on the waist may produce significant error, while the pocket seems to be the best location with the arm as another potentially accurate position.

1365 Board #40 June 1 9:00 AM - 10:30 AM

Wristband Physical Activity Monitors Over-Report "Steps" Accumulated During Activities of Daily Living.

Kristina Hasanaj, Lea Haverbeck, Nicole S.C. Bidolli, Michael A. Preston, Rachael K. Nelson. Central Michigan University, Mount Pleasant, MI.
(No relationships reported)

Physical activity (PA) guidelines recommend accumulating 10,000 steps/day through 30 minutes of aerobic exercise (~3,500 steps) and maintaining a physically activity lifestyle (~6,500 steps). The advent of wristband PA monitors has made monitoring steps easier than ever, yet "steps" accumulated with wristband PA monitors may not equal validated pedometer devices. **PURPOSE:** To compare 10,000 steps accumulated during exercise and activities of daily living using a pedometer and wristband PA monitor. **METHODS:** 26 healthy males (n=13) and females (n=13) were recruited for this two-day study. On Day 1 participants completed 30 minutes of exercise on a treadmill at 64-74% of their predicted HRmax wearing a pedometer and wristband PA monitor. Pedometer and wristband PA monitor steps were recorded after exercise and pedometer steps were subtracted from 10,000 to determine the remainder of steps participants needed to accumulate to achieve 10,000 steps. Remaining steps were accumulated by walking on a treadmill at 3 mph and wristband PA monitor steps were re-recorded. Participants were then sent home with a pedometer and wristband PA monitor to assess steps during activities of daily living on Day 2. On Day 2, participants accumulated the same number of pedometer steps achieved on Day 1 (during treadmill walking) while engaging in their normal activities of daily living and wristband PA monitor steps were recorded. **RESULTS:** Participants accumulated significantly fewer wristband PA monitor than pedometer steps during exercise (4016±138 vs. 4306±86 steps; $P < 0.01$) and treadmill walking (5211±126 vs. 5699±86 steps; $P < 0.01$) on Day 1. Consequently, total steps accumulated on Day 1 was significantly lower with the wristband PA monitor than pedometer (9226±188 vs. 10005±2 steps; $P < 0.01$) on Day 1. However, wristband PA monitor steps were significantly greater than pedometer steps during activities of daily living (7125±430 vs. 5512±255 steps; $P < 0.01$) as well as total steps (when combined with exercise) on Day 2 (11134±397 vs. 9818±233 steps; $P < 0.01$). **CONCLUSION:** Wristband

PA monitors are a useful qualitative device to promote/maintain a physically active lifestyle. However, findings from our analysis indicate that quantitatively, wristband PA monitors may over report accumulated steps through activities of daily living.

C-32 Free Communication/Poster - Biomechanics in Ball Sports

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

**1366 Board #41 June 1 8:00 AM - 9:30 AM
Effect of Jaw Pad Thickness on American Football Helmet Performance**

Sean E. Quisenberry, Mark Jesunathadas, Scott G. Piland, Trenton E. Gould. *University of Southern Mississippi, Hattiesburg, MS.*
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(No relationships reported)

Equipping athletes with properly fitted helmets is purported to ensure devices are performing to manufacturer's product claims. Traditional methods of verifying product safety claims are based on linear acceleration measures. A more recent measure, the Summation of Tests for the Analysis of Risk (STAR) rating system, also incorporates linear acceleration weighted at each location by on-field season exposure. However, little research is available linking the influence proper fit may have on the helmet's ability to mitigate impact energy. **PURPOSE:** To investigate whether helmet fit, adjusted by jaw pad thickness, affects an American football helmet's ability to mitigate linear acceleration measures (peak g, STAR). **METHODS:** The fit of nine, new, size large, widely used make and model helmets (3 STAR rated), was manipulated using jaw pads of three different thicknesses (S = 1.65, M = 2.4, and L = 3.5cm). Helmets were fit to a medium National Operating Committee on Standards for Athletic Equipment (NOCSAE) headform and then impacted per guidelines detailed in the STAR rating system. Helmets were impacted twice at 4 locations (front, rear, side, top), and 5 drop heights (0.31, 0.61, 0.91, 1.22, 1.52m). Linear acceleration in the three cardinal planes was measured with a triaxial accelerometer mounted in the center of gravity of the headform (sampling rate 20 kHz). A three-way (thickness x height x location) ANOVA with repeated measures was used to test for differences in vector resultant linear peak g accelerations ($\alpha = 0.05$). **RESULTS:** Statistical differences in resultant linear peak g by location ($F_{3,45} = 43.2, p < 0.01, f = 3.34$), drop height ($F_{1,76.60} = 2720.85, p < 0.01, f = 19.5$), and location*height ($F_{3,9.51} = 27.97, p < 0.01, f = 2.31$) were found. There were no statistical differences for thicknesses (Means \pm SD, S = 75.15 \pm 23.22, M = 76.75 \pm 22.58, L = 78.39 \pm 23.51g, $p = 0.068$), height*thickness ($p = 0.058$), or location*thickness ($p = .124$). STAR values were calculated to be S = 0.43 (3 STAR), M = 0.47 (3 STAR), and L = 0.52 (2 STAR). **CONCLUSIONS:** Jaw pad thickness had no influence on linear acceleration measures. However, application of the thickest jaw pad in our test set-up resulted in a reduction of the advertised STAR rating, from 3 to 2 STARS (Good, Adequate respectively).

**1367 Board #42 June 1 8:00 AM - 9:30 AM
Can an Elbow Brace Change Elbow Valgus Acceleration During Throwing?**

Takahiro Otsudo¹, Hiroshi Hattori², Yutaka Sawada¹, Yu Okubo¹, Kiyokazu Akasaka¹. ¹*Saitama Medical University, Saitama, Japan.* ²*Saitama Medical Center Saitama Medical University, Saitama, Japan.*
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(No relationships reported)

The effectiveness of elbow brace to decrease elbow valgus acceleration during throwing is not clearly identified. **PURPOSE:** To measure the effect of an elbow brace on elbow valgus acceleration during throwing. **METHODS:** Repeated measures were taken of elbow valgus acceleration in 20 college students (16.7 \pm 0.7 yrs) with and without an elbow brace. One acceleration device was fixed to the medial epicondyle of the humerus while another to the distal forearm. All subjects threw 100 balls over a distance of 18.44m consecutively. Valgus acceleration was calculated as the sum of the acceleration of internal rotation of the humerus and posterior rotation of the forearm. Average elbow valgus acceleration (Ave-VA: m/s²) from the 5th to 9th throw (early phase) were compared with the average from the 90th to 94th throw (late phase). Additionally, ball speed (mile/h) and accuracy (percentage strike) were measured. Comparisons of ball speed, strike rate and Ave-VA were conducted using two-way ANOVA with repeated measures. **RESULTS:** All values are presented in time order (early and late phase). Ave-VA with a brace was 652.4 \pm 172.1 and 647.5 \pm 198.2, respectively. Ave-VA without a brace was 842.0 \pm 246.7 and 816.5 \pm 195.5, respectively. These differences were significant ($p < 0.05$). Ball speed with a brace was 63.5 \pm 5.3 and

63.9 \pm 5.0, while ball speed without a brace was 65.2 \pm 4.1 and 65.5 \pm 5.0, respectively which was not significantly different. Strike accuracy with a brace was 47.0 \pm 27.7 and 64.0 \pm 20.1 while with a brace was 52.0 \pm 20.9 and 50.0 \pm 27.1, respectively. There was a significant difference in strike accuracy when comparing early and late phase when wearing a brace ($p < 0.05$). **CONCLUSIONS:** Ave-VA was decreased by wearing an elbow brace during throwing compared with normal throwing. **Acknowledgement:** Supported by a grant from the Faculty of Health and Medical Care, Saitama Medical University (2015-006).

1368 Board #43 June 1 8:00 AM - 9:30 AM

Perceived and Actual Throwing Performance of Quarterbacks While Wearing Soft and Hard Rib Protectors

Marika A. Walker, Kathy J. Simpson, FACSM, Julia C. Dolgetta, Jeremy R. Raiford, Christine O. Samson. *University of Georgia, Athens, GA.*
(No relationships reported)

Football rib protectors could prevent and reduce the severity of injuries, such as fractured ribs, splenic lacerations or kidney injuries. However, athletes often do not wear them, possibly due to perceptions that the equipment hinders performance. It is unclear if quarterbacks' perceptions of rib protectors are consistent with actual performance, dependent on the protector's hardness and different after having worn them while throwing. **PURPOSE:** To determine whether throw performance (ball speed and throw error) outcomes and perceptions are affected by rib protector hardness and whether perceptions change after performing overhand football throws. **METHODS:** Seven males (age: 23.25 \pm 4.41 yr) with competitive quarterback experience (high school varsity to professional) participated. In a counterbalanced order, for each rib protector condition, no protector (NO RIB), soft (SOFT RIB) and hard protector (HARD RIB), the participant completed a 10 cm subjective visual analogue scale (VAS) of their perceived performance ability (10 cm perfect performance) before and after completing 10 single-step drop-back football passes as fast and accurately as possible at a target 9.1 m (10 yd) away. Performance measures of throw error (distance from target center) and ball speed (Bushnell® radar gun) among rib protectors were compared using repeated (RM) ANOVA. For VAS scores (% of 10 cm), RM ANOVA (3 Protector x 2 Time) were used. Significance for all tests was $p < .05$. **RESULTS:** HARD RIB (27.73 \pm 2.83 cm) compared to NO RIB (24.68 \pm 4.59) was greater; SOFT RIB throw error (26.86 \pm 2.81), between NO and HARD RIB values, was nonsignificant. Speed differences up to 0.2 m/s among protectors were nonsignificant. For VAS, protector type but not time was significant. VAS of HARD RIB (78.1 \pm 13.9%) was less than SOFT RIB (87.25 \pm 13.06%) and NO RIB (93.39 \pm 5.61%). **CONCLUSION:** For these athletes, hardness of the hard rib protector negatively influenced their perceived influence of rib protector on throwing performance, but only accuracy actually decreased. Throwing while wearing protectors did not change their perceptions. A non-rigid rib protector could be an acceptable compromise between getting an athlete to wear a protector and having no rib protection at all, but only if the softer protector has been proven to reduce collision forces or injury.

1369 Board #44 June 1 8:00 AM - 9:30 AM

Kinematic Predictors of Ball Velocity and Elbow Varus Torque in Adolescent Baseball Pitchers

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Ulnar collateral ligament injuries in baseball pitchers may be the result of high-magnitude torques generated during the pitching motion. Maximizing ball velocity while simultaneously avoiding excessive elbow torque may improve performance and decrease injury risk in baseball pitchers. The identification of kinematic variables that predict ball velocity and peak elbow varus torque may assist in developing efficient pitching mechanics. **PURPOSE:** To identify the kinematic factors during a baseball pitch associated with ball velocity and peak elbow varus torque in adolescent male baseball pitchers. **METHODS:** Twenty male baseball pitchers (15.3 \pm 1.3 years; 78.9 \pm 21.1 kg; 177.0 \pm 21.1 cm) pitched three fastballs from the windup while undergoing three-dimensional motion analysis with a ten camera motion capture system, collected at 480 Hz. Ball velocity was simultaneously captured using a radar gun. Elbow varus torques were normalized to body weight and height. Six kinematic pitch variables were analyzed: trunk forward lean range of motion (ROM) between maximum stride leg knee height and stride foot contact (stride phase), trunk forward lean ROM between stride foot contact and maximum glenohumeral external rotation (GHER) (cocking phase), stride leg sagittal knee angle at stride foot contact, trunk rotation at stride foot contact, stride length, and contralateral trunk lean at GHER. A multivariate linear

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regression model was constructed for the purpose of this study. Outcome variables were ball velocity and peak elbow varus torque. Kinematic pitch variables were the predictor variables.

RESULTS: Statistically significant predictive models were found for ball velocity ($R^2=0.30$; $p=0.003$) and peak elbow varus torque ($R^2=0.52$; $p<0.001$). Significant predictors of ball velocity included trunk forward lean ROM during the cocking phase ($\beta=0.22$, 95% CI [0.02, 0.43], $p=0.04$) and stride length ($\beta=0.30$, 95% CI [0.09, 0.50], $p=0.005$). Significant predictors of peak elbow varus torque included trunk rotation at stride foot contact ($\beta=-0.01$, 95% CI [-0.02, -0.01], $p<0.001$) and stride length ($\beta=0.05$, 95% CI [0.02, 0.07], $p<0.001$).

CONCLUSIONS: Greater stride lengths are associated with greater ball velocities and greater peak elbow varus torques in adolescent male baseball pitchers.

1370 Board #45 June 1 8:00 AM - 9:30 AM

Electromyographic Analysis Of The Elbow And Forearm In The Overhead Football Throw

Scott Winnier¹, Jarrod Smith², Adam Anz², Roger Ostrander², Lonnie Douglas², James Andrews². ¹Independent Research, Pensacola, FL. ²Andrews Institute, Gulf Breeze, FL.

(No relationships reported)

Purpose: This study was to describe the muscle activation patterns of the elbow and forearm during the overhead football throw. The hypothesis was that the unique grip and obligatory pronation upon ball release will cause the elbow and forearm muscles to have a unique activation pattern during the overhead football throw. **Methods:** IRB approval was obtained. Electromyographic (EMG) and motion capture data was collected on 8 male quarterbacks. An EMG data was collected at 1200 Hz with 9 surface electrodes. The signals were normalized to maximal voluntary contraction (MVC) values for each subject. EMG sensors were placed on the biceps, triceps, brachialis, brachioradialis, anconeus, extensor digitorum communis, flexor digitorum superficialis, pronator teres, and pronator quadratus. A 13 camera Vicon motion capture system measuring at 240 Hz with a full body marker set of 39 retro-reflective 9mm markers was used. The throwing motion was divided into four events: early cocking, late cocking, acceleration, and follow through. **Results:** All athletes had NCAA experience and were aged 18-30 years old. The anconeus (26.9%, 36.3%, 57.6%, and 105.8% MVCs), extensor digitorum communis (22.7%, 28.0%, 31.0%, and 42.8% MVCs), and flexor digitorum superficialis (19.4%, 39.3%, 22.3%, and 104.7% MVCs) had high levels of activity throughout all phases of the football throw. The brachioradialis (56.8%MVC) and anconeus (57.6%MVC) were the most active muscles during the acceleration phase. The pronator teres (78.4%MVC), pronator quadratus (90.9%MVC), and flexor digitorum superficialis (104.7% MVCs) have very high levels of activation during the follow through phase. **Conclusion:** High levels of activity of the anconeus suggest that it functions as a dynamic stabilizer during all phases of the throwing motion. High levels of activity of the extensor digitorum communis and flexor digitorum superficialis suggest that they are important for grip. The pronator teres and pronator quadratus are important at ball release to produce a spiral motion of the football. High activity of the medial sided musculature may impart dynamic stability to the elbow. These findings may explain why quarterbacks have a lower rate of UCL injury and a higher return to play without surgery.

1371 Board #46 June 1 8:00 AM - 9:30 AM

Changes In Functional Movement Patterns And Injuries For In-season Division III Women.

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(No relationships reported)

Athletes achieve high-level performances utilizing dysfunctional movement patterns that can increase an athlete's injury risk. Little is known about how movement patterns change during the competitive season with or without corrective intervention.

PURPOSE: To compare the functional movement patterns of Division III (D3) women's (S) and volleyball (V), and how those movement patterns are affected during a single competitive season.

METHODS: 17 S (19±0.3 yo) and 14 V (19.2± 0.4 yo) D3 players volunteered for the study. Injury history was obtained before the season and then after. FMS testing and 3-site % body fat (%BF) skinfold analysis were performed 1-wk prior to in-season, twice in-season, and 1-wk post season. After pre-season FMS, teams were split into matched pairs and allocated to either a corrective exercise (CE) or sham (SH) exercise group. CE groups were prescribed exercises to improve specific FMS issues after the first in-season re-test. Repeated measures ANOVA with post-hoc Tukey were run comparing differences within and between sports at each time period. Pearson correlations were run to examine the relationships between the FMS and %BF. All data were expressed as mean + se, and all significance levels were set at $\alpha=0.05$.

RESULTS: Pre-season FMS showed that S players scored significantly higher (Tukey $p < 0.05$) in Squat (Sq) 1.7 + 0.2 vs 1.2 + 0.2, Hurdle (Hd) 1.8 + 0.2 vs 1.1 + 0.18,

and leg raise (ASLR) 2.59 + 0.14 vs 1.8 + 0.16 scores, but lower in Lunge (Ln) 1.4 + 0.2 vs 2.1 + 0.2 and Push-up (PU) 1.3 + 0.1 vs 1.9 + 0.2. Total scores (S 12.9 + 0.6 vs V 12.3 + 0.6) did not differ. After 4-wk, S improved ($p < 0.05$) Ln 2.4 + 0.2, PU 2.2 + 0.1, and Total scores 15.5 + 0.5, while V scores failed to improve. %BF appears to negatively impact FMS scores ($r = -0.36$, $p=0.0447$). Injury rates were not available, but S reported engaging in a structured strength training program.

CONCLUSION: There appears to be significant disparities in FMS scores among D3 women. Initial in-season 4-wk improvement was only seen in S players with all scores trending higher. A plausible conclusion is that the structured strength training program by S, compared to no training for V, accounted for these differences. The negative relationship between %BF and lower FMS scores supports prior research that increased BF limits movement quality and increases risk for injury.

1372 Board #47 June 1 8:00 AM - 9:30 AM

Kinematics of the Handball Power Serve

Andrew Anderson, Adam Coronado, Tim R. Anderson, Mark Baldis, Jacobo Morales. CSUFresno, Fresno, CA.

(No relationships reported)

Handball is a court sport practiced by recreational and competitive athletes to develop speed, agility, power, muscular endurance, ambidexterity, and similar skills and components of fitness. Handball is a paragon of the principle of generality/cross transfer; it develops skills and fitness which directly transfer to many team, individual sports and physical activities. The elemental nature of handball (no external implements) emphasizes the importance of biomechanics; only the kinetic chain influences and contributes to interactions with the ball. Despite the elemental, minimalistic mechanics of handball, research regarding biomechanics of performance is scarce. **PURPOSE:** To determine transverse plane angular velocity of hip and shoulder rotation and resultant linear velocity of the ball associated with the power serve. **METHODS:** Eighteen handball players competing at the B-class level or above (4 professional, 2 qualifiers, 4 open, 5 A and 3 B) provided informed consent and were videotaped in the transverse and sagittal plane while performing 10 power serves. Vicon Motus 9.2 software was used to quantify peak hip (HAV) and shoulder (SAV) angular velocity in the transverse plane, and peak resultant linear velocity of the ball (RVB). **RESULTS:** HAV ranged from 3.2 to 12.3 rad·s⁻¹ in individual players; grand mean = 8.13 rad·s⁻¹. SAV ranged from 10.5 to 18.4 rad·s⁻¹ in individual players; grand mean = 13.98 rad·s⁻¹. RVB ranged from 25.5 to 36.7 m·s⁻¹ in individual players; grand mean = 29.4 m·s⁻¹. To evaluate sequentially accumulated angular velocity within the kinetic chain, the proportion of serves in which HAV preceded SAV were tallied, and ranged from 30% to 100%; grand mean = 72.2%. SAV was more strongly related to peak ball velocity ($r=.205$; $p<0.05$) than was HAV ($r=.139$; $p>0.05$). Players in higher competitive divisions exhibited faster ball velocity and angular kinematics, and more effective timing within the kinetic chain. **CONCLUSIONS:** Angular kinematics, linear ball velocity and kinetic chain sequence and timing of the handball serve were comparable to those reported for throwing sports. The experience, practice and playing time necessary to achieve higher competitive status in handball were related to faster angular kinematics and linear ball velocity, and more effective timing within the kinetic chain.

1373 Board #48 June 1 8:00 AM - 9:30 AM

Agility K-test In Adolescent Soccer Players As Function Of Age

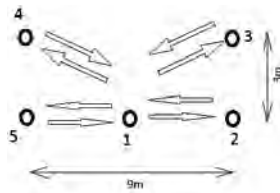
Lee Cabell¹, Frantisek Zahalka², Tomas Maly², Lucia Mala². ¹Seton Hall University, South Orange, NJ. ²Charles University, Prague, Czech Republic.

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(No relationships reported)

Performance relative to age differences in a new Agility K-test (Cabell, 2015, 2016) required testing among three age groups. **PURPOSE:** To compare agility times in the Agility K-test among the three age groups. **METHODS:** Late adolescent male soccer players ($n = 56$) volunteered in the study and were divided into three groups (age = 16 years, $n_1 = 26$; age = 17 years, $n_2 = 14$; age = 19 years, $n_3 = 16$). The Agility K-test consisted of the subjects running at maximum speed between cones positioned in a "K" pattern at an indoor gym with hardwood flooring. The subjects started and ended running at the intersection of the "K" pattern. A contact switch for time measurement was placed on the top of each cone which subjects touched with the right or left hand. The subjects performed two trials with a 10-minute rest in between repetitions of the Agility K-test, and the time of test execution was measured in seconds. The difference among the age groups were statistically analyzed with the Kruskal-Wallis test and pair-wise comparison Mann-Whitney U test as a post-hoc test. $P < .05$. **RESULTS:** The subjects achieved a time of $n_1 = 11.14 \pm 0.26$ s, $n_2 = 12.96 \pm 0.69$ s, $n_3 = 10.87 \pm 0.32$ s in the Agility K-test. There was an increase in agility time from 16 to 17 years of age (16.44%), and a decrease in agility time from 17 to 19 years of age (19.22%). There was a significant difference among the groups, $K(2, n = 56) = 34.23$, $p < .001$, $\eta^2 = 0.81$. The post hoc tests showed a significant difference between 16-17 years, $Z = -5.16$, $p < .001$; 17-19 years, $Z = -4.66$, $p < .001$; 16-19 years, $Z = -2.43$, $p < .05$.

CONCLUSION: The results indicated significant differences in Agility K-tests among late adolescent soccer players. The results may be beneficial for strength and conditioning coaches, physical therapists, and other clinical and sports science staff in amateur soccer as a useful set of reference values for comparison with subjects of particular ages.



1374 Board #49 June 1 8:00 AM - 9:30 AM
Dynamic Trunk Stability During A Step-down Task In Baseball Players
 Adam J. Barrack¹, Yunae Lee¹, Hillary A. Plummer¹, Bernard Li², Lori A. Michener¹. ¹University of Southern California, Los Angeles, CA. ²Los Angeles Angels of Anaheim, Anaheim, CA. (Sponsor: Gretchen Oliver, FACSM)
 (No relationships reported)

Trunk stability is critical for the transfer of energy from the lower extremity to upper extremity during throwing. Defining lower extremity kinematics during dynamic tasks will enable understanding of their contribution to trunk stability. **PURPOSE:** To examine the effects of trunk stability on lower extremity kinematics during a step-down task (SDT). **METHODS:** Professional baseball players (n=70; 22.6 ± 2.2 years; 91.8 ± 9.9kg; 185.8 ± 6.6cm) volunteered. A SDT was performed on their lead leg from a 20.3cm box, lowering their contralateral heel to the ground and then returning to the starting position. Participants were filmed in the frontal and sagittal planes. Data were analyzed at heel strike using Dartfish. Trunk stability was defined as 'poor' when trunk motion (sum of trunk flexion and lean) was >24.9°, the median of the sample. 'Good' stability was defined as <24.9°. A one-way ANOVA was performed to determine if kinematics were different between participants with poor and good trunk stability. Pearson Product correlations characterized the relationship between trunk motion and lower extremity kinematics. **RESULTS:** See Table 1. Knee flexion (p=0.04) and hip flexion (p=0.03) were significantly greater in participants with good trunk stability. Significant negative correlations between trunk motion and knee (r=-0.323) and hip flexion (r=-0.360) were observed. **CONCLUSION:** Participants with poor trunk stability had significantly less knee and hip flexion during the SDT. Correlations indicate that as lower extremity motion decreases, trunk stability decreases. Deficits in knee and hip motion may have contributed to trunk instability, or they are a compensation strategy for the increased trunk motion in those classified with poor trunk stability. Research is needed to assess the impact of altered lower extremity kinematics and trunk stability on energy transfer during throwing.

Table 1. SDT data in participants with good and poor trunk stability. Mean (SD).

Trunk Stability	Ankle Dorsiflexion	Knee Flexion	Hip Flexion	Knee Valgus	Pelvic Drop
Good	45.6 (3.8)	100.5 (4.5)*	119.9 (15.1)*	7.4 (8.6)	7.1 (3.4)
Poor	46.9 (3.2)	98.2 (4.8)*	112.2 (13.5)*	9.5 (8.0)	6.9 (3.0)

1375 Board #50 June 1 8:00 AM - 9:30 AM
Self-reported Measures Of Fatigue during Golf Performance
 McKenna Benson, Michael Decker, Casey Myers, Craig Simons, Kevin Shelburne, Bradley Davidson. University of Denver, Denver, CO.
 (No relationships reported)

PURPOSE: To determine the influence of directional compression core shorts on self-reported measures of pain and fatigue and maximum driving distance during repeated, maximum-effort golf drives. **METHODS:** Nine participants with an average PGA handicap of 1.2 (range: 0 to 3) performed 52 drives on an outdoor driving range: 12 practice drives, 20 drives with a driver, 20 drives with a 6 iron. Half of the drives were performed while wearing directional compression core shorts (DCP). Visual analog scores (VAS, 150 mm) for low back pain (LBP), low back muscle fatigue (LBF), quadriceps fatigue (QF) and total fatigue (TotF) were measured at the beginning and end of each 26 trial condition (none, DCP). A launch monitor was used to measure carry distance. Two-way repeated measures ANOVA were computed to contrast the VAS (compression (none, DCP); time (pre, post)) variables. Carry distance was measured with a launch monitor and the maximum carry distance was contrasted with a repeated measures ANOVA between conditions for each club. The coefficient

of variation and Cronbach's Alpha were computed to determine the reliability of carry distance for each club (driver, 6 iron) and condition (none, DCP). **RESULTS:** Significant time by compression statistical interactions were found for LBF (p=.019), QF (p=.046) and TotF (p=.033). The pre-to-post change in these variables were 57%, 75%, and 57% lower during the DCP condition for LBF (none, 14.6 ± 10.9%; DCP, 6.2 ± 8.0%), QF (none, 7.9 ± 9.6%; DCP, 2.0 ± 4.8%) and TotF (none, 14.9 ± 12.0%; DCP, 6.4 ± 8.7%). Maximum carry distance was not different between conditions for the 6 iron (p=.777; none, 268.6 ± 14.6 yards; DCP, 268.0 ± 17.1 yards) or driver (p=.916; none, 183.0 ± 9.4 yards; DCP, 183.1 ± 9.1 yards). Reliability for the 6 iron drives were .881 and .976 for none and DCP conditions whereas the driver drives were .962 and .975, respectively. The coefficient of variation measurements were 5.6 ± 4.0% and 4.4 ± 1.5% for the 6 iron drives during the none and DCP conditions whereas the variation for the driver drives were 2.8 ± 0.9% and 2.8 ± 1.3%. **CONCLUSION:** Directional compression core shorts improved self-reported measures of low back, quadriceps and total body muscle fatigue but did not influence carry distance when performing golf drives with a 6 iron or driver.

1376 Board #51 June 1 8:00 AM - 9:30 AM
Kinematic Differences Shooting Motion in Professional Lacrosse Players: Key Anatomical Sites for High Stress Risk
 Heather K. Vincent, FACSM, Trevor Leavitt, Joseph Wasser, Cong Chen. University of Florida, Gainesville, FL.
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 (No relationships reported)

PURPOSE: Lacrosse offensive players emphasize ball speed during shooting to maximize the chance for scoring. Attackmen shoot from near the goal whereas the midfielders tend to shoot from farther away from the goal. It is unclear, however, whether specific features of high-speed shooting motion of these two positions differ and place certain anatomical sites at higher risk for high tissue stresses and injury. The purpose of this study was to compare kinematics of shooting motion in men's professional midfielders and attackmen. **METHODS:** Fifteen male players (5 midfielder, 10 attackmen) from a professional team participated in this experimental study. Three dimensional motion capture system was used to collect overhead shooting motion in sagittal, frontal and transverse planes. The shot cycle was defined as the time from lead foot contact (0% of throw) to the ball release (100% of throw). Pelvis, torso, shoulder and crosse angular velocities were determined. Joint and trunk angles at FC and BR were calculated. The range of motion (ROM) during the throw cycle of the different joint and segment motions were found. The 'X-Factor', was calculated as the angle of shoulder-to-pelvis crossover. **RESULTS:** Ball speed was higher in the midfielders than attack (149.7 km/h versus 134.2 km/h; p=0.021). Maximal torso and shoulder angular velocities were greater in the midfielders than attack by 17.3%-31.8% (p<0.05). The timing of maximal angular velocity tended to be later in midfielders (maximal velocity occurred at 76% versus 60% in attackmen; =p=0.058). Pelvic anterior tilt in the sagittal plane during the shot cycle was greater in the midfielders than attackmen (p<0.05). Attackmen demonstrated less shoulder-to-pelvis crossover at follow-through than midfielders in the transverse plane (40.0 6.4 vs 58.1 14.0; p=0.004). **CONCLUSION:** Positional differences exist in shooting motion between offensive players. Midfielders shoot to generate relatively higher rotational velocities of the upper body and anterior pelvic tilt than attackmen in order to achieve the ball speed needed to score from a farther distance. The high-speed rotation and tilt differentials about the spine in midfielders may place high stress and risk for injury in the tissues surrounding the low back.

1377 Board #52 June 1 8:00 AM - 9:30 AM
Axiomatic Movement And Dynamic Balance Disparities Between Varying Competition Levels In Golfers
 Garrett S. Bullock¹, Christopher R. Harnish², Amy M. Knab³, Sean Krysak³, Ariel Blount³. ¹Duke University, Durham, NC. ²Ferrum College, Ferrum, VA. ³Queens University of Charlotte, Charlotte, NC.
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 (No relationships reported)

Deficiencies in fundamental movement patterns and dynamic balance have been shown to increase injury risk, and that movement testing is proportional to competitive skill level. Golf has a high prevalence of injuries, but little research on the relationship between movement patterns and injuries exists. **Purpose:** To examine differences in axiomatic movement patterns and dynamic stability in different competition levels in golfers. **Methods:** 72 golfers were recruited across several regional middle and high schools (SCHOL; n= 40), and division I, II, and III colleges (COL; n=32). Each group performed the seven-test functional movement screen (FMS), and the upper (UQ) and lower quarter Y-balance tests (YBT-LQ). Limb lengths were normalized to percent limb length (%LL). Statistical analyses were run using students T-tests comparing test results with competition level (p<.05).

Abstracts were prepared by the authors and printed as submitted.

Results: COL golfers exhibited greater UQ (medial: 95.2 vs. 86.6 %LL, $p < .0001$; inferolateral: 94.8 vs. 88.6 %LL, $p = .0007$; superolateral: 72.1 vs. 64.5 %LL, $p < .001$); and LQ (anterior: 77.0 vs. 68.6 %LL, $p < .001$; posteromedial: 117.4 vs. 104.7 %LL, $p < .001$; posterolateral: 116 vs. 97.2 %LL, $p < .001$) dynamic balance compared to SCHOL. COL athletes displayed greater proficiency in the lunge (COL: 1.81 ± 0.11 , SCHOL: 1.44 ± 0.12 ; $p = .0163$), hurdle step (COL: 1.88 ± 0.09 , SCHOL: 1.59 ± 0.10 ; $p = .0167$) and active straight leg raise (COL: 2.38 ± 0.10 , SCHOL: 2.07 ± 0.11 ; $p = .0207$), and a greater composite score (COL: 13.7 ± 0.54 ; SCHOL: 12.44 ± 0.52 ; $p = .0293$) compared to SCHOL.

Conclusions: COL level golfers had better proficiency in UQ and LQ dynamics stability, individual movement patterns that involved unilateral stance, and overall movement ability compared to SCHOL. These data support the premise that movement quality improves with increased competitive level among golfers. These data may also help establish functional movement and dynamic stability normative values for golfers of different competition levels.

1378 Board #53 June 1 8:00 AM - 9:30 AM

Are Indian Cricket Fast Bowlers At Risk Of Injury? - A 3d Biomechanical Investigation

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(No relationships reported)

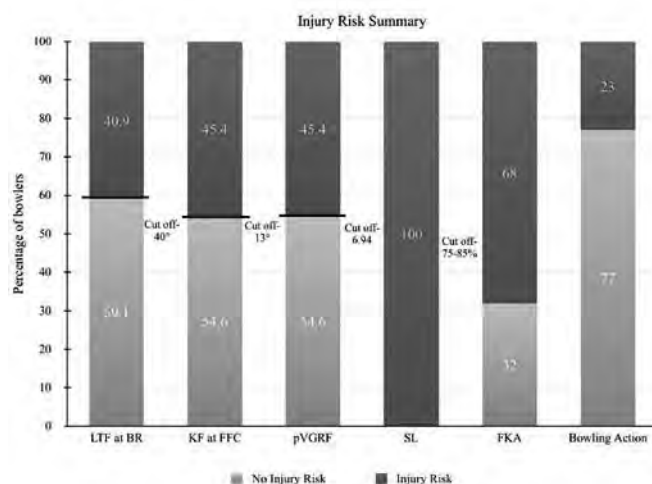
Cricket is the most commonly played and followed sport in India. Modern day Cricket demands a high level of performance from the fast bowler who obviously carries the highest risk for injury. 3D motion analysis could be used to prevent injuries by identifying incorrect techniques. Researchers have identified certain key biomechanical variables as predictors of injury in fast bowlers apart from other factors like bowling workload and on-field injuries. Very little such information is available with respect to Indian Cricket fast bowlers despite the huge popularity of the sport here.

PURPOSE: To identify injury risks in Indian fast bowlers with respect to key biomechanical variables, using 3D motion analysis.

METHODS: 22 male fast bowlers from state & division level Cricket teams between ages 18-30 years underwent 3D motion analysis in a Cricket Biomechanics testing facility. The bowling action was captured with a set of 3D cameras (250fps) and 2D video cameras (125fps). Key biomechanical variables including Delivery Stride Length (SL), Lateral Trunk Flexion at Ball Release (LTF at BR) and Knee Flexion at Front Foot Contact (KF at FFC) were measured. Peak Vertical Ground Reaction Forces (pVGRF) were recorded simultaneously using Force Plates. Data processing & analysis was done with proprietary software using a standard model. Descriptive statistical analysis of results was done.

RESULTS: A large proportion of the study population were at risk of injuries (100% had less than optimum SL, 41% had high LTF at BR, 45% had high pVGRF and 45% had lower KF at FFC). Bowling Action Type was found ideal or acceptable in 77%.

CONCLUSION: Indian Fast Bowlers, in spite of possessing ideal to acceptable bowling action types, are vulnerable to injury with respect to key biomechanical variables.



C-33 Free Communication/Poster - Biomechanics of Cycling

Thursday, June 1, 2017, 7:30 AM - 12:30 PM

Room: Hall F

1379 Board #54 June 1 9:00 AM - 10:30 AM

Front Suspension Does Not Increase Mechanical or Metabolic Power Requirements during Uphill Bicycling

Todd M. Carver¹, Asher H. Straw², Jesse H. Frank², Tyler S. Kraus³, Wouter Hoogkamer². ¹Specialized Bicycle Components Inc., Boulder, CO. ²University of Colorado Boulder, Boulder, CO. ³Specialized Bicycle Components Inc., Morgan Hill, CA. (Sponsor: William Byrnes, FACSM)

Reported Relationships: T.M. Carver: Salary; Specialized Bicycle Components Inc.

Riding bicycles with rigid frames on rough roads leads to fatigue and discomfort. In response to this problem, manufacturers have begun designing road bicycles with suspension systems. However, suspension systems intrinsically dissipate mechanical energy, which may impose a metabolic penalty. Suspension losses may be greatest for riding uphill in a standing position.

Purpose: To quantify the effects of a novel front suspension system on the mechanical and metabolic power requirements during steep uphill bicycling.

Methods: 11 males (74.9kg) rode six 5-min trials at 3.35 m/s uphill (4.0°) on a large motorized treadmill in both sitting and standing positions using their preferred gear ratio/cadence. They wore a helmet and metabolic mouthpiece (1.05kg combined) and rode the same road bicycle (9.02kg) with the suspension in rigid and compliant configurations. The suspension system comprises a spring-loaded steering tube that allows for vertical travel of the handlebars. We equipped the bicycle with a crank-based power meter and video recorded the axial displacement (ΔL) of the steering tube relative to the frame headtube. From the video measurements of ΔL (m) and knowing the stiffness k (N/m), we calculated the mechanical power put into the suspension system: mechanical power (watts) = $k \Delta L^2 2f$, where, f = cadence in rev/s. We averaged $\dot{V}O_2$ and $\dot{V}CO_2$ for the last 2 min of each trial and calculated metabolic power.

Results: For the rigid and compliant conditions, mechanical power was the same (2.85 ± 0.05 W/kg) while sitting ($p = 0.71$) and not different for standing: 2.86 ± 0.03 W/kg vs. 2.87 ± 0.05 W/kg respectively ($p = 0.51$). Metabolic power for sitting was 13.11 ± 0.56 W/kg rigid vs. 13.21 ± 0.57 W/kg compliant ($p = 0.23$). For standing, metabolic power was 14.23 ± 0.76 W/kg and 14.15 ± 0.84 W/kg respectively ($p = 0.45$). Power losses in the suspension while sitting 0.01 ± 0.004 W/kg, and standing 0.03 ± 0.01 W/kg, were $< 1.05\%$ of total mechanical power.

Conclusion: The steering tube suspension system did not require significantly more mechanical or metabolic power compared to riding with the suspension rigidly locked out.

Supported by a gift from Specialized Bicycle Components Inc.

1380 Board #55 June 1 9:00 AM - 10:30 AM

Knee Joint Angle Variability Does Not Differ Between Healthy and Knee OA Participants during Cycling

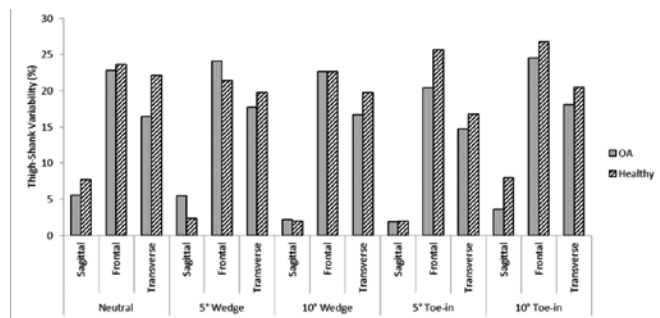
Jacob K. Gardner¹, Kristyne Wiegand², Julia Freedman Silvernail². ¹Biola University, La Mirada, CA. ²University of Nevada, Las Vegas, NV.

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(No relationships reported)

Stationary cycling is commonly prescribed for people with knee osteoarthritis (OA) yet anecdotal evidence suggests that for many patients, cycling tends to aggravate knee symptoms which may reduce the likelihood of cycling participation. To date, very little research has been conducted on cycling with knee OA participants and it is unclear if, and to what extent, individuals with OA cycle differently than individuals without OA. Coordination variability measures can be used to assess how an individual alters their movement from one repetition to the next, where greater variability is reflective of a healthy system. Therefore, it is possible that knee joint variability differences may exist among these populations. **Purpose:** To investigate differences in knee joint (thigh-shank) variability among healthy and knee OA participants during stationary cycling. **Methods:** Thirteen participants with medial knee OA (age: 56.8 yrs., mass: 83.2 kg) and 11 healthy participants (age: 50.0 yrs., mass: 80.17 kg) cycled for 2 minutes at 60 rpm and 80 Watts in 5 testing conditions: neutral, 5° and 10° of toe-in foot progression angle, and 5° and 10° of eversion angle. Five consecutive crank cycles in each condition was recorded. A custom vector coding program was used to calculate thigh-shank coupling variability during two phases: 0-50% of the pedal cycle and 50-100% of the pedal cycle. A 2 x 5 (group x condition) ANOVA was used to assess differences in knee joint variability. **Results:** No group or condition differences were found for any of the 3 planes of motion (all p -values > 0.05). Figure 1 indicates variability across all conditions, planes, and groups for the first 50% of the cycle only.

CONCLUSION: These findings suggest that OA participants do not display different knee angle variability by condition or compared to healthy participants. Thus, OA symptoms during cycling associated with individuals with knee OA are likely not a result of knee angle variability.



1381 Board #56 June 1 9:00 AM - 10:30 AM

Are Frontal Plane Knee, Hip And Trunk Kinematics Associated With Cycling Power In Trained Cyclists?

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(No relationships reported)

In cycling, increased power output at the pedal results in increased speeds (1). Pedal power output is primarily generated by the muscles spanning the trunk, hip, knee, and ankle and is a result of the summation of angular power produced from all lower extremity joints (2, 3). To our knowledge, non-sagittal kinematic variables have not been studied with respect to power production in cycling. **PURPOSE:** To assess the relationship between frontal plane knee, hip and trunk kinematics during maximal seated and standing cycling with average and peak power generation in trained cyclists. **METHODS:** Seventeen trained male cyclists (39.1±7.8yrs; 1.82±0.07m; 80.8±9.2kg) completed a 15min warm-up followed by two, seated or standing (i.e., off the saddle), 3min cycling bouts at 80% of their maximal power output in a randomized order. Maximal power output was measured during 30s maximal cycling efforts during the warm-up. In the last 20s of the 3min cycling bouts, cyclists were asked to perform a maximal-effort sprint at 90-110rpm (4). During these bouts, knee, hip, and trunk 3D kinematics were collected using a motion capture system (240Hz, Qualisys, Sweden). Average and peak pedal power (W) was also collected (Vector, Garmin, USA) during these maximal efforts. All cycling testing was performed on the participants' own bicycle fixed to a stationary trainer that allows side-to-side motion (Rock and Roll, Kurt Kinetic, USA). Pearson's *r* correlation coefficients between frontal plane joint angular positions and cycling power were computed ($p \leq 0.05$). **RESULTS:** Seated average and peak powers were 701±91 W and 875±158 W while standing average and peak powers were 728±88 W and 897±130 W, respectively. Hip abduction excursion during the down stroke of standing cycling was positively correlated with power ($r = 0.53, p = 0.028$). No other frontal plane kinematic variables were significantly correlated with peak or average power during seated (range $r = 0.029$ to 0.24) or standing (range $r = 0.031$ to 0.25) maximal cycling ($p > 0.05$). **CONCLUSION:** These findings suggest that hip abduction excursion may play a role in maximal standing power generation during cycling. Greater abduction excursion may indicate increased contributions of hip abductor muscles and future studies should assess muscle activation of hip abductors as a predictor of cycling power.

1382 Board #57 June 1 9:00 AM - 10:30 AM

Fatigue Induced Changes of the EMG Profile of Select Lower Extremity Muscles in Competitive Cyclists

Gabriela Narowska, Juan Garbalosa, Karen Myrick, Zachary Friedenreich, Thomas Martin. *Quinnipiac University, Hamden, CT.*
(No relationships reported)

PURPOSE: To determine the effect of fatigue on the median frequency (MF) and amplitude (AMP) of select lower extremity muscles in competitive cyclists. **METHODS:** Five category 4 or above cyclists (29.6 yrs ± 16.0) were recruited for this pilot study. Data collection consisted of 2 sessions. At session one, the subject's maximum work load (MWL) was determined during an incremental cycling test. At session two, EMG activity of the rectus femoris (RF), vastus medialis (VM) and lateralis (VL), semitendinosus (ST), biceps femoris (BF), gastrocnemius (GS), tibialis anterior (TA) and gluteus maximus (GM) were recorded bilaterally at 2400 Hz using surface electrodes during a fatigue protocol. The fatigue protocol consisted of a 4-minute warm-up at 55% of their MWL followed by 5, alternating efforts at

90% and 55% of their MWL for 1 and 2-minutes respectively. This was followed by a continuous cycling effort at 90% of their MWL until fatigue (pedaling rate < 80 RPM). For each muscle, the EMG data were band pass filtered and the MF was determined using a time-frequency analysis based on power spectra estimation (short-time Fourier transform). The average MF and average peak AMP was calculated for each trial. The average change in MF and average peak AMP from the 1st trial to the fatigue trial for each muscle were calculated. **RESULTS:** The average MF for the RF, VM, VL, ST, BF, and TA increased by 3.0, 3.4, 5.8, 4.2, 1.2, and 0.6 %, respectively from trial 1 to the fatigue trial while the MF for the GM and GS decreased by 7.3 and 5.8%, respectively. The average peak AMP for the RF, VM, VL, ST, BF, and GM increased by 44.9, 27.5, 23.4, 18.6, 38.3, and 51.6%, respectively while the average peak AMP for the TA and GS decreased by 2.0 and 6.3%, respectively. **CONCLUSION:** According to Luttmann et al's (1996) joint analysis of EMG spectrum and amplitude theory, the quadriceps (RF, VM, VL) and hamstring (BF, ST) muscles demonstrated an increase in force production, while the GS and TA exhibited a decrease force production during fatigue. Only the GM exhibited a classical fatigue pattern of activity (decrease MF, increase AMP). These results suggest that in the current testing paradigm both central and peripheral fatigue may be contributing to the inability to maintain pedaling rate. Funding was provided in part by the 2016 NEACSM Undergraduate Research Experience Grant.

1383 Board #58 June 1 9:00 AM - 10:30 AM

Measuring Mechanical and Metabolic Power during Uphill Treadmill Cycling

Asher H. Straw¹, Jesse H. Frank¹, Bryant T. Pham¹, Todd M. Carver², Wouter Hoogkamer¹. ¹University of Colorado Boulder, Boulder, CO. ²Specialized Bicycle Components Inc., Boulder, CO. (Sponsor: William Byrnes, FACSM)

Reported Relationships: A.H. Straw: Contracted Research - Including Principle Investigator; Specialized Bicycle Components Inc.

Stationary cycle ergometers are useful, but they do not accurately mimic riding uphill, nor the balance or lateral rocking movements involved in overground bicycling. It is possible to study overground bicycling, however, variations in wind (air resistance), velocity, incline, and road surface (rolling resistance) can be confounding. Bicycling on an inclined treadmill may offer a realistic and controlled simulation of overground conditions, albeit without air resistance. **Purpose:** To compare and verify mechanical and metabolic power measurements during uphill treadmill bicycling in both sitting and standing positions.

Methods: 11 males (74.93 ± 2.16 kg) rode six 5-min trials of uphill (4.0°/7.0%) bicycling on a large motorized treadmill (3.2m x 0.9m), in both sitting and standing positions at a velocity of 3.35 m/s (7.5MPH). Subjects used their preferred gear ratio/cadence combination. All subjects wore a helmet and metabolic mouthpiece (1.05kg combined) and rode the same rigid-framed road bicycle (9.02kg) equipped with a crank-based power meter and a pedal-based power meter. We calculated gravitational power from $m \cdot g \cdot v \cdot \sin(\text{incline angle})$ where m = mass of rider + bicycle in kg, g = 9.81m/s², v = treadmill velocity in m/s. We empirically measured rolling resistance power, summed the gravitational and rolling resistance powers and assumed 2% transmission loss. We averaged $\dot{V}O_2$, and $\dot{V}CO_2$ for the last 2 minutes of each trial and calculated metabolic power. **Results:** Calculated mechanical power output was 2.85±0.03 W/kg body mass for sitting trials, which was not different from the crank-based (2.85±0.05 W/kg) or pedal-based (2.83±0.06 W/kg) values ($p = 0.72$). Metabolic power was 13.11±0.57 W/kg for sitting and 14.23±0.77 W/kg for standing, i.e. standing was 8.27% more expensive ($p < 0.001$).

Conclusion: Calculation-based, crank-based and pedal-based methods of measuring mechanical power output give very similar results. Treadmill cycling appears to be a valid method for studying rider and bicycle performance. Independent of air resistance, standing up while cycling uphill is substantially more metabolically costly than the sitting position.

Supported by a gift from Specialized Bicycle Components Inc.

THURSDAY, JUNE 1, 2017

1384 Board #59 June 1 9:00 AM - 10:30 AM
Kinematic Measures Of The Knee While Cycling: A Comparison Of Vicon And Retül 3d Motion Analysis Systems
 Sinéad A. FitzGibbon¹, Bill Vicenzino², Mitchell J. Rauh³, Jeanne F. Nichols⁴, Sue Ann Sisto⁵. ¹Rocky Mountain University of Health Professions, Provo., Provo, UT. ²University of Queensland, Brisbane, Australia. ³San Diego State University, San Diego, CA. ⁴University of California San Diego, San Diego, CA. ⁵Stony Brook University, Stony Brook, NY.
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 (No relationships reported)

Factors contributing to knee pain in cyclists include deviations from optimal pedaling patterns and poor bike fit. Accurate measurement of kinematics is essential to obtain optimal positioning, but motion analysis equipment cost is an obstacle for many clinicians.

PURPOSE: To compare the Retül 3D motion capture system to the Vicon 3D system. A lack of significant difference between devices would support a low-cost option for clinicians working with cyclists.

METHODS: Cycling kinematics were captured from eleven competitive female cyclists using a 10-camera Vicon MX system and compared with a cycling-specific motion analysis system, Retül, while pedaling at 70% peak power output on a Velotron cycle ergometer.

RESULTS: MANOVA demonstrated no significant difference between systems for knee range of motion (ROM) (mean difference (MD)=0.12°, p=0.96), knee extension (MD=0.12°, p=0.10), knee frontal plane knee angles (MD=2.7°, p=0.15), ankle dorsiflexion (DF) (MD=-1.45°, p=0.46) and plantarflexion (PF) (MD=4.51°). However, knee flexion (MD=1.42°, p=0.02), hip flexion (MD=32.83°, p<0.001), hip ROM (MD=3.8°, p<0.001), ankle ROM (MD=3.7°, p<0.001) and measurement of the mean knee distance from bicycle centerline (MD=11.13 mm, p<0.001) were significantly different between systems. ICC indicated moderate agreement between systems for knee flexion (ICC_(2,5)=0.52, p<0.001). Linear regression of difference scores on mean scores demonstrate a significant relationship for knee flexion, hip ROM and ankle DF (p=0.66, p=0.10, p=0.38, respectively).

CONCLUSION: In general, these data support Retül for use in comparison with Vicon for the measurement of knee extension, ankle DF and ankle PF, which are most relevant measurements for obtaining correct fit on a bicycle.

Keywords: Bike-fit, kinematics, agreement

1

1385 Board #60 June 1 9:00 AM - 10:30 AM
Effect Of Cadence And Gender On Pedaling Technique of Youth Cyclists At Constant Power Output
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 (No relationships reported)

Changing pedal cadence would affect resultant forces (RF), effective force (EF), index of effectiveness (IE), we could observe these with the biomechanics measurement. Which could supply evidence from research to coaches to improve youth cyclists performance. **Purpose:** This study aimed to compare the effects of gender and cadence in pedaling cadence (65 and 115 RPM) on RF, EF, and IE during power and recovery phase. **Methods:** A total of 16 youth cyclists (8 males, 15.0 ± 0.8 years, 8 females, 15.1 ± 1.0 years) were divided into two groups based on gender. Left pedal forces and lower limb kinematics of participants were measured at 250 W power output, for two pedaling cadences (65 and 115 RPM). The integral RF, EF and IE during power and recovery phase (IE_{pow} and IE_{rec}) were calculated. A two-way MANOVA with repeated measures was conducted to determine the effect of intervention to measure of integral RF, EF, IE, IE_{pow} and IE_{rec}. Group (male versus female group) was used as the between subject factor, and cadences (65 and 115 RPM) as a within-subjects. All data were analyzed using SPSS 20.0. **Results:** There was a significance between two cadence on integral IE_{rec} (-30±7% and -54±8%, p<0.05), but we did not observe this phenomenon on IE_{pow} (79±7% and 77±10%). Female youth cyclists' integral IE_{rec} was higher than male for all cadences (-19±7% vs. -40±12% and -39±17% vs. -60±17%, p<0.05). For RPM65 there was no significance between female and male youth cyclists on integral IE_{pow} (79±5% and 78±4%). There was a significance between female and male youth cyclists on integral IE_{pow} (81±6% and 73±8%, p<0.05) for RPM115. However, the male youth cyclists' RF and EF was higher female's during power phase (p<0.05). **Conclusion:** The results suggest that cycling at lower cadences were more effective during the recovery phase for both male and female youth cyclists. The coaches should pay attention to youth cyclists' pedaling technique especially during recovery phase in order to improve cycling efficiency.

1386 Board #61 June 1 9:00 AM - 10:30 AM
Age Effects on Sagittal Plane Joint Powers during Submaximal Cycling
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 (No relationships reported)

During walking, older adults generate more power about the hip and less power about the ankle compared to young adults. Cycling is another cyclic task and a popular mode of exercise. No research has examined whether older compared to young adults demonstrate a similar lower extremity motor pattern characterized by distal-to-proximal redistribution of effort during cycling. **PURPOSE:** To investigate the effects of age on lower limb motor patterns during submaximal cycling. **METHODS:** Thirteen young (22.9±3.4 years) and 13 older (69.7±4.5 years) male recreational cyclists completed a 6-minute pedaling trial at 125W and 90 rpm on a Lode bicycle ergometer. Reflective markers (n=21) were attached to the left pedal and on the subject's pelvis and left lower limb. Marker positions and pedal reaction forces were sampled synchronously at 100 Hz and 2000 Hz, respectively. A three-segment sagittal plane inverse dynamics model was used to compute net joint forces, moments, and powers. Lower limb motor patterns were characterized by examining the distribution of total absolute lower limb power about ankle, knee, and hip. Independent t-tests were used to examine the effects of age on total and average absolute joint powers. **RESULTS:** Absolute total and average joint powers were not significantly different between young and older participants (Table 1). The net ankle, knee, and hip joint power profiles were similar for older and young participants showing a higher reliance on knee and hip power and lower reliance on ankle power when pedaling. These results can be explained by the high level of control in our experimental design. To examine age effects on lower limb motor patterns, we controlled external power output, cadence, posture, and cycling experience in our study. Many of these factors have been shown to affect lower limb kinetic and kinematic variables. **CONCLUSION:** Older and younger adults employ similar patterns of distributed effort in the lower extremity during submaximal cycling.

	Total power (W)	Ankle power (W)	Knee power (W)	Hip power (W)
Older	107.8±16.1	14.0±3.6	56.0±7.6	37.8±9.9
Young	111.8±15.2	15.1±5.4	51.6±8.0	45.1±9.1

C-34 Free Communication/Poster - Biomechanics of Jumping, Landing, and Cutting

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1387 Board #62 June 1 8:00 AM - 9:30 AM
A Comparison of Different Methods for Assessing Plyometric Ability During Jumps
 Brandon W. Snyder¹, Gavin L. Moir¹, Chris Connaboy², Hugh S. Lamont³, Shala E. Davis, FACSM¹. ¹East Stroudsburg University, East Stroudsburg, PA. ²University of Pittsburgh, Pittsburgh, PA. ³Coastal Carolina University, Conway, SC.
 (Sponsor: Shala Davis, FACSM)
 (No relationships reported)

ABSTRACT

Purpose: To compare different methods for assessing plyometric ability during countermovement (CMJ) and drop jumps (DJ) from different heights. **Methods:** Twelve resistance-trained men (age: 21.8 ± 1.7 years; height: 1.81 ± 0.06 m; mass: 85.1 ± 8.6 kg) performed CMJ and DJ from heights of 0.40 m, 0.60 m, and 0.80 m. Force plates recorded the ground reaction force from which the descent (absorption phase) and ascent (propulsive phase) of the center of mass during ground contact was determined. Jump height (JH), vertical stiffness (V_{STIFF}) and normalized work (W_{NORM}), power output (P_{NORM}), and impulse (I_{NORM}) during the absorption and propulsion phases were calculated. Plyometric ability was assessed using the modified reactive strength index (RSI_{MOD}) and four indices using propulsion time (PTI), propulsive work (PWI), propulsive power (PPI), and propulsive impulse (PII). Analysis of variance was used to assess the differences in the mechanical variables and the plyometric indices across the four jump conditions. Correlations were used to assess the relationships between the plyometric indices and JH. **Results:** JH (mean differences: 0.03 – 0.06 m; p=0.007) and V_{STIFF} (mean differences: 0.69 – 0.93 kN/m, p<0.001) were greater during CMJ compared to the DJ conditions. The mechanical variables during the absorption phase were greatest during the highest DJ (W_{NORM} mean differences: 1.6 –

10.0 J/kg, $p < 0.001$; PO_{NORM} mean differences: $4.9 - 31.3$ W/kg, $p < 0.001$; I_{NORM} mean differences: $0.36 - 2.52$ m/s, $p < 0.001$, while W_{NORM} and I_{NORM} during the propulsive phase were greatest during the CMJ (W_{NORM} mean differences: $0.2 - 1.1$ J/kg, $p = 0.020$; I_{NORM} mean differences: $0.09 - 0.21$ m/s, $p < 0.001$) with no differences in PO_{NORM} ($p > 0.05$). RSI_{MOD} increased across the four jumps and was greatest at the highest DJ condition (mean differences: $0.003 - 0.150$, $p < 0.001$). The greatest values for the other indices were reported for the CMJ ($p < 0.001$). The largest correlations with JH were found for PII ($r = 0.958 - 0.993$). **Conclusion:** RSI_{MOD} does not reflect the changes in mechanical variables during the propulsion phases of CMJ and DJ and may not therefore provide an accurate assessment of the ability to utilize the stretch-shortening cycle during different jumps. Practitioners should consider using PII as a measure of plyometric ability.

1388 Board #63 June 1 8:00 AM - 9:30 AM
The Influence Of The Number Of Jumps On Eccentric And Concentric Force-Velocity Characteristics
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PURPOSE: To investigate how the number of jumps affects the force-velocity (Fv) characteristics derived from drop jumps (DJ) from different heights and squat jumps (SJ) performed with different loads.
METHODS: Twelve resistance-trained men (age: 21.8 ± 1.7 years; height: 1.81 ± 0.06 m; mass: 85.1 ± 8.6 kg; 1-RM squat: 162.3 ± 27.3 kg) performed SJ with loads equivalent to 0% (SJ_0), 27% (SJ_{27}), 56% (SJ_{56}), and 85% (SJ_{85}) 1-RM and DJ from heights of 0.40 m (DJ_{40}), 0.60 m (DJ_{60}), and 0.80 m (DJ_{80}). Force plates were used to record the ground reaction force (GRF) during each jump from which the descent and ascent of the center of mass (CM) during ground contact was determined. The absorption phase during DJ was determined when the net impulse of the GRF was positive and the CM was descending while the propulsive phase during SJ was determined when the net impulse of the GRF was positive and the CM was ascending. The eccentric and concentric Fv characteristics (average vertical GRF, average vertical velocity of CM) for each subject were calculated during the absorption phase of DJ and the propulsive phase of SJ, respectively. Linear regression equations were fitted to the Fv data and the differences in the regression parameters were assessed when the number of jumps included was varied for concentric Fv (model 1: $SJ_0, SJ_{27}, SJ_{56}, SJ_{85}$; model 2: SJ_0, SJ_{27}, SJ_{56} ; model 3: SJ_0, SJ_{27}) and eccentric Fv (model 1: $SJ_0, DJ_{40}, DJ_{60}, DJ_{80}$; model 2: SJ_0, DJ_{40}, DJ_{60} ; model 3: SJ_0, DJ_{40}).
RESULTS: Model 3 for the eccentric Fv characteristics produced a significantly greater y-intercept (mean difference: 1.2 N/kg, $p = 0.043$) and lower slope (mean difference: 1.2 Ns/m, $p = 0.020$) than model 1. There were no significant differences in the y-intercept (range of differences: $1.7 - 3.7$ N/kg, $p > 0.05$) or slope (range of differences: $1.5 - 2.8$ Ns/m, $p > 0.05$) between the three models for the concentric Fv characteristics, although some of the parameters associated with model 3 were unrealistic.
CONCLUSIONS: Both DJ and loaded SJ may provide means of assessing the eccentric and concentric Fv characteristics, with the regression parameters becoming more realistic with the inclusion of a greater number of jumps.

1389 Board #64 June 1 8:00 AM - 9:30 AM
Squat Jump Performance Is Not Related to Bilateral Asymmetry or Training State in College-aged Men
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 (No relationships reported)

Bilateral asymmetry has been observed in muscular strength/power movements and has been linked to poor performance and/or risk of injury. **PURPOSE:** to investigate bilateral asymmetry during jumping. **METHODS:** Athletes (A, intercollegiate sports; $n = 13$) and active (C, $n = 11$) men gave informed consent to participate in this approved study. Subjects completed repeat trials of 2-leg (2L) and single-leg (1L; left and right leg) squat jump without countermovement; data averaged across trials. Jumps were conducted on individual force plates (2L) or singularly for 1L. Jump height (JHt) was calculated from jump impulse (IMP) determined from ground reaction force and from flight time (Δt). Asymmetry index was calculated; $(L-R)/(0.5*(L+R))$. Bilateral facilitation/deficit was determined from JHt; $(1L+1R)/2L$. Data were analysed by ANOVA and significant differences were accepted with $p < 0.05$. **RESULTS:** 2L (A: 36.7 ± 0.4 cm; C: 33.7 ± 0.8 cm) and 1L (left & right: A: 17.5 ± 0.4 & 16.7 ± 0.3 cm; C:

15.9 ± 0.4 & 16.8 ± 0.6 cm, respectively) JHt was similar between groups. An extreme bilateral asymmetry (AI range 37 to -58%) was noted in IMP_J during 2L; individual leg IMP_J was not related to JHt ($r = 0.13$ left; $r = 0.14$ right). To accomplish similar 2L JHt both groups produced a greater jump impulse in one leg (A: 135.1 ± 25.4 N; C: 108.3 ± 24.1 N) vs the other (A: 111.6 ± 19.7 N; C: 89.1 ± 14.1 N); accounting for asymmetry. 2L performance was associated with a bilateral deficit ($n = 4$) or facilitation ($n = 15$); yet, neither bilateral asymmetry nor deficit/facilitation impacted performance directly. The top 5 jumps (> 40 cm) were recorded from 2 A and 3 C with bilateral asymmetry (10-40%) and bilateral deficit (2-19%) or facilitation (5-12%). 1L jump performance was asymmetric (-35 to 28%). 1L JHt was also poorly related to IMP_J ($r = 0.58$ left and 0.50 right). **CONCLUSION:** Performance of 2-leg squat jump is associated with extreme IMP, bilateral asymmetry ($\pm 45\%$) and is independent of training status. Expression of bilateral facilitation or deficit does not appear to impact jump effectiveness. 1L jump performance is limited in its ability to explain 2L jump performance, bilateral asymmetry, or neural strategy (bilateral deficit/facilitation) likely due to balance issues indicated by pattern (slope, appearance of plateaus, flat peak, etc.) of force expression.

1390 Board #65 June 1 8:00 AM - 9:30 AM
Biomechanical Comparison of Loaded Countermovement Jumps on Land and in Water
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 (No relationships reported)

Compared with land-based exercise, researchers have observed that when individuals undergo aquatic exercise and rehabilitation programs, they achieve similar, if not greater, improvements in physical function. **PURPOSE:** To evaluate the mechanical specificity of jumping movements performed in partial water immersion versus land using conditions of light external load, with a combined kinetic and kinematic analysis. **METHODS:** Twenty young males and twenty-four NCAA division I women's soccer and gymnastics athletes were asked to perform unloaded and loaded (adding 10, 20, and 30% BW with weighted vest) countermovement jumps on land and in partial water immersion. Kinetic and kinematic measures of jump performance were obtained using a tri-axial force platform and two dimensional videography, respectively. **RESULTS:** Compared to land, peak and mean mechanical power outputs (W), on average, were 88% (8919 ± 3744 W vs. 4734 ± 1418 W) and 81% (3640 ± 1807 W vs. 2011 ± 736 W) greater for jumps performed in water, respectively. While most kinematic differences were small, peak dorsiflexion velocity was, on average, 688% faster ($44 \pm 39^\circ/s$ vs. $5.6 \pm 5.4^\circ/s$; $p < 0.001$) for jumps performed in the water and tended to model similarly with measures of mechanical power and amortization rate. In water, the addition of light, external loading was associated with an average decrease in bodyweight normalized peak and mean mechanical power of $23.6 \pm 2.7\%$ and $23.8 \pm 1.9\%$, respectively. On land, the addition of load was associated with an $8.7 \pm 2.3\%$ and $10.5 \pm 4.4\%$ decrease in bodyweight normalized peak and mean mechanical power, respectively. **CONCLUSIONS:** Buoyancy appears to alters movement strategies at amortization, which may provide a unique stimulus for training the stretch-shortening cycle contribution to jump performance. The combination of fluid resistance and buoyancy are likely responsible for previously reported improvements in athletic performance and functional mobility.

1391 Board #66 June 1 8:00 AM - 9:30 AM
Strength and Biomechanical Contributions to Vertical Ground Reaction Forces in a Single Limb Landing Task
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Reducing dynamic joint loading is a key strategy included in injury prevention landing mechanics programs. Previous research has noted the importance of increased knee flexion to reduce vertical ground reaction forces (vGRF), and the relationship between strength asymmetry and asymmetrical landing mechanics following injury. **PURPOSE:** To determine if and how landing kinematics at the hip, knee, and ankle, as well as quadriceps strength contribute to vGRF in a single limb landing task. **METHODS:** Thirty-four physically active males (Age: 27.6 ± 4.6 yrs; Height: 177.74 ± 7.15 cm; Mass: 84.31 ± 11.83 kg) completed a single limb drop landing off a 45.7 cm box onto a force plate. A 3D motion system was used to collect dominant (DOM) and non-dominant (NON) hip flexion at initial contact, peak knee flexion (PKF), knee flexion at initial contact (KFIC), peak ankle flexion, ankle flexion at initial contact and, peak vGRF. DOM and NON quadriceps strength (IKQS) was collected using an isokinetic dynamometer at $60^\circ/s$. Simple linear regression models were run for each limb to detect independent contributions to vGRF. Backward stepwise multiple linear regression was used to determine the best model to predict vGRF. **RESULTS:**

KFIC independently accounted for 11.8% ($p=0.047$) of the variance in DOM vGRF. No DOM limb multiple linear regression model was significant. KFIC and PKF independently accounted for 15.7% ($p=0.021$) and 16.5% ($p=0.017$) of the variance in NON vGRF, respectively. KFIC and IKQS as a multiple linear regression model accounted for 18.9% ($p=0.043$) of variance in NON vGRF. **CONCLUSION:** KFIC, on DOM and NON limbs, is the best sagittal plane kinematic predictor of vGRF, in a single limb drop landing task in physically active males. Despite IKQS not being an independent significant predictor on either limb, it improved KFIC prediction of vGRF on the NON limb. This study highlights how active males use sagittal plane knee motion and quadriceps strength to influence vGRF in a single leg landing task, as research has shown women are more likely to use hip and knee kinematic strategies. Active individuals with weak quadriceps and a stiffened knee at initial contact are likely at risk for injuries associated with increased impacts during single limb landings.

1392 Board #67 June 1 8:00 AM - 9:30 AM
Influence of Trunk Angle on Joint Mechanics During the Vertical Jump

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 (No relationships reported)

Vertical jump is an important skill in many sports. Sports such as volleyball and basketball require its participants to perform a vertical jump in a more upright position and gain as much height as possible. Previous research has shown that when trunk motion is restricted during a vertical jump participants have decreased jump height, take-off velocity, and hip extension moment compared to a jump with non-restricted trunk motion. Findings also suggested that the knee was the greatest compensator during this movement. **PURPOSE:** The aim of the current study is to identify the alterations in lower extremity joint mechanics when participants jump with a more upright trunk position. **METHODS:** 15 participants (age 23 ± 3 , weight 160 ± 33 lbs, height 68.6 ± 4.3 in) performed body weight squats, side lunges, and leg swings as a warm-up. Reflective markers were placed on the lower extremities. Participants performed 3 vertical jumps with a self-selected trunk angle (SS) and 3 vertical jumps after being instructed to keep trunk angle as vertical as possible (UR). Arm swing was limited by placing hands on the hips. Force data were collected with a force plate (Bertec, Inc.; Columbus, OH). Motion capture data were collected with Vicon Nexus (Vicon, Inc.; Oxford, UK). All data were processed with Visual 3D (C-Motion, Inc.; Germantown, MD) and analyzed using a paired t-test ($\alpha=0.05$). **RESULTS:** The results showed that hip extension moment was significantly reduced in the SS trials ($M=1.44$ Nm/kg and 1.26 Nm/kg for SS and UR, respectively, $p=0.006$). Knee and ankle moments did not show a significant difference and jump height was significantly decreased ($p<0.001$), although 3 participants jumped higher in the UR position. **CONCLUSIONS:** Hip extension moment alone was significantly influenced by trunk angle. Data did not show evidence that knee and ankle moments compensated for the difference in hip extension moment. It was interesting to note that some participants jumped higher with the UR. This shows that there might be potential to train individuals to jump higher while maintaining an upright trunk. It is important to recognize that there are sports that require task performance in less than ideal situations. It could be worthwhile to repeat this study with athletes who are trained to jump with a vertical trunk i.e. volleyball players, basketball players.

1393 Board #68 June 1 8:00 AM - 9:30 AM

Effects of Athletic Floor Surfaces on Cutting and Jumping Ground Reaction Forces in Female Athletes

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Reported Relationships: E. Nyman: Contracted Research - Including Principle Investigator: SATECH, INC., WA, USA.

Purpose: To assess ground reaction forces in female athletes performing sport-specific movements (drop vertical jump and cut) on two athletic flooring surfaces: Smartcells® [SM] and Sport Court® [SP], as compared with a control [CO] surface.

Methods: After providing informed consent, sixteen NCAA female athletes (age 20 ± 1.3 yrs; height 175.8 ± 7.3 cm; weight 71.5 ± 7.1 kg) were instrumented with a standard lower extremity plug-in-gait marker set, after which ground reaction forces were assessed during performance of two movement types (drop vertical jump and 45 degree cut) on each surface using a 6 camera MOCAP system (Vicon, Denver, CO, USA) and two force platforms (AMTI, Watertown, MA, USA). Test order was randomized. Subjects performed 3 successful trials for each movement on each surface. Data were normalized by participant weight before comparison via paired t tests ($p<0.05$) between conditions for right-side peak and mean medial/lateral [ML], anterior/posterior [AP], and vertical [VERT] ground reaction forces [GRF].

Results: During cutting, peak ML GRF for SM (42.62 ± 15.31 Nkg⁻¹) and SP (41.11 ± 12.32 Nkg⁻¹) were reduced as compared with CO (51.99 ± 13.25 Nkg⁻¹) ($p=0.039$ and $p=0.002$, respectively). Mean ML GRF for SM (4.14 ± 4.28 Nkg⁻¹) and SP (3.81 ± 3.76 Nkg⁻¹) were also reduced as compared with CO (6.58 ± 5.18 Nkg⁻¹) during cutting movements ($p=0.009$ and $p=0.004$, respectively). During drop vertical jump performance, mean AP GRF for both SM (-1.88 ± 0.90 Nkg⁻¹) and SP (-1.13 ± 0.52 Nkg⁻¹) were reduced as compared with CO (-4.02 ± 1.33 Nkg⁻¹) ($p<0.0001$ & $p<0.0001$, respectively). Peak ML GRF for SM (25.09 ± 4.43 Nkg⁻¹) was less than both CO (32.70 ± 8.45 Nkg⁻¹) ($p=0.0009$) and SP (29.67 ± 5.36 Nkg⁻¹) ($p=0.0008$). Mean ML GRF for SM (1.71 ± 0.33 Nkg⁻¹) was less than CO (2.04 ± 0.40 Nkg⁻¹) ($p=0.0012$). Mean AP GRF for SP (-1.13 ± 0.52) was reduced compared to SM (-1.88 ± 0.90) ($p=0.0011$). A trend for peak VERT GRF between SM (151.99 ± 5.28 Nkg⁻¹) and both CO (156.91 ± 10.71 Nkg⁻¹) and SP (156.52 ± 8.53 Nkg⁻¹) during drop vertical jump was noted.

Conclusion: SP and SM athletic flooring may reduce selected peak and mean GRF. SM mitigated GRF to a greater extent. Data trends also demonstrated reductions in VERT GRF during drop vertical jump for SM that may be further elucidated with a greater sample size in future efforts.

1394 Board #69 June 1 8:00 AM - 9:30 AM
Relationship Between Functional Movement Patterns And Performance Between Division Iii Women's Soccer And Volleyball

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The functional movement screen (FMS) has been shown to be a valid and reliable tool for assessing fundamental movement patterns. While dysfunctional movement patterns have been shown to increase an athlete's risk for injury, it is unclear what influence they have on athletic performance.

PURPOSE: To examine the relationship between FMS testing and sport specific performance tests for Division III (D3) women's soccer (SOC) and volleyball (VB), as well as compare performance differences between sports.

METHODS: 17 SOC (19 ± 0.3 yo) and 13 VB (19.2 ± 0.4 yo) players consented to the study and performed pre-season FMS, a 3-site % body fat (%BF) skinfold analysis, and performance testing. Performance testing included 1-min push-up test, Vertical Jump (VJ) test, Illinois Agility (IA) test, and 12x 20 m repeated sprint test (RST) with 20 sec recovery each sprint. 1-way ANOVA was run to compare differences between sports. Pearson correlations were run to examine the relationships between the FMS and performance measures. All data were expressed as mean + se, and all significance levels were set at $\alpha=0.05$.

RESULTS: Players were of similar height but VB players weighed (76.5 ± 2.1 kg) significantly ($p<0.0001$) more than SOC (63.0 ± 1.9 kg). %BF was significantly higher ($p=0.0022$) for VB ($28.6\pm 1.4\%$ vs $22.2\pm 1.3\%$), which resulted in 5.8 kg greater fat free mass (FFM) for VB ($p=0.0001$). There were no significant differences in any of the performance measures, including VJ. However, the estimated power output for the VJ was significantly higher ($p<0.0001$) for VB (3888.1 ± 105.8 W) than SOC (3094.6 ± 92.6 W). The FMS lunge score was moderately related to both mean ($r=-0.46$, $p=0.0140$) and best ($r=-0.41$, $p=0.0295$) RST time (sec). The total FMS score showed a similar relationship for mean ($r=-0.42$, $p=0.00251$) and best ($r=-0.50$, $p=0.0066$) RST. %BF appears to negatively impact FMS scores ($r=-0.36$, $p=0.0447$).

CONCLUSIONS: In a cohort of D3 women athletes, there appears to be no differences between athletes in common skill-related performance measures, despite significant differences in %BF and FFM. The inverse relationship between %BF and lower FMS scores suggests that reducing body fat could improve performance measures. The FMS may be useful in identifying potential skill-related performance decrements in similar athletes.

1395 Board #70 June 1 8:00 AM - 9:30 AM

Lower Limb Kinetic And Kinematic Effects Of An Arm Swing During Counter-movement Vertical Jumps

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PURPOSES: This study determined the effects of an arm swing on lower limb kinematics (joint ranges of motion; ROM) and kinetics (peak joint torques; Nm) during a CMVJ. **METHODS:** Fourteen healthy, recreationally active men (\pm SD; age= 24.1 ± 3.9 yrs, height= 1.76 ± 0.05 m, weight= 82.6 ± 10.6 kg) performed 6 CMVJ, 3 with an arm swing (AS) and 3 with no arm swing (NAS), in random order. The AS CMVJ began with the participant standing upright with arms fully raised above the

head. The NAS CMVJ began with the dominant upper limb fully raised overhead, while the non-dominant hand remained on the iliac crest during the entire CMVJ. All jumps were performed by descending to an internal knee angle of 90°, using maximal effort, and reaching for an overhead target. A three dimensional markerless motion capture system (MCS; DARI, Lenexa, KS) was used to analyze the kinetic and kinematic data. T-tests and ANOVAs (*AS vs. NAS, †eccentric [ECC] vs. concentric [CON]; p<0.05) were performed on mean values from all 3 jumps for AS and NAS for each subject. **RESULTS:** Results for AS and NAS CMVJs are shown in the table. The AS CMVJ produced greater vertical jump height (VJH) an average of 0.07±0.03 m (3.0±1.3 in). The hips and ankles produced greater ECC and CON torques, less hip flexion, and greater time in the concentric phase during the AS CMVJ. The knees produced greater concentric torque, however there were no differences between jump conditions. The AS CMVJ also had greater time in the concentric phase of the jump. **CONCLUSION:** Compared to NAS, use of an AS produced a 13% increase in CMVJ height, and greater peak torques for the hips and ankles, even when comparing eccentric and concentric phases. The AS CMVJ also increased the duration of the concentric phase, thus permitting greater torque generation to increase CMVJ height.

Table 1.

Table 1. Kinetic and kinematic comparison of joint flexion and peak joint torques during eccentric (ECC) and concentric (CON) phases of counter-movement vertical jumps with arm swing (AS) and no arm swing (NAS) (X±SD)

	AS	NAS
Jump Height (m)	0.55 ± 0.09	0.48 ± 0.07*
ECC Duration (s)	0.62 ± 0.15	0.59 ± 0.07
CON Duration (s)	0.30 ± 0.06	0.27 ± 0.05*
Hip Flexion (°)	102.45 ± 19.14	92.65 ± 15.48*
Knee Flexion (°)	101.36 ± 15.08	103.58 ± 11.86
Ankle Flexion (°)	27.43 ± 4.84	27.36 ± 4.33
ECC Hip Peak Torque (Nm)	28.54 ± 6.52	25.15 ± 8.05*
ECC Knee Peak Torque (Nm)	15.21 ± 3.56	10.71 ± 4.21
ECC Ankle Peak Torque (Nm)	7.60 ± 2.37	4.15 ± 1.72*
CON Hip Peak Torque (Nm)	50.43 ± 11.24	37.43 ± 13.42*†
CON Knee Peak Torque (Nm)	17.48 ± 2.96	16.30 ± 6.40†
CON Ankle Peak Torque (Nm)	7.78 ± 1.55	6.86 ± 2.81*†

*AS vs. NAS, †ECC vs. CON

1396 Board #71 June 1 8:00 AM - 9:30 AM

Visual Memory Influences the Effect of Soccer Ball Handling on Knee Valgus Angle while Cutting

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(No relationships reported)

BACKGROUND: Sports injuries remain a major concern for athletes despite ongoing efforts to improve screening and prevention methods. Recent research suggests that neurocognition may play a role in the neuromuscular control associated with injuries such as anterior cruciate ligament tears. Additionally, sport-specific tasks, such as dribbling a soccer ball, are integral to playing sports, but may also influence lower extremity mechanics. The relationship between neurocognitive ability and biomechanics during a sport specific cutting task has yet to be investigated.

PURPOSE: To determine the relationship between neurocognition and the effect of soccer ball handling on lower extremity mechanics during a side-step task.

METHODS: Fifteen healthy male collegiate soccer players (20.8 ± 2.0 yr; 1.77 ± 0.07 m; 77.0 ± 8.6 kg) participated in the study. Participants performed anticipated 45° run-to-cut trials while dribbling a soccer ball (BH) and without dribbling (NB) while 3D kinematics and kinetics were recorded. Approach speeds of NB trials were matched to those of BH trials. Peak knee valgus angle (pKValA) and moment for the plant leg were calculated. Participants also completed the ImpACT[®] neurocognitive assessment to evaluate visual and verbal memory, reaction time, and visual motor speed.

Composite scores from the neurocognitive assessment were entered as candidate linear regression predictors for the change scores in lower extremity biomechanical parameters (i.e., BH – NB). Promising models with respect to adjusted-R² and Mallows' C_p were further evaluated for significance (α=0.05) through linear regression analysis.

RESULTS: A one unit decrease in the visual memory composite score (i.e., worse visual attention, scanning, and/or visual learning) was associated with an increase in pKValA of 0.25° ± 0.07° during the BH task compared to the NB task (R² = 45.8%, p = 0.006).

CONCLUSION: The detrimental effect of soccer ball handling during a side-step cut movement on knee valgus was found to be influenced by athletes' visual memory ability. These results may suggest that athletes with a diminished capacity for visual memory may be less able to maintain optimal biomechanics while accommodating the demands of sport-specific tasks that require visual attention.

1397 Board #72 June 1 8:00 AM - 9:30 AM

Landing Kinetics and Time to Stabilization for Loaded Countermovement Jumps Performed on Land and in Water

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Competitive sports require athletes to focus on several aspects of human performance, especially training techniques that maximize muscle power. This type of training may pose risk of injury, and performing these exercises in water appears to reduce risk due to lower impact forces, yet the influence of adding external loads in water has not been investigated. **PURPOSE:** Compare landing kinetics of weighted countermovement jumps performed in water versus land. **METHODS:** Twenty-four NCAA DI female athletes (19.9±1.1 yr, 12 soccer, 12 gymnasts) performed three countermovement jumps per trial with each trial including a different external load (body weight (BW, kg), BW*1.1, BW*1.2, BW*1.3) using a weighted vest. Landing kinetic measures were peak force (PF), rate of force development (RFD), impulse (Imp), and time-to-stabilization (TTS). Results were analyzed using a three-way 2 (sport) x 2 (environment) x 4 (load) ANOVA. **RESULTS:** There were no significant differences in any measure for the sport factor. The aquatic condition displayed significantly (p<0.001) reduced PF by 50.7%, RFD by 53.5%, Imp by 38.6% and TTS by 6.5%. On land, increasing external load did not significantly change PF or RFD, but did produce significantly (p=0.001) greater Imp (12% increase for BW vs BW*1.3). In water increasing load produced significant (p<0.001) increases in PF (except BW 1.1 vs BW 1.2), RFD (except for BW vs BW*1.1) and Imp (except for BW*1.2 vs BW*1.3). Despite this increase in PF, RFD and Imp with load in Water, all measures were still significantly (p<.001) lower than land. **CONCLUSION:** The results for lower PF, RFD and Imp in water vs land validate the potential lower risk of injury for performing countermovement jumps in water. Adding small to moderate external loads in water increase PF, RFD and Imp in most conditions, yet still apply a significantly lower orthopedic stress compared to Land. Further research should monitor injury rates between these two environments.

1398 Board #73 June 1 8:00 AM - 9:30 AM

Pre-landing Lower Extremity Kinematics and Muscle Activation in Chronic Ankle Instability Patients Following Rehabilitation Intervention

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Muscle preactivation prior to high impact landing is a normal sensorimotor strategy to attenuate loads and place joints in stable positions. Patients with chronic ankle instability (CAI) have shown sensorimotor deficits, which can result in injury-prone joint positions. Little is known whether rehab training can improve pre-landing joint positions and muscle activation in patients with CAI.

PURPOSE: To examine the effect of a 6-week ankle and hip intervention program on sagittal ankle, knee and hip joint kinematics and medial gastrocnemius (MG), vastus lateralis (VL) and gluteus maximus (GX) activation from 150 ms pre- to initial-contact of landing.

METHODS: 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. EMG data were normalized to a 3-sec squat position. Functional analyses (α=.05) were used to detect group x treatment interactions. If 95% CI did not cross the zero, significant differences existed.

RESULTS: Figure 1. The rehab intervention resulted in up to (i) 32% less VL activation at 55-42 ms pre-, 39-24 ms pre-, and 6 ms pre-contact to initial-contact and (ii) 8.5% less GX activation at 150-81 ms pre-contact. No changes were detected in sagittal ankle, knee and hip kinematics, and MG activation.

CONCLUSIONS: As knee and hip extensors act as a shock absorber during landing, reduced VL and GX preactivation could reduce the ability to attenuate the high impact loads at initial landing. While no corresponding kinematic differences were observed, these EMG alterations could have a delayed effect on kinematics at or following impact.

THURSDAY, JUNE 1, 2017

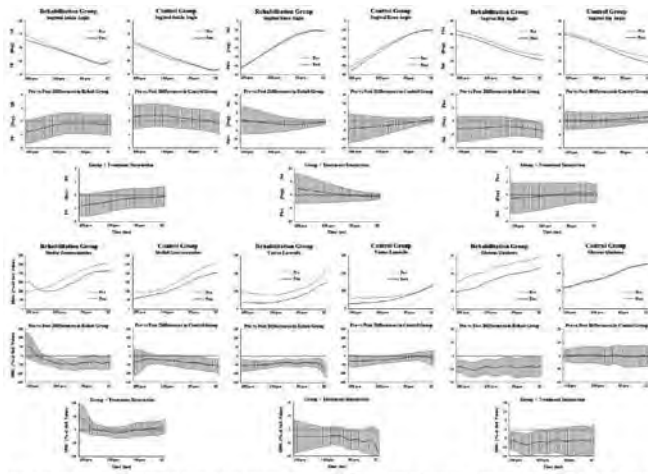


Figure 1. Ground reaction forces for eight subjects. See and by kinematics and muscle activation from 15 cameras in a 3D motion capture facility. A ground reaction force platform was used for data collection. The force platform was used to measure the ground reaction forces (GRF) and to calculate the vertical, medial-lateral, and anterior-posterior forces. The force platform was used to measure the ground reaction forces (GRF) and to calculate the vertical, medial-lateral, and anterior-posterior forces. The force platform was used to measure the ground reaction forces (GRF) and to calculate the vertical, medial-lateral, and anterior-posterior forces.

1399 Board #74 June 1 8:00 AM - 9:30 AM

Effects of Jump Landing on Achilles Tendon Loading

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(No relationships reported)

Sports involving frequent jumping (JUMP) and landing (LAND) and changes in direction may increase risk of Achilles tendon (AT) injury. Mechanisms of AT rupture are thought to be related to weight bearing activities such as JUMP and LAND that involve knee extension and vigorous dorsiflexion on a plantar flexed foot. Studies report less postural stability and a higher plantarflexor moment during lateral jump-landing. To our knowledge, there are no studies that have examined AT loads during JUMP and LAND in forward-backward (F/B) and medial-lateral (M/L) directions.

Purpose: Compare AT loading during JUMP and LAND in a F/B and M/L directions. **Methods:** 16 physically active, healthy males (age 21.6: \pm 1.8 years, height: 178.4 \pm 6.4 cm, weight: 76.4 \pm 11.2 kg) were fitted with 47 markers and performed dominant single leg F/B and M/L JUMP and LAND over a 20 cm barrier. The rate of LAND and JUMP was paced with the use of a metronome set at 60 Hz (approximately 1 second for each LAND and JUMP). Kinematic and force data sampled by 15 motion analysis cameras (180 Hz) and force platforms (1800 Hz), respectively. Inverse dynamics and then static optimization was used to estimate muscle force. AT cross sectional area (CSA) was measured by ultrasound. AT force was divided by each subject's AT CSA for stress estimation and strain from an average Young's modulus. Body center of mass trajectory was used for clipping data during LAND and JUMP, which occurred approximately the first and second 50% of movement, respectively. Two way repeated measures multivariate analyses of variance ($\alpha=0.05$) were used to compare peak AT force, stress, and strain between movements (JUMP and LAND) and directions (F/B and M/L). **Results:** M/L JUMP and LAND peak AT force ($p=0.002$), stress ($p=0.004$) and strain ($p=0.004$) were greater than A/P. JUMP peak AT force ($p=0.007$), stress ($p=0.015$) and strain ($p=0.015$) were higher than LAND. There was no interaction between movements and directions. **Conclusion:** M/L JUMP LAND has greater AT loading demands than F/B JUMP LAND. JUMP showed higher AT loading demands than LAND. This may provide insight to both AT injuries and rehabilitation efforts.

1400 Board #75 June 1 8:00 AM - 9:30 AM

Test-retest Reliability Of The Kinetic Time To Stabilization Measurement During A Single-legged Jump Landing

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Biomechanical deficits during jump landings often contribute to common lower extremity musculoskeletal (MSK) injuries in athletes. Time to stabilization (TTS) measurements have recently been used to assess MSK injury risk. Greater TTS values represent a diminished dynamic postural stability. **PURPOSE:** To determine the reliability of TTS during a single-legged jump-landing task. We hypothesized that reliability would be good for both within- and between-day measures. **METHODS:** Eight physically active male participants (16.8 ± 0.7 yr) completed three trials of a single-legged jump landing in a non-fatigued state, on two days, separated by about one week. Subjects jumped on their dominant leg from a distance equal to 60% of their maximum, single-legged forward jump distance and landed on the same leg in the middle of a force platform. Subjects were instructed to stabilize and remain as still as possible upon landing. TTS was quantified as the time required for the vertical force component to reach and remain within $\pm 5\%$ of the subject's body weight for one second after landing. The first attempt served as a familiarization trial, while the mean TTS of the remaining two attempts were used for between-day comparisons. Intraclass correlation coefficients (ICC) and standard error of measurement (SEM) were calculated for TTS between Day 1 and Day 2, and between attempts 2 and 3 on each day. **RESULTS:** Mean TTS was 0.87 [95% CI 0.54-1.20] and 0.81 [95% CI 0.47-1.14] seconds for Day 1 and Day 2, respectively. Within-day reliability for Day 1 (ICC = 0.84 [95% CI 0.28-0.97]) and between-day reliability (ICC = 0.98 [95% CI 0.92-0.99]) were excellent, while within-day reliability for Day 2 (ICC = 0.49 [95% CI 0.0-0.90]) was fair. The SEM was 0.17, 0.34, and 0.05 seconds for Day 1, Day 2, and between-day measures, respectively. **CONCLUSIONS:** Between-day reliability of TTS was excellent, yet within-day reliability was inconsistent. Thus, a single measurement may not be a reliable indicator of jump-landing TTS. These results support the use of TTS as a test-retest assessment of neuromuscular control following a bout of exercise or a MSK injury risk reduction training program. The reliability of TTS using additional jump variations and calculation methods, and its efficacy as a MSK injury prediction tool should be examined further.

1401 Board #76 June 1 8:00 AM - 9:30 AM

Effect of Ankle and Hip Rehabilitation Intervention on Knee Landing Mechanics in Chronic Ankle Instability

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(No relationships reported)

Sensorimotor deficits due to lateral ankle sprains can result in altered landing mechanics in the lower extremity. The ankle and hip have been a focus of interventions in patients with chronic ankle instability (CAI), however, knee landing mechanics may also be affected by the intervention.

PURPOSE: To examine the effect of a 6-week ankle and hip intervention program on knee landing mechanics in patients with CAI.

METHODS: 15 CAI subjects in a rehab group (23 ± 2 yrs, 178 ± 8 cm, 76 ± 9 kg, $83 \pm 7\%$ FAAM ADL, $56 \pm 10\%$ FAAM Sports, 3.6 ± 1.1 MAII, 4.7 ± 2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22 ± 2 yrs, 177 ± 9 cm, 75 ± 12 kg, $81 \pm 9\%$ FAAM ADL, $56 \pm 12\%$ FAAM Sports, 3.4 ± 1.2 MAII, 5.9 ± 3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ($\alpha=0.05$) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed.

RESULTS: Figure 1. The rehabilitation intervention resulted in up to (i) 2 deg less knee flexion at 13-18% of stance, (ii) 0.23 Nm/kg more knee extension moment at 21-27% and 35-69% of stance, and (iii) 1.6 deg more knee valgus at 0-8% and 48-64% of stance. No changes were detected in frontal knee moment over time between groups.

CONCLUSIONS: Relative to the control group, CAI patients in the rehabilitation group tend to land more aggressively using more knee extensor moment with less flexion and more valgus positions of the knee. These positions and moments, due to the ankle and hip exercises in CAI patients, could be a risk factor for knee injury in this CAI population.

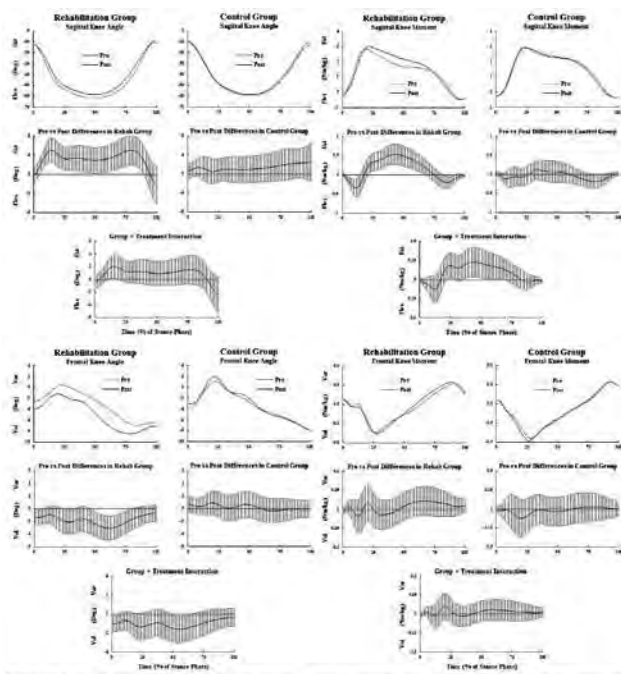


Figure 3. Grand ensembles for sagittal and frontal knee kinematics and kinetics during the stance phase of a cutting task. A group x treatment interaction was detected unilaterally. *Pre vs Post Differences in Rehab Group; †Pre vs Post Differences in Control Group; ‡When 95% confidence intervals (shaded area) did not overlap the zero (horizontal red line), significant differences existed. Abbreviations: Pre = Before, Post = extension, Var = error, Y-axis values.

1402

Board #77

June 1 8:00 AM - 9:30 AM

The Effect of a Single Bout of Exercise on the Motor Learning of a Drop Vertical Jump Landing Strategy

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(No relationships reported)

Purpose: A single bout of cardiovascular exercise improves cognitive learning, but effects on motor learning have been scarcely researched with mixed results. Key questions remain, including the intensity of exercise required to achieve behavioral effects. The purpose of this study is to test the effect of moderate intensity exercise (ModEx) on the retention of a drop vertical jump (DVJ) landing strategy. **Methods:** 40 healthy females (mean age: 20.1, range: 18-22) with no history of leg injury in the past 12 months attended a 1 hour session, first performing 2 DVJs to gather baseline data. Peak vertical ground reaction forces (PVGRF) and hip flexion (HF) angles at the deepest point of landing were measured with a force plate and 2D motion capture software. Next they performed 30 DVJs with feedback for enhanced “soft” landing mechanics. Individuals were then randomized to the ModEx group (n=20), to perform 30 minutes of biking at 55-65% heart rate reserve, or the control (C) group (n=20) for 30 minutes of sham electrical stimulation. After 1 week, a retention session was performed to assess PVGRF and HF during 2 DVJs. **Results:** Baseline performance did not differ between groups (C: mean PVGRF=48 N/kg, (SD)=12), ModEx PVGRF=45 N/kg (12), p=0.84; C: HF angle=96° (23), ModEx: HF angle=94° (24), p=0.62). Both groups reduced PVGRF and HF angles after training (C:PVGRF=38.5 N/kg (11.5), 56°(14), ModEx: PVGRF= 39 N/kg (10), 62° (14), p<0.01) and at retention (C:PVGRF=42 N/kg (10), 58°(15), ModEx: PVGRF= 41 N/kg (8), 60° (15), p<0.01). There was a group by time interaction effect on relative retention (percent change from training to retention) for PVGRF (d=0.21) and HF (d=0.31), which failed to reach statistical significance (p>0.05). **Conclusion:** Training methods were sufficient to induce motor learning, however the effect of ModEx on retention of the skill was small, and these results fail to statistically support the hypothesis that ModEx enhances motor learning of landing strategies. Recommendations for use of ModEx to enhance motor learning cannot be made on the basis of these results. Due to substantial variability, further study with a larger sample will strengthen conclusions. Other considerations for further investigation include exercise timing and dosage, motor skill complexity, and length of the retention period.

1403

Board #78

June 1 8:00 AM - 9:30 AM

Association Between Rate of Torque Development, Strength, Landing Biomechanics, And Dynamic Postural Stability In Physically Active Males

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(No relationships reported)

During exercise and sport, physically active individuals often perform movements that require dynamic postural stabilization. Postural stability has been linked to ankle and knee injuries and examining factors associated with stabilization may provide insight as to how poor stability influences joint loading. **PURPOSE:** To examine mechanisms associated with postural stability during a Forward Jump Single-Leg Landing task (FJSL). **METHODS:** Dynamic postural stability index (DPSI), a composite of the anterior-posterior, medial-lateral, and vertical ground reaction forces, kinematics, knee extension strength (KES), and knee extension rate of torque development (RTD) were collected on 23 males (Age: 23.9 ± 1.3 years, Height: 178.4 ± 7.1 cm, Mass: 84.4 ± 8.6 kg). KES and RTD were collected using an isokinetic dynamometer. DPSI, sagittal plane joint angles at initial contact (Hip@IC, Knee@IC, ANK@IC) and peak flexion angles (KneePkFlex, ANKPkFlex) were collected during a FJSL for the dominant (DOM) and non-dominant (NON) limb using a 3D motion capture system. Paired samples t-tests examined lower extremity asymmetries in DPSI, kinematics, KES, and RTD. Pearson correlation coefficients examined the relationships between KES, RTD, DPSI, and landing kinematics. Significance was set at p<0.05. **RESULTS:** Subjects demonstrated asymmetrical DPSI (p=0.003) and asymmetrical ANKPkFlex (p=0.033) but not asymmetrical KES or RTD (p>0.05). Increased KneePkFlex and ANKPkFlex correlated with an improved DPSI (r=-0.519, p=0.016 and r=-0.466, p=0.033) on the DOM limb while KneePkFlex and HIP@IC correlated with an improved DPSI on the NON limb (r=-0.472, p=0.031 and r=-0.520, p=0.016). Neither KES nor RTD correlated with DPSI or any of the kinematic measures for their respective sides. (p>0.05). **CONCLUSIONS:** Biomechanical stabilization strategies utilized the knee but the DOM, which had better stabilization, incorporated more ANKPkFlex, likely distributing weight over the forefoot. Neither strategy related to KES or RTD. Incorporating movement and balance components focused on symmetrical coordination of corrective movement strategies, including ankle stability, into current training programs may be necessary for improved dynamic postural stabilization.

1404

Board #79

June 1 8:00 AM - 9:30 AM

Biomechanical Correlates of Vertical Jump Height in Children

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(No relationships reported)

INTRODUCTION: Jumping is a fundamental skill for children to develop. While the vertical jump has been extensively researched in adults, such investigations have not been thoroughly extended to children. Understanding the biomechanical correlates of jump height in children could help guide future research of jump height prediction models leading to valuable information about the development of fundamental motor skills in children. **PURPOSE:** To conduct a preliminary analysis on the relationship between lower extremity joint kinetics and vertical jump height (JH) in children. **METHODS:** 37 children [age (yrs): 7.2 ± 1.5; height (m): 1.2 ± 0.1; mass (kg): 26 ± 7.7] participated in the study. Anthropometric measurements were obtained prior to the start of the jump protocol. The task consisted of participants performing five maximal effort vertical jumps. Segment position data were collected using a ten camera optical motion capture system, and ground reaction forces were obtained from two force platforms. To assess joint kinetics, sagittal plane moments at the hip, knee, and ankle were calculated using an inverse dynamics technique and normalized to bodyweight. Maximum vertical displacement of the center of mass after takeoff was calculated to determine JH. **RESULTS:** Correlation analysis revealed a significant positive linear relationship between peak ankle moment (.21 ± .08 Nm/kg) and JH (18.05 ± 2.40 cm) (r=.51; p<.01), peak knee moment (.07 ± .04 Nm/kg) and JH (r=.50; p<.01) as well as peak hip moment (.15 ± .06 Nm/kg) and JH (r=.61; p<.01). **CONCLUSION:** Peak ankle, knee, and hip moments were found to be moderate to strong correlates of JH in children. Future research investigating JH predictors in children should consider lower extremity joint kinetics as plausible predictors.

1405 Board #80 June 1 8:00 AM - 9:30 AM
Net Peak Power and Hip Moment Predict Vertical Jump Height in Children
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 (No relationships reported)

INTRODUCTION: Jumping is a fundamental motor skill that influences successful participation in various physical activities and sport. Understanding the factors associated with vertical jump performance can provide a more extensive indication of normal or deviated motor skill development in children. However, predictors of vertical jump height in children have not been extensively explored. **PURPOSE:** To explore potential biomechanical, anthropometric, and descriptive predictors of vertical jump height (JH) in children. **METHODS:** 37 children [age (yrs): 7.2 ± 1.5 ; height (m): 1.2 ± 0.1 ; mass (kg): 26 ± 7.7] participated in the study. Participants were asked to perform five maximal effort vertical jumps. Lower extremity position data and ground reaction forces were collected using an optical motion capture system and two force platforms respectively. Peak sagittal plane lower extremity joint moments were calculated using an inverse dynamics technique, and peak joint powers were calculated as the product of individual joint moments and angular velocities. Net peak power (NP) was calculated as the highest sum of hip, knee, and ankle power at a given instant. In addition to biomechanical variables, age, height, weight, leg length, and weekly amount of physical activity served as independent variables (IV). Stepwise multiple regression analysis was conducted to determine the accuracy of IV predicting JH. **RESULTS:** Regression results indicated that the model significantly predicts JH [$R^2 = .716$, $R^2_{adj} = .70$, $F(2, 35) = 44.158$, $p < .001$], and accounts for 71.6% of the variance in JH when net peak power (14.43 ± 3.95 W/kg) and peak hip moment ($.15 \pm .06$ Nm/kg) were the sole predictors. **CONCLUSION:** NP and peak hip moment were shown to be significant predictors of JH in children, which coincides with previous research on biomechanical JH predictors in adult populations.

1406 Board #81 June 1 8:00 AM - 9:30 AM
Joint Loading While Jumping on a Pilates Reformer
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 (No relationships reported)

Exercising on a Pilates reformer has been successfully used as an exercise intervention for numerous pathologies. One area where this type of exercise has not been applied is for maintenance of bone health. Currently, it is unknown whether the forces experienced when jumping on a Pilates reformer reach recommended thresholds for osteogenic exercises. **PURPOSE:** Develop an instrumented Pilates reformer capable of measuring the ground reaction forces during Pilates jumping activities and use this device to compare joint loading when jumping on a Pilates reformer and during activities recommended for maintaining bone health. **METHODS:** An instrumented Pilates reformer (INST) was built with a strain gauge force plate mounted to the base and used as the foot board. To validate the device behaved like a commercially available reformer (COMM), a tri-axial accelerometer was used to measure tibial acceleration and a 3D motion capture system was used to measure knee kinematics while jumping on both the COMM and INST reformers. Subsequent to validation, loading rates, peak resultant hip joint reaction forces, and peak sagittal plane hip moments were evaluated while jumping on the INST reformer and during brisk walking (W) and low amplitude hopping (HOP). **RESULTS:** There were no differences between COMM and INST reformers in peak tibial acceleration (23.8 ± 3.5 m/s² vs. 24.1 ± 4.8 m/s², $p = 0.95$) or peak knee flexion ($110.1 \pm 5.9^\circ$ vs. $113.4 \pm 6.1^\circ$, $p = .54$) during jumping, suggesting the INST reformer behaved similarly to the COMM reformer. Vertical loading rates were lower in the INST condition (20.3 ± 3.5 BW/s) than in either W (95.1 ± 9.4 BW/s, $p = .026$) or HOP (109.5 ± 7.7 BW/s, $p = .007$) conditions. Peak hip joint reaction forces were not different between INST (1.2 ± 0.1 BW) and W (1.3 ± 0.1 BW, $p = .136$), but both were lower than HOP (2.9 ± 0.3 BW). Peak hip moments were not different between the INST (2.3 ± 0.2 Nm/kg), W (2.1 ± 0.5 Nm/kg, $p = .936$), or HOP (2.4 ± 0.7 Nm/kg, $p = .886$) conditions. **CONCLUSION:** Jumping on a Pilates reformer results in hip joint reaction forces similar to those experienced during brisk walking, and similar joint moments to both walking and hopping. Additional work is required to quantify bone stresses and strains during Pilates activities to determine if they reach sufficient thresholds to be classified as osteogenic exercise.

1407 Board #82 June 1 8:00 AM - 9:30 AM
Joint Stiffness and Energy Contribution during Drop Jump in Fatigued and Non-fatigued Conditions
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 (No relationships reported)

Repetitive movements in training or competitions will inevitably lead to neuromuscular fatigue. It is still unclear about the specific influence of induced fatigue on drop jump biomechanics, e.g., joint energy contribution and stiffness. **PURPOSE:** To examine the differences in joint energy contribution and stiffness before and after fatigue, further exploring how fatigue affects drop jump performance. **METHODS:** 15 male participants were required to complete 5 consecutive countermovement jumps (CMJs) and a group of shuttle running in order to induce fatigue. Subjects repeated the above procedure until the average height of 5 consecutive CMJs was below the 70% of the maximum height. Vicon system and Kistler force plates were employed to collect the kinematics and GRF data. The variables included: 1) Leg stiffness: $K_{leg} = F_i/\Delta y$, F_i was the GRF at the transition from the eccentric to concentric phase, Δy was the maximum vertical displacement of the body gravity from touchdown to the lowest position of squatting. 2) Joint stiffness: $K_{joint} = \Delta M/\Delta \theta$, ΔM and $\Delta \theta$ were the amount of change in moment and joint angle respectively. 3) Hip joint energy contribution: $C_{hip} = W_{hip} / (W_{hip} + W_{knee} + W_{ankle})$, the same as knee and ankle. W_{hip} , W_{knee} and W_{ankle} were joint work which calculated by the integration of net joint powers respectively. Paired sample *t*-tests were used to determine the statistical differences. **RESULTS:** The maximum height (0.53 ± 0.03 vs. 0.51 ± 0.04 m, $P < .05$) of drop jump in fatigued condition was decreased compared to non-fatigue. Only energy absorbed contribution of knee joint (58.36 ± 8.51 vs. 55.00 ± 8.00 %, $P < .05$) in fatigued condition was decreased during the eccentric phase of drop jump. Meanwhile, the leg stiffness (2.01 ± 0.46 vs. 1.73 ± 0.4 kN/m, $P < .01$) and ankle joint stiffness (0.018 ± 0.005 vs. 0.015 ± 0.003 Nm/kg⁰, $P < .05$) were reduced after fatigue. **CONCLUSIONS:** Drop jump in fatigued condition affected joint energy contribution and stiffness. The reduction of leg stiffness, ankle joint stiffness and energy absorbed contribution of knee joint in fatigued condition may be considered as the major factors leading to the decrease of jump height. These variables may be sensitive in indicating the performance of drop jump after fatigue, which might be helpful in monitoring the training effect. Supported by NSFC (11302131).

1408 Board #83 June 1 8:00 AM - 9:30 AM
The Relationship Between A New Test Of Trunk Control To Cutting Mechanics
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 (No relationships reported)

Poor neuromuscular control of the trunk in laboratory studies has been identified as a significant risk factor for lower extremity injuries in females. To date few clinical tests have been developed that capture trunk control which have been compared to trunk and lower extremity control. Establishing the relationship between multidirectional trunk control and lower extremity control during a cutting task would serve as the first step in establishing a measure to identify females at risk for injury in a clinical setting. **PURPOSE:** To determine the association between a new seated trunk test and trunk and lower extremity kinematics during an unanticipated cutting task. **METHODS:** 8 female subjects (20.9 ± 1.6 ages, 20.6 ± 2.0 BMI) with no prior lower extremity injuries performed an instrumented three dimensional assessment of an unanticipated cutting task. Visual 3D was used to analyze frontal plane trunk, hip, and knee kinematics at initial contact (IC). Subjects were asked to sit on a wobble board placed on a solid surface on a plinth with their feet approximately 0.1 m off the ground with their eyes closed. Errors were counted and averaged during the two 30 second trials. Errors included uncrossing the arms, opening eyes, or if the wobble board touched the plinth. Pearson Product Moment Correlations were calculated between kinematics at IC and the mean number of trunk errors. **RESULTS:** Mean frontal plane angles were trunk $-1.1 \pm 1.8^\circ$, hip, $-4.7 \pm 3.5^\circ$, knee $2.9 \pm 4.1^\circ$ and the numbers of trunk errors were 1.7 ± 1.5 . A significant relationship was observed with errors and hip adduction ($r = 0.84$, $p = 0.009$). Significant associations were not observed at the trunk ($r = 0.23$, $p = 0.578$) and knee ($r = -0.59$, $p = 0.126$). **CONCLUSIONS:** There was a significant relationship between greater hip adduction which is associated with numerous injuries to the errors on the seated trunk test. While not significant the relationship to the frontal plane knee motion did have a high *r* value indicating a strong relationship that may become significant with additional subjects. The lack of relationship to trunk mechanics could be due to a greater contribution of trunk rotation than frontal plane motion during cutting from the trunk. Future analysis will further assess this possibility.

1409 Board #84 June 1 8:00 AM - 9:30 AM
Effect of Rehabilitation Intervention on Hip Mechanics during Cutting in Patients with Chronic Ankle Instability

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 Email: prestonddanielson@gmail.com
 (No relationships reported)

Hip dysfunction may be closely associated with chronic ankle instability (CAI). Ankle and hip intervention strategies in CAI patients could improve hip mechanics during functional sport movements.

PURPOSE: To examine the effect of a 6-week ankle and hip intervention program on hip landing mechanics in patients with CAI.

METHODS: 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ($\alpha=.05$) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed.

RESULTS: Figure 1. The rehab intervention resulted in up to (i) 3.5 deg less hip flexion at 9-82% of stance, (ii) 0.27 Nm/kg less hip extension moment at 8-16% stance, and (iii) 0.2 Nm/kg more hip extension moment at 19-25% of stance. No changes were detected in frontal hip angle and frontal hip moment over time between groups.

CONCLUSIONS: Relative to the control group, CAI patients in the rehab group tend to land with less hip flexion angle along with less hip extension moment initially, but they increased hip extension moment in an effort to control the high impact landing. Less hip flexion angle and more hip extension moment are indicative of a stiff hip landing strategy. Data are needed to examine whether this strategy reduces the risk of ankle injury.

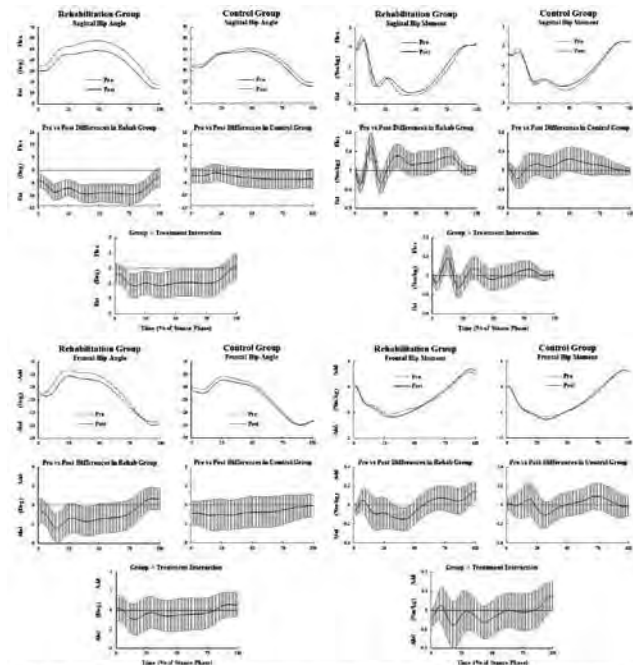


Figure 1. Ground reaction force for sagittal and frontal hip kinematics and kinetics during the stance phase of a cutting task. A group x treatment interaction was defined subtracting "Pre vs Post Differences in Rehab Group" from "Pre vs Post Differences in Control Group". When 95% confidence intervals (shaded areas) did not overlap the zero (horizontal red line), significant differences existed. Abbreviations: Pre: flexion, Ext: extension, Add: adduction, Abd: abduction.

1410 Board #85 June 1 8:00 AM - 9:30 AM
Six-week Rehabilitation Intervention Increases Ground Reaction Force during Cutting in Patients with Chronic Ankle Instability

Cameron Hadley¹, S. Jun Son¹, Hyunsoo Kim², Preston Danielson¹, Dustin Breuning¹, Matthew K. Seeley¹, J. Ty Hopkins, FACSM¹. ¹Brigham Young University, Provo, UT. ²West Chester University, West Chester, PA. (Sponsor: J. Ty Hopkins, FACSM)
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 (No relationships reported)

Altered ground reaction force (GRF) during cutting is associated with chronic ankle instability (CAI). Little is known whether a rehabilitation intervention alters GRF patterns during a cutting task.

PURPOSE: To examine the effect of a 6-week ankle and hip intervention program on GRF during the stance phase of cutting in patients with CAI.

METHODS: 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ($\alpha=.05$) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed.

RESULTS: Figure 1. The rehab intervention resulted in up to (i) 0.16 N/kg less vertical GRF at 3-9% of stance, and 0.21 N/kg more vertical GRF at 17-23% and 39-74% of stance, (ii) 0.06 N/kg more posterior GRF at 11-22% and 38-48% of stance, and 0.03 N/kg less posterior GRF at 82-97% of stance, while no changes were detected in medial-lateral GRF.

CONCLUSION: Relative to the control group, CAI patients in the rehab group tend to land with greater vertical and posterior GRF, which results in a stiffer landing. While this may lead to a faster execution of the cutting task, greater vertical GRF could result in greater impact loads in the lower extremity, which might increase the risk of ankle injury in a CAI population.

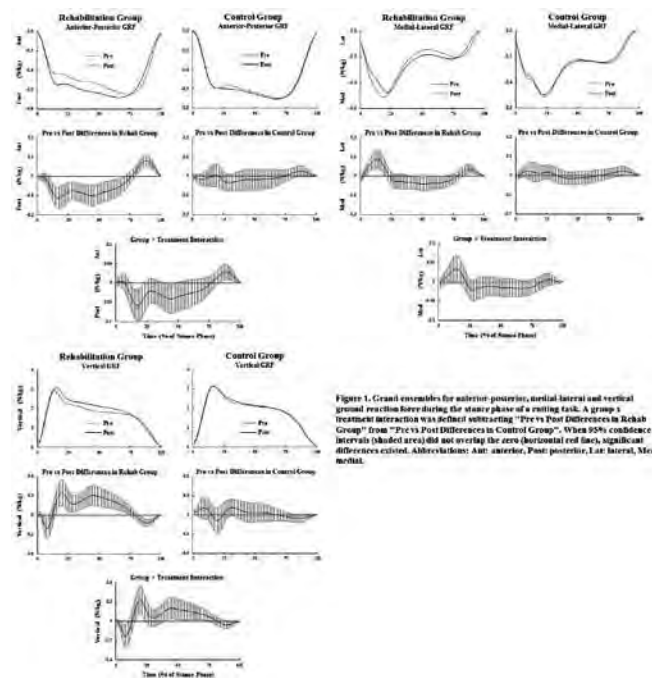


Figure 1. Ground reaction force for the anterior-posterior, medial-lateral and vertical ground reaction force during the stance phase of a cutting task. A group x treatment interaction was defined subtracting "Pre vs Post Differences in Rehab Group" from "Pre vs Post Differences in Control Group". When 95% confidence intervals (shaded areas) did not overlap the zero (horizontal red line), significant differences existed. Abbreviations: Ant: anterior, Post: posterior, Lat: lateral, Med: medial.

1411 Board #86 June 1 8:00 AM - 9:30 AM

Changes in Lower Extremity Energetics during Cutting in Chronic Ankle Instability Patients Following Rehabilitation Intervention

Brandon Winward¹, S. Jun Son¹, Hyunsoo Kim², Joseph Mills¹, Dustin Breuning¹, Matthew K. Seeley¹, J. Ty Hopkins, FACSM¹.
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 (No relationships reported)

Energetic redistribution from the distal to proximal joints may be linked to sensorimotor deficits at the ankle in patients with chronic ankle instability (CAI). Little is known whether a rehab intervention improves lower extremity energetic patterns during cutting.

PURPOSE: To examine the effect of a 6-week ankle and hip intervention program on ankle, knee and hip joint power during cutting in CAI patients.

METHODS: 15 CAI subjects in a rehab group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ($\alpha=.05$) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed.

RESULTS: Figure 1. The rehab intervention resulted in up to (i) 0.8 W/kg less ankle power generation at 89-98% of stance, (ii) 2.9 W/kg more knee power absorption at 19-26% and 41-49% of stance, and 0.9 W/kg more knee power generation at 64-76% and 94-100% of stance, and (iii) 2.7 W/kg more hip power absorption at 2-5% and 17-25% stance and 1.6 W/kg less hip power absorption at 9-14% of stance.

CONCLUSIONS: Relative to the control group, CAI patients in the rehab group tend to absorb power using the knee and hip during landing and to generate power using the knee during push-off. Proximal joints play a key role in landing energetics in patients with CAI following the intervention.

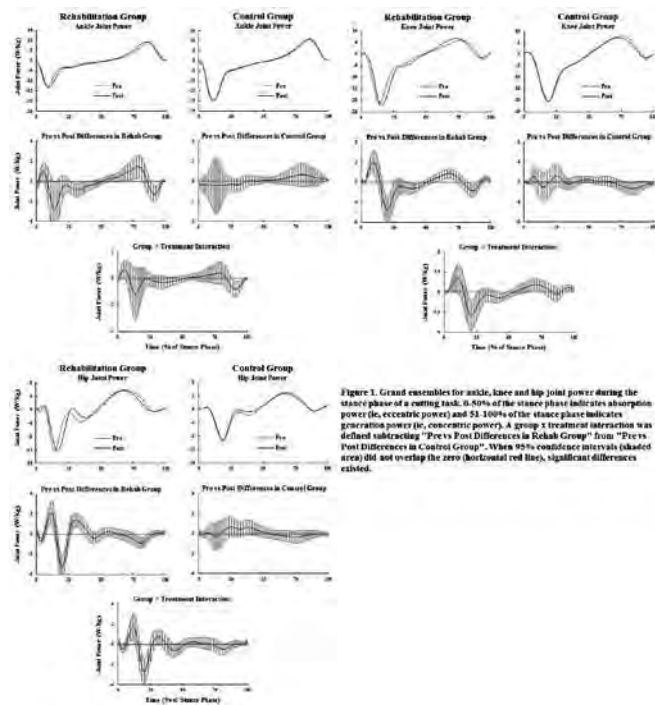


Figure 1. Grand ensembles for ankle, knee and hip joint power during the stance phase of a cutting task. 0-50% of the stance phase indicates absorption power (ie, eccentric power) and 51-100% of the stance phase indicates generation power (ie, concentric power). A group x treatment interaction was detected subtracting "Pre vs Post Differences in Rehabilitation Group" from "Pre vs Post Differences in Control Group". When 95% confidence intervals (shaded area) did not overlap the zero (horizontal red line), significant differences existed.

C-35 Free Communication/Poster - Biomechanics of Resistance Training

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1412 Board #87 June 1 9:00 AM - 10:30 AM

Back Squat Performance Characteristics of Resistance Trained Males Are Affected by Wearing Knee Wraps

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 (No relationships reported)

Knee wraps have been used to improve back squat performance characteristics during free weight resistance training. **PURPOSE:** To investigate the effects of using knee wraps on back squat performance characteristics (force, velocity, power). **METHODS:** Twelve resistance-trained males (mean±SD; Age: 25±4yrs, Height: 1.78±0.06m, Mass: 86.6±13.3kg, 1RM: 152±21kg) volunteered to participate in a 2-week back squat training study. Subjects performed a back squat training protocol (5 sets of 5 repetitions with 5 min rest between sets) without (UW) and with knee wraps (KW) on separate days in a randomized order. A linear position transducer was used to measure average concentric/eccentric velocity (AV/EV), peak concentric velocity (PV), peak concentric force (PF) and average/peak concentric power (AP/PP). Repeated measures ANOVAs were used to determine differences in back squat performance across treatment (UW, KW) and set (1-5). Paired t-tests were used with a Bonferroni correction for post-hoc analysis of significant ANOVAs. **RESULTS:** Significant ($p<0.001$) treatment by set interactions were observed such that wearing knee wraps during the back squat increased AV (Set1: 14.3%, Set2: 25%, Set3: 25%, Set4: 26.7%, Set5: 22.6%, $p<0.001$), decreased EV (Set1: 18.9%, Set2: 13.3%, $p<0.001$), increased PV (Set4: 7.5%, Set5: 13.8%, $p<0.001$), and increased AP (Set1: 12.1%, Set2: 23.2%, Set3: 23.9%, Set4: 26.7%, Set5: 24.5%, $p<0.001$). In addition, significant ($p<0.001$) main effects of treatment were observed such that wearing knee wraps during the back squat increased AV (UW: 0.32 ± 0.08 m/s, KW: 0.39 ± 0.10 m/s, $p<0.001$), decreased EV (UW: 0.38 ± 0.10 m/s, KW: 0.34 ± 0.12 m/s, $p<0.001$), increased PV (UW: 0.72 ± 0.19 m/s, KW: 0.77 ± 0.18 m/s, $p<0.001$), increased PF (UW: 2671 ± 411 N, KW: 2745 ± 308 N, $p<0.001$), increased AP (UW: 671 ± 172 W, KW: 817 ± 192 W, $p<0.001$), and increased PP (UW: 1760 ± 524 W, KW: 1899 ± 585 W, $p<0.001$). **CONCLUSIONS:** These data demonstrate that knee wrap treatment can be used to improve back squat performance characteristics in resistance-trained men. Future studies should measure the effects of knee wraps treatment at near maximal intensities (>85%1RM) and submaximal intensities (<85%1RM) in order to further evaluate velocity, force, and power characteristics of the back squat.

1413 Board #88 June 1 9:00 AM - 10:30 AM

Comparison Of Peak Ground Reaction Forces Of Flexible Barbell And Steel Olympic Barbell At Various Lifting Speeds

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 (No relationships reported)

Previous research reported that force production of a flexible barbell (FB) to that of a steel Olympic barbell (SB) resulted in the FB generating greater maximum ground reaction forces (GRFmax) for experiments with a lifting machine and human subjects lifting at 1.73 ft/s. No studies have shown that the same trend is true for other lifting speeds (LS). **PURPOSE:** The purpose of this study was to compare maximum and minimum ground reaction force production (GRFmax, GRFmin) of the FB and the SB at various physiologically relevant LSs. **METHODS:** Using a bar-lifting machine, an SB and FB were lifted at various speeds between 1.87 ft/s and 3.57 ft/sec. The weight of each bar was set to 63lbs. The GRFmax and the GRFmin of FB and SB were compared with independent-samples t-tests. **RESULTS:** The FB had significantly higher GRFmax for all speeds excluding 3.06 ft/s (LS=1.87 ft/s: 4619 +/- 11 N vs. 4609 +/- 19 N, $p<0.001$; LS=2.04 ft/s: 4834 +/- 11 N vs. 4662 +/- 23 N, $p<0.001$; LS=2.21 ft/s: 5202 +/- 29 N vs. 4731 +/- 16 N, $p<0.001$; LS=2.38 ft/s: 5345 +/- 11 N vs. 4911 +/- 28 N, $p<0.001$; LS=3.23 ft/s: 5433 +/- 15 N vs. 5233 +/- 35 N, $p<0.001$; LS=3.40 ft/s: 5701 +/- 19 N vs. 5293 +/- 21 N, $p<0.001$; LS=3.57 ft/s: 5897 +/- 55 N vs. 5430 +/- 43 N, $p<0.001$). The FB also had significantly lower GRFmin for all speeds excluding 3.06 ft/s, 3.40 ft/s and 3.57 ft/s (LS=1.87 ft/s: 4055 +/- 7 N vs. 4131 +/- 10 N, $p<0.001$; LS=2.04 ft/s: 3861 +/- 16 N vs. 4076 +/- 11 N, $p<0.001$; LS=2.21 ft/s: 3520 +/- 17 N vs. 4025 +/- 10 N, $p<0.001$; LS=2.38 ft/s: 3604 +/- 26 N vs. 3932 +/- 21 N, $p<0.001$; LS=3.23 ft/s: 3325 +/- 23 N vs. 3417 +/- 25 N, $p<0.001$). **CONCLUSIONS:**

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These results may provide a physiological mechanism to recruit more type IIx muscle fibers compared to the SB under these conditions. Future studies need to be conducted to validate these results with human subjects for different types of lifts.

1414 Board #89 June 1 9:00 AM - 10:30 AM
Comparison of the Effect of Flexible Barbell Weight Position on Max Ground Reaction Force
 Sun Lee, Randolph E. Hutchison, Nicholas Hayden, Simone Alimonti, Anthony Caterisano, FACSM. *Furman University, Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)
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 (No relationships reported)

Previous research reported that force production of a flexible barbell (FB) to that of a steel Olympic barbell (SB) resulted in the FB generating greater maximum ground reaction forces (GRFmax) for experiments with a lifting machine and human subjects lifting at 1.73 ft/s at an inner position. No studies have shown that the same trend is true for other lifting speeds (LS) at various inner and outer positions of the FB. **PURPOSE:** The purpose of this study was to compare maximum ground reaction force production (GRFmax) of the FB at various physiologically relevant LSs at an inner-most and outer-most position for the loaded weight plates. **METHODS:** Using a bar-lifting machine, FB were lifted at various speeds of 2.04 ft/s, 2.21 ft/s, and 2.38 ft/sec. The weight of each bar was set to 63lbs and placed at an inner-most (in) and outer-most (out) position on the FB. The GRFmax of FB in and out positions were compared with independent-samples t-tests. **RESULTS:** The FB had significantly higher GRFmax for all speeds for the out position (see table below). **CONCLUSIONS:** These results may provide a physiological mechanism to recruit more type IIx muscle fibers compared to the SB under these conditions. Future studies need to be conducted to validate these results with human subjects for different types of lifts.

Maximum Ground Reaction Forces (N) for In vs. Out Position		
Speed (ft/s)	FB in position	FB out position
2.04	4743+/-15.5	4877+/-25.1
2.21	4852+/-20.3	5178+/-21.8
2.38	5001+/-24.2	5397+/-32.0

1415 Board #90 June 1 9:00 AM - 10:30 AM
Ground Reaction Force Asymmetries in the Bodyweight Squat: An Examination of Phases
 Raoul F. Reiser, II, FACSM, Steven D. Medberry, Grant V. Overmoyer. *Colorado State University, Fort Collins, CO.*
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 (No relationships reported)

Lower-extremity functional asymmetries (LEFA) of the bodyweight squat have been found to be related to injury risk, post-injury function, and physical performance. Due to movement complexity, several sources may cause LEFA to change throughout the exercise. **PURPOSE:** The goal of this investigation was to examine vertical ground reaction force (GRFv) LEFA and their relationships in multiple phases of the movement. **METHODS:** Twenty recreationally active adults (9 men, 11 women; age = 21.9 ± 2.6 yrs; height = 171 ± 8.8 cm; mass = 67.2 ± 1.9 kg (mean ± SD)) performed five consecutive bodyweight squats while GRFv were recorded under each foot. Squats were performed in a controlled manner with hands on hips, each repetition separated by a brief pause. LEFA was calculated by subtracting the percent of the average GRFv on the preferred kicking leg (KL) from that of the non-preferred kicking leg (NKL) over the entire movement and within 6 phases: the entire down (eccentric), the entire up (concentric), and first and second half of each. Eleven subjects were reassessed at a later date for repeatability. **RESULTS:** LEFA in the phases were not significantly different from the 1.4 ± 4.9% NKL-KL LEFA over the entire movement (p = 0.998). Similarly, absolute levels of LEFA in the phases were not significantly different from the 4.5 ± 2.1% LEFA over the entire movement (p = 0.415). Pearson's correlations of LEFA levels found all phases to be significantly correlated with each other as well as the total movement (r ≥ 0.499). However, when just the 10 most asymmetric subjects were examined (absolute LEFA > 4.5%) significant correlations between concentric and eccentric phases were less common (p ≥ 0.055 in 4 of 9 comparisons). LEFA were found to be highly repeatable (Chronbach's α ≥ 0.715 except in the second half of the up phase where α = 0.548). **CONCLUSION:** These results suggest that in healthy subjects with low levels of LEFA the source(s) of any weight-bearing asymmetry may be expressed similarly throughout the movement. However, in those that are more asymmetric different sources may exist between phases or the mode of contraction may cause asymmetries to be expressed differently from a single source. Therefore, when screening for injury risk, it may be necessary to examine more than just the average over the entire squat movement.

1416 Board #91 June 1 9:00 AM - 10:30 AM
Effects of Zero-Drop Shoes on Knee Joint Kinematics & Kinetics During the Barbell Back Squat
 Tanner Thorsen, 37996¹, Chris Cummings², Tyler Standifird².
¹University of Tennessee Knoxville, Knoxville, TN. ²Utah Valley University, Orem, UT. (Sponsor: Songning Zhang, FACSM)
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 (No relationships reported)

PURPOSE: During the barbell back squat, increased loading promotes strength gain, but also poses potential for injury from increased exertion at lower extremity joints. Barefoot and zero-drop footwear are being studied in running and other athletic situations, but little is known about how they influence squatting. It has been shown that there is a reduction of frontal plane knee moments during squatting in barefoot and zero-drop footwear compared to standard athletic shoes. The purpose of this study was to investigate joint moment differences at the ankle and hip while performing barbell back squats in barefoot and zero-drop footwear. **METHODS:** 10 male and 5 female (n=15) recreational weight lifters performed 1 set of 10 repetitions of barbell back squats at a self-selected weight, defined as the amount of weight the participant would do with performing 4 sets of 10 repetitions. The sets were performed in unshod, non-cushioned zero-drop (0mm heel-toe drop, minimalist style), cushioned zero drop (0mm heel-toe drop, cushioned soles), and standard athletic shoe (SAC) conditions while 3D kinematics and kinetics were collected. **RESULTS:** The barefoot condition led to a reduced peak dorsiflexion angle (14.4° ± 3.6°, p < 0.001) and sagittal plane range of motion (15.3° ± 3.6°, p < 0.001) compared to the SAC. A reduced peak plantarflexion moment in the barefoot condition was trending towards significance (p = 0.072) compared to the SAC. Peak dorsiflexion angles were not significantly different between either zero-drop condition and SAC. The peak plantarflexion moment in the cushioned zero-drop condition was reduced compared to the standard condition (0.80 Nm/kg ± 0.36 Nm/kg, p = 0.008). A decrease of the peak ankle inversion moment in the non-cushioned zero-drop condition was also trending towards significance (p = 0.082). No significant differences were seen in the hip kinematic and moment variables. **CONCLUSION:** The results indicate that performing barbell back squats in either of the zero-drop conditions reduces the demands placed on the ankle joint compared to the SAC. Performing the barbell back squat barefoot provides the greatest reduction of stress to the ankle. Implication of these findings suggest that zero-drop footwear are effective to use while squatting in companion with other athletic footwear used for training.

1417 Board #92 June 1 9:00 AM - 10:30 AM
A Kinematic And Kinetic Analysis Of The Partial And Conventional Deadlift In Resistance-trained Males
 Matthew K. Beeler¹, Stuart D. Inglis², Robert Ammon³, William J. Kraemer, FACSM¹, Brett A. Comstock³. ¹The Ohio State University, Columbus, OH. ²University at Buffalo, Buffalo, NY. ³University of South Dakota, Vermillion, SD. (Sponsor: William J. Kraemer, FACSM)
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 (No relationships reported)

The partial deadlift (PDL) is commonly used to improve maximum strength in the conventional deadlift (CDL). However, it has been proposed that a problem with the PDL may be the lifters inability to replicate the CDL body position and form in the PDL at the liftoff position. Currently, no studies have been conducted to determine the kinematic or kinetic profile of the PDL or how it compares to the CDL. **PURPOSE:** To investigate the kinematic and kinetic differences between the PDL and CDL by comparing the joint angles of the ankle, knee, hip, thorax, and joint moments of the ankle, knee, and waist. **METHODS:** A group of 10 resistance-trained healthy males (22.50 ± 2.12 years; 165.50 ± 6.57 cm; 93.69 ± 12.51 kg) with a minimum of two years of resistance training experience that included frequent use of the barbell squat and CDL volunteered for this study. Subjects attended a familiarization session before beginning the study. They were tested on three visits separated by no less than 48 hours. One repetition maximum (1RM) CDL strength was determined in visit 1. In visits 2 and 3, each subject completed the CDL or PDL at 80% of 1RM of the CDL. Whichever lift was not completed in visit 2 was completed in visit 3 in a randomized and balanced fashion. Data was collected using 3D motion analysis and two force plates. Data was compared between the PDL and CDL by beginning the capture at the liftoff point of the PDL for each lift. Joint angles of the ankle, knee, hip, and thorax as well as joint moments of the ankle, knee, and waist were compared. Separate 1 factor (group) MANOVAs were performed to determine if a significant difference exists between the PDL and CDL in these variables. **RESULTS:** The PDL exhibited significantly greater knee flexion (37.32 ± 5.18° to 27.61 ± 6.83°, p £ 0.05), less hip extension at near significance (104.04 ± 7.94° to 112.67 ± 11.35°, p = 0.064), a significantly smaller NJM at the knee (764.19 ± 393.33 Nm to 1225.74 ± 279.09 Nm, p £ 0.05), and a significantly smaller NJM at the waist (3901.63 ± 386.85 Nm to 4527.82 ± 712.62 Nm, p £ 0.05) at liftoff of the PDL. **CONCLUSION:** The form used, and forces at the knee and trunk extensors

at liftoff in the PDL may be significantly different than the CDL. Due to these differences, the PDL may not be an appropriate exercise for improving the CDL. Care should be used when selecting appropriate exercises to improve the CDL.

- 1418 Board #93 June 1 9:00 AM - 10:30 AM
Validity Of Using The Microsoft Kinect™ To Automatically Assess Deep Squat Performance
 Paul D. Smith¹, Michael Hanlon². ¹*GSK Human Performance Lab, Brentford, United Kingdom.* ²*Waterford Institute of Technology, Waterford, Ireland.* (Sponsor: Glyn Howatson, FACSM)
 Email: paul.3.smith@gsk.com
 (No relationships reported)

The Functional Movement Screen (FMS™) identifies limitations in an individual's movement patterns. The Microsoft Kinect™ sensor is reported to be a feasible markerless system to assess joint angles during a squat and has the potential to be a quantitative tool for the FMS™. **PURPOSE:** To assess the inter and intra-rater reliability of the Microsoft Kinect™ sensor, integrated with bespoke software, for assessing the deep squat FMS™ sub test. **METHODS:** A prototype (V1) was developed to allow the Kinect™ to track flexion of the hip and knee joints, and alignment between ankle and knee joints, to score deep squat performance against FMS™ guidelines. Prototype (V2) was developed to enhance reliability by tracking 20 body joints during deep squat performance. Raw data was captured, based on a deep squat score of three, as per FMS™ guidelines, to generate teaching samples. The samples were fed into a machine learning algorithm to allow the Kinect™ to learn deep squat performance. A data model was then created to identify individual movement errors as outlined by FMS™ guidelines, to calculate a performance score. For prototype (V1), a convenience sample of 141 children (9.7±3.7 years) performed the deep squat three times. For prototype (V2), 43 adults (23±7.5 years) completed the deep squat three times and repeated 72 hours later in a test retest protocol. For both validations, the Kinect™ was set four metres from each participant in the frontal plane and at one metre high. In addition, a blinded manual assessment of each performance was completed by a certified FMS™ tester, whilst the bespoke software automatically assessed performance. A Cohen's Kappa statistic was calculated to determine inter-rater reliability between manual and the prototype (V1) automatic scoring methods. For prototype (V2), the intraclass correlation coefficient (ICC) was determined to assess intra-rater reliability between test re-test performances. **RESULTS:** Inter-rater reliability between blinded manual assessment and the bespoke software was found to be excellent for prototype (V1) (Kw = 0.89). Intra-rater reliability was found to be high for prototype (V2) (ICC = 0.99). **CONCLUSIONS:** The results indicate the Kinect™ sensor, linked with bespoke software, is a more reliable tool to assess deep squat FMS™ test performance than manual assessment.

- 1419 Board #94 June 1 9:00 AM - 10:30 AM
The Effects of Squats and Jump Squats on Mechanical Work and Energy Expenditure
 Shawn N. Munford, Michael L. Rossetti, Gavin L. Moir, Brandon W. Snyder, Shala E. Davis, FACSM. *East Stroudsburg, East Stroudsburg, PA.* (Sponsor: Shala E. Davis, FACSM)
 (No relationships reported)

PURPOSE: To investigate the effects of two non-ballistic squat and two ballistic jump squat protocols performed over multiple sets on the total mechanical work performed and oxygen uptake. **METHODS:** In a counterbalanced cross-over design, 11 resistance-trained men (age: 21.9 ± 1.8 years; height: 1.79 ± 0.05 m; mass: 87.0 ± 7.4 kg) attended four testing sessions during a three week period where they performed multiple sets of squats and jump squats with a load equivalent to 30% 1-repetition maximum under one of the following conditions: 1) three sets of four non-ballistic repetitions (30N-B), 2) three sets of four non-ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PN-B), 3) three sets of four ballistic repetitions (30B), 4) three sets of four ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PB). Force plates and a 3-D motion analysis system were used to determine the total mechanical work performed during each session while a portable gas analysis system was used to collect expired gases. **RESULTS:** Total mechanical work performed during each set was significantly greater during 30B compared to 30N-B (mean difference [MD]: 7,792 J, p<0.001, effect size [ES]: 1.88) and 30PN-B (MD: 7,749 J, p<0.001, ES: 1.89), while that during 30PB was significantly greater than that during both 30N-B (MD: 7,488 J, p<0.001, ES: 1.89) and 30PN-B (MD: 7,445 J, p<0.001, ES: 1.90). Energy expenditure during each set was significantly greater during the 30B condition compared to the 30N-B (MD: 13,983 J, p<0.001, ES: 1.08) and the 30PN-B (MD: 11,326 J, p=0.001, ES: 0.92). Energy expenditure during 30PB was also significantly greater than that during 30N-B (MD: 12,615 J, p=0.001, ES: 1.04) and 30PN-B (MD: 9,958 J, p=0.006, ES: 0.86). Furthermore, energy expenditure during set 1 was significantly greater than that during set 2 (MD: 6,840 J, p<0.001, ES: 0.64) and set 3 (MD: 8,070 J, p<0.001,

ES: 0.75). **CONCLUSION:** Ballistic resistance training exercises may represent a more effective metabolic stimulus compared to traditional resistance training exercises and a pause inserted between the eccentric and concentric phases has little effect.

- 1420 Board #95 June 1 9:00 AM - 10:30 AM
Electromyographic Analysis Of The Two Parts Of The Gluteus Maximus During Squat Exercises
 Bhupinder Singh, Alex Bachtelle, Derek S. Camilleri, Melissa Lai. *California State University, Fresno, CA.*
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 (No relationships reported)

PURPOSE: Many lower extremity strengthening programs prescribed after injury include the squat as an integral part of rehabilitation. Little attention has been paid, however, in either research or clinical settings, to the impact of the functional differentiation on segmentation of the gluteus maximus (GM) muscle on the prescription of therapeutic exercise. The purpose of this study was to describe the activation of the two parts of the gluteus maximus muscle during a single and double leg squat.

METHODS: Ten subjects (7 females, 3 males, mean age 23.6 years) without current neuromuscular or orthopedic ailments participated in the study. Electromyographic (EMG) activity was assessed with surface electrodes, (Model EMG-55, Therapeutics Unlimited). Electrodes were placed on the right side, lateral and inferior to PSIS for upper part of GM and inferior to the greater trochanter for the lower part of GM. EMG electrodes were also placed on the gluteus medius (GMED) and adductor magnus (ADM). Subjects performed 5 trials for each bilateral and single leg squats with a maximum knee flexion angle of 100 degrees. Squat activity was time normalized and EMG amplitudes normalized to %Maximal Voluntary Contraction (MVIC). Paired t-test and Pearson correlations (p-value <0.05) were performed between the levels of muscle activation for two types of squat.

RESULTS: Mean activation was greater for the UGM (0.38 ± 0.04) compared to the LGM (0.25 ± 0.04) for the single leg squat (p < 0.01) demonstrating different recruitment. UGM activation was greater than LGM (p < 0.01) during abduction MVIC testing. A stronger correlation was observed between LGM-ADM (0.76) compared to UGM-ADM (0.55) for single leg squat. LGM was highly correlated to ADM during the bilateral squat (0.95). A strong correlation was also observed between UGM-GMED (0.74) during single leg squat.

CONCLUSIONS: Differences are seen in the activation levels and patterns for the upper and lower GM. LGM compliments the role of ADM during both bilateral and single leg squats. Upper part of GM were strongly correlated with the GMED, suggesting the GM has an abductor function during a single leg squat. The results suggest that segmentation of muscles based on moment arms should be taken into consideration for muscle modeling and in developing more specific therapeutic exercises.

- 1421 Board #96 June 1 9:00 AM - 10:30 AM
A Consecutive Loop Elastic Band Placed Around the Distal End of the Thighs During an Overhead Barbell Squat Increases Medial Knee Collapse
 Brandon W. Collins¹, Davis A. Forman², Michael E. Rogers, FACSM³, Garrick N. Forman², Phil Page, FACSM⁴, Michael W.R. Holmes², Duane C. Button¹. ¹*Memorial University, St. Johns, NL, Canada.* ²*University of Ontario Institute of Technology, Oshawa, ON, Canada.* ³*Wichita State University, Wichita, KS.* ⁴*Louisiana State University, Baton Rouge, LA.* (Sponsor: Michael E Rogers, FACSM)
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 (No relationships reported)

The use of a resistant band wrapped around the distal end of the thighs may act as a proprioceptive aid to reduce medial collapse of the knee during squats. No studies have examined this corrective technique on mechanically advanced exercises, such as the overhead barbell squat. **PURPOSE:** The purpose of this study was to examine the influence of a high resistance consecutive loop elastic band on lower body kinematics during an overhead barbell squat.

METHODS: 8, resistant-trained males participated in the study. 3D kinematics were assessed using motion capture and sampled at 50 Hz. Kinematics were captured using rigid bodies consisting of active, infrared markers placed bilaterally on the mid-segmental areas of the foot, shank, thigh and thorax. Participants warmed up with a single set of bodyweight squats for a self-selected number of repetitions, followed by two sets of overhead barbell squats with a load of 25% of their bodyweight with and without a consecutive loop elastic band (resistance of 6.5 KG at 100% elongation) wrapped around the distal end of the thighs. Sets were performed for 12 repetitions, or to voluntary failure, at a controlled tempo. The order with which the band was used was randomized. Medial knee collapse was calculated using a knee width index (KWI) as a ratio of the distance between the distal thigh segments and the distal shank segments. KWI was evaluated for both concentric and eccentric phases.

RESULTS: The maximum knee flexion angle across the 12 repetitions was not different between the band and no band conditions ($P = 0.18$). However, the average KWI was smaller with the band condition for the concentric phase (band: 0.96 ± 0.6 ; no band: 1.0 ± 0.06 , $P < 0.05$) and eccentric phase (band: 0.97 ± 0.06 ; no band: 1.0 ± 0.05 , $P < 0.05$). Maximum KWI was also smaller for the band condition for the concentric phase (band: 1.0 ± 0.06 ; no band: 1.04 ± 0.05 , $P < 0.06$) and eccentric phase (band: 1.0 ± 0.05 ; no band: 1.04 ± 0.06 , $P < 0.05$).

DISCUSSION: KWI during the overhead barbell squat was significantly smaller with the use of the band. Familiarity may have played a role in this finding as none of the participants had any prior experience with band-assisted work. Because the band provides a high amount of resistance, the use of the band may have actually enhanced medial collapse rather than improve it. Sponsored by Performance Health.

1422 Board #97 June 1 9:00 AM - 10:30 AM
Internal and External Focus of Attention During Bench Press Results in Increased EMG Amplitudes

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It is generally acknowledged that performance in various motor skills can be significantly affected by the participant's focus of attention, induced by instructions for instance. However, the effect of focus of attention in relation to strength training exercises remains to be investigated. **PURPOSE:** To address the effect of internal and external focus of attention on the surface electromyography (EMG) amplitude during bench press. **METHODS:** Twenty-one young male individuals (age 25 ± 2 years) with at least two years of strength training experience (3 repetition maximum (3RM) in bench press 109 ± 25 kg) voluntarily participated in this study. Participants performed a 3RM maximum test followed by a set of 3 repetitions at 75% of 3RM and three sets of eight repetitions in bench press at 60% of 3RM. This task was executed in three experimental conditions: (1) without any specific instruction concerning the focus of attention (NOI), (2) with an internal focus of attention on the contraction of the pectoral muscle (INT), and (3) with an external focus of attention on the movement of the bar (EXT). The order of (2) and (3) were randomized. EMG data was recorded from 13 muscles, i.e. 7 from the upper body and 6 from the lower body. Each EMG envelope was normalized with respect to the EMG data recorded at 75% of 3RM and the average EMG amplitude was calculated. **RESULTS:** The average normalized EMG amplitude values were significantly higher for EXT than NOI for pectoralis major (PM) 44 ± 16 vs. $40 \pm 16\%$, anterior deltoid (DA) 43 ± 18 vs. $38 \pm 17\%$, triceps brachii medial head (TBM) 40 ± 19 vs. $35 \pm 17\%$, latissimus dorsi (LD) 40 ± 17 vs. $36 \pm 16\%$, and erector spinae (ES) 24 ± 15 vs. $22 \pm 14\%$ ($p \leq 0.05$ for all). The average normalized EMG amplitude values were significantly higher for INT than NOI for DA 43 ± 18 vs. $38 \pm 17\%$, biceps brachii (BB) 30 ± 18 vs. $28 \pm 16\%$, TBM 40 ± 19 vs. $35 \pm 17\%$, LD 43 ± 18 vs. $36 \pm 16\%$, and ES 27 ± 17 vs. $22 \pm 14\%$ ($p \leq 0.05$ for all). In other words, the EMG amplitude increased in 6 of 7 muscles of the upper body, when an external or internal focus of attention was applied as compared to a control condition. **CONCLUSIONS:** The present findings indicate that adopting an internal or external focus of attention significantly increases the EMG amplitude in muscles of the upper body during bench press when compared to a control condition.

1423 Board #98 June 1 9:00 AM - 10:30 AM
External Mechanical Indices of Resistance Exercise and the O₂ Cost

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PURPOSE: (1) To measure external mechanical indices of Work & Power during bouts of resistance exercise (RE) completed at 3 relative intensities (RI). (2) To determine the relationship between external measures of Work & Power during RE & O₂ uptake (VO₂) & CO₂ production (VCO₂). **METHODS:** 9Ss, 7 female, who were RE untrained volunteered. Ss underwent assessments to determine VO_{2max}, body composition (BodPod), & 1-RM for Chest Press (CP) & Leg Press (LP). RI were set at 33, 50, & 75% 1-RM; 22, 15, & 10 reps were performed, respectively, in an attempt to control for volume of work during RE. Experimental procedures consisted of: 5min Rest, followed by RE, & 10min Post RE Rest; RE & Post RE Rest were repeated for LP & CP at each RI. RE-RI combinations were counterbalanced. VO₂, VCO₂ & HR were recorded using a Cosmed K4b². Work (W), Work Integral (IntW), Power (P), & Total RE Time (T) was measured with an ultrasound sensor (used to measure Distance & Time of weight stack movement) and NI's Labview software platform. **RESULTS:** Age= 21.5 ± 0.5 yrs, Ht= 166.5 ± 6.2 cm, Mass= 65.4 ± 11.7 kg, BMI= 23.5 ± 3.7 , BodyFat%= 20.7 ± 7.5 , FM= 13.8 ± 7.5 kg, LM= 51.5 ± 7.7 kg, VO_{2max}= 46.4 ± 8.4 ml/kg/min, RERmax= 1.13 ± 0.03 , & HRmax= 200 ± 6.2 . Total O₂ cost (TVO₂) was measured

as the O₂ used during RE & 10min Post RE Rest using Integral estimation of breath-by-breath intervals. W, IntW & P during LP & CP was not significantly different (sd) by RI. T during LP & CP was sd by RI [LP75<LP50<LP33 & CP75<CP50<CP33; $p < 0.005$]. W, IntW & P for LP compared to CP at each RI was significantly greater ($p < 0.01$). T during LP75 vs CP75 was not sd while T for LP vs CP was significantly greater at 50% & 33% RI ($p < 0.005$). W & IntW for Rep1 vs last Rep were not sd for LP or CP by RI. P for Rep1 vs last Rep was sd for LP75 & CP75 ($p < 0.05$). W, IntW & P were significantly, positively correlated with VO₂ & VCO₂ during RE for CP at each RI & for LP50. W, IntW & P for LP or CP were not correlated with TVO₂. **CONCLUSIONS:** Measurement of W & P was actually held constant during RE bouts at each RI, but W & P during LP was greater at each RI. Only during CP were W & P related to VO₂ & VCO₂ at each RI; however, TVO₂ was not related to W & P during either LP or CP. This suggests a disassociation between W & P and the dynamics of VO₂, VCO₂ & TVO₂ and ultimately the O₂ deficit & debt incurred during & following RE.

C-36 Free Communication/Poster - Body Composition

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1424 Board #99 June 1 9:00 AM - 10:30 AM
Polyphenol Supplementation Attenuates Apoptotic Signaling Following Acute Resistance Exercise in Untrained Males

Jeremy R. Townsend¹, Jeffrey R. Stout, FACSM², Adam R. Jajtner³, David D. Church², Kyle S. Beyer², Michael B. La Monica², Joshua J. Riffe², Tyler W.D. Muddle², Leonardo P. Oliveira², Kelli A. Herrlinger⁴, David H. Fukuda², Jay R. Hoffman, FACSM². ¹Lipscomb University, Nashville, TN. ²University of Central Florida, Orlando, FL. ³Kent State University, Kent, OH. ⁴Kemin Foods L.C., Des Moines, IA. (Sponsor: Jeffrey Stout, FACSM)
 (No relationships reported)

Research has demonstrated an increase in free radical production, oxidative stress, and apoptotic signaling following resistance exercise. Thus, identifying dietary strategies to prevent or attenuate exercise-induced cellular stress and apoptotic activity are of interest. **PURPOSE:** To examine the effects of 28-days of supplementation with an aqueous proprietary polyphenol blend (PPB) sourced from *Camellia sinensis* on intramuscular apoptotic signaling following an acute lower-body resistance exercise protocol and subsequent recovery. **METHODS:** Untrained males ($n=38$, 21.8 ± 2.7 y, 1.7 ± 0.1 m, 77.6 ± 14.6 kg) were randomized to PPB ($n = 14$), placebo (PL; $n = 14$) or control (CON; $n = 10$). Participants completed a lower-body muscle-damaging resistance exercise protocol comprised of 10 repetitions at 70% of 1-RM for the squat (6 sets), leg press (4 sets) and leg extension (4 sets), with 90 seconds of rest between sets. Skeletal muscle microbiopsies were obtained from the vastus lateralis pre-exercise (PRE), 1-hour (1HR), 5-hour (5HR), and 48-hours (48HR) post-resistance exercise. Apoptotic signaling pathways were quantified using multiplex signaling assay kits to quantify total proteins (Caspase 3, 8, 9) and markers of phosphorylation status (JNK, FADD, p53, BAD, Bcl-2). Change scores from PRE were calculated for each group (PPB, PL, CON) and analyzed by magnitude based inferences to compare the effects of each condition on intramuscular signaling following resistance exercise. The precision of the magnitude inference was set at 90% confidence limits using the p value corresponding to the t-statistic. **RESULTS:** Magnitude based inferences indicated a "likely" decrease in total Caspase 3 and "possibly" decreased total Caspase 9 in PPB compared to PL from PRE-5H. JNK phosphorylation was "likely" decreased from PRE-5H in PPB compared to PL. BAD was "very likely" decreased from PRE-5H in PPB when compared to PL and Bcl-2 was "likely" decreased from PRE-1H and PRE-5H in PPB compared to PL. Phosphorylation of p53 was "likely increased" in PPB compared to PL from PRE-1H and PRE-48H. **CONCLUSION:** These data indicate that chronic supplementation with PPB may attenuate or delay indices of apoptosis in skeletal muscle following an acute muscle-damaging resistance exercise. Supported by Kemin Foods L.C.

THURSDAY, JUNE 1, 2017

1425 Board #100 June 1 9:00 AM - 10:30 AM

Body Composition Of Italian Soccer RefereesCristian Petri¹, Gabriele Mascherini¹, Carlo Castagna², Angelo Pizzi², Pierluigi Collina³, Giorgio Galanti¹. ¹*Sport Medicine Center, Florence, Italy.* ²*FIGC, Florence, Italy.* ³*UEFA, Florence, Italy.*

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(No relationships reported)

PURPOSE Soccer is a sport in which players perform different kind of activities at different level of effort over a 90-min match. Referee is so important for this sport that without him there is no match. The objective of the present study was determined the body composition of official Italian soccer referees and compare their changes through a regular season (T1, October; T2, December; T3, May) with a team of the first Italian league. **METHODS** 22 elite soccer referees (SR) from the Italian Association of Soccer and 18 elite Soccer players (SP) were enroll in this study. The variables of body mass, height, skinfold thicknesses, body circumferences (waist, hip and biceps) were collected with the purpose of estimating Sum of skinfold thicknesses, Fat Mass (FM %), Fat Mass (FM kg), Fat Mass index (FMI kg/h) and Free-fat mass (FFM kg). **RESULTS** We observed statistical differences in age (SR= 39.0 ± 3.6; SP= 27.0 ± 3.5; p= ≤ 0.005). In T1, T2 and T3 evaluation are been detected statistical differences if we compare the 2 groups (Table 1). During the season in referees group are been observed statistical difference in body mass (T1, 77.4 ± 4.2; T2 78.1 ± 4.4; T3 78.3 ± 4.2 kg; p= < 0.005), waist circumference (T1, 76.5 ± 2.3; T2 78.1 ± 2.9; T3 77.4 ± 2.6 cm; p= < 0.005) and free-fat mass (T1, 66.7 ± 3.8 T2 67.6 ± 4.0; T3 67.1 ± 4.0 kg; p= < 0.005). In elite soccer players don't are been found statistical differences. **CONCLUSION** Considering the results of the present study we may conclude that official football referees presented an amount of body fat higher of that observed in football players. Therefore, the nutritional habits must be adapted to their daily physical activities, short training periods and moderate energy intensity physical activity, on average, during match refereeing, to obtain better performance.

	Soccer Referees T1	Soccer Players T1	P value	Soccer Referees T2	Soccer Players T2	P value	Soccer Referees T3	Soccer Players T3	P value
Sum of thick-nesses	78.0 ± 19.4	48.9 ± 7.9	< 0.005	74.4 ± 17.1	47.8 ± 2.8	< 0.005	80.0 ± 17.0	47.9 ± 3.3	< 0.005
FM %	13.6 ± 3.0	8.8 ± 1.7	< 0.005	13.2 ± 2.7	9.0 ± 1.8	< 0.005	13.9 ± 2.9	8.8 ± 1.6	< 0.005
FM Kg	10.7 ± 2.2	7.2 ± 1.5	< 0.005	10.6 ± 2.0	7.5 ± 1.6	< 0.005	11.1 ± 2.1	7.3 ± 1.2	< 0.005
FM/h	5.8 ± 1.2	3.9 ± 0.8	< 0.005	5.7 ± 1.1	4.1 ± 0.9	< 0.005	6.0 ± 1.1	3.9 ± 0.6	< 0.005
FFM Kg	66.7 ± 3.8	72.7 ± 4.7	< 0.005	67.6 ± 4.0	72.7 ± 4.6	< 0.005	67.1 ± 4.0	72.9 ± 5.2	< 0.005

1426 Board #101 June 1 9:00 AM - 10:30 AM

High-intensity Interval Training Vs. Moderate-intensity Continuous Training For Body Composition. A Systematic Review And Meta-analysis.Michael A. Weuge, Roanna van den Berg, Rachel E. Ward, Andrew Keech. *University of New South Wales, Sydney, Australia.*

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(No relationships reported)

Physical activity is an important component of weight management, but the optimal exercise characteristics for body fat loss and weight reduction are not clear. High-intensity interval training (HIIT) is becoming increasingly popular as an alternative to moderate-intensity continuous training (MICT), with robust evidence for its efficacy to improve maximal aerobic fitness and vascular function in healthy and clinical populations. However, there are no systematic reviews exploring the relative merits of HIIT and MICT on body composition outcomes. **PURPOSE:** To conduct a systematic review and meta-analysis comparing the effects of HIIT and MICT protocols on body composition outcomes in overweight or obese, healthy adults. **METHODS:** Data was systematically sourced from controlled trials (randomised or matched) found on electronic search engines (MEDLINE, Scopus, Embase, SportDiscus, Web of Science, CINAHL and PEDro) up to September 2016. Trials directly compared HIIT and MICT intervention in healthy but overweight or obese patients aged 18-45 years. Outcome measures included body mass, body fat, lean mass and trunk fat. Data was analysed using RevMan 5.3 and SPSS. **RESULTS:** From 1330 articles, 15 studies were included, involving 455 participants (mean age = 33years; BMI = 29.6; 53% male). HIIT (N=231) and MICT (N=224) interventions duration averaged nearly 11 weeks (3.5 sessions/week), and the majority of studies applied matched exercise modes and work outputs. Weekly exercise time was significantly lower in HIIT than MICT (95.5 vs. 158.54 minutes; p = 0.002). Both HIIT and MICT appear to induce modest improvements (effect sizes ranging 0.2-0.3) in body mass, BMI, body fat %

and fat mass (kg), and waist circumference. There was no significant difference in effectiveness of HIIT and MICT on any of these outcome measures, with no significant heterogeneity in any of the 32 analyses conducted. **CONCLUSION:** Exercise training involving either HIIT or MICT can induce mild improvements in body composition. HIIT is just as efficacious as MICT for improving body composition, however HIIT requires ~40% less time commitment. More studies are required to analyse regional-specific changes in body fat, especially central adiposity and visceral fat.

1427 Board #102 June 1 9:00 AM - 10:30 AM

Impact of Acute Dietary Manipulations on Dual-Energy X-ray Absorptiometry Estimates of Visceral Adipose TissueJeffrey S. Forsse¹, Grant M. Tinsley², Flor E. Morales Marroquín¹, Peter W. Grandjean, FACSM¹. ¹*Baylor University, Waco, TX.* ²*Texas Tech University, Lubbock, TX.* (Sponsor: Peter Grandjean, FACSM)

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Purpose

Dual-energy x-ray absorptiometry (DXA) is viewed as a superior method of body composition assessment, but whole-body DXA scans are impacted by variation in pre-assessment activities, such as eating and drinking. DXA software now allows for estimation of visceral adipose tissue (VAT), which has been implicated in a number of diseases. It is unknown to what extent food and fluid intake affect VAT estimates. In the present analysis, the effects of acute high-carbohydrate (HC) and very low-carbohydrate (VLC) diets on DXA estimates of VAT were examined.

Methods

Male and female adults completed two one-day dietary conditions in random order: a VLC diet (1 - 1.5 g CHO/kg) and a HC diet (9 g CHO/kg). The diets were isocaloric to each other, and all food items were provided to participants. DXA scans were conducted in the morning after an overnight fast and in the afternoon soon after the third standardized meal. VAT volume, mass, and area were obtained, and paired samples t-tests were performed to compare the changes in VAT measures between diets.

Results

Fifteen males (age 22 ± 3, BF% 21 ± 5%) and eighteen females (age 21 ± 2, BF% 31 ± 5%) were included in the analysis. The change in VAT volume between the fasted and fed visits was different between diets (HC: +1.6%; VLC: -9.2%, p = .047). There were also trends for differences in VAT mass (p = .089) and area (p = .096) changes between diets.

Conclusions

Within a single day, VAT estimates are differentially affected by isocaloric HC and VLC diets, with VLC consumption leading to reductions in VAT estimates. The content of the diet on the day of a DXA scan can affect estimates of VAT, which could spuriously influence the categorization of an individual's health risk by DXA VAT estimates. Standardization of food intake prior to scans, preferably in the form of an overnight fast, should be employed to eliminate this important source of error.

1428 Board #103 June 1 9:00 AM - 10:30 AM

Utility of Skinfold Measures and Lifestyle Questionnaires in Prenatal CareKidan Kidane, Anna Magee Morris, Katherine H. Ingram. *Kennesaw State University, Kennesaw, GA.*

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(No relationships reported)

Gestational diabetes is a serious condition, affecting up to 12% of pregnancies, and is associated with obesity and inactivity. During late pregnancy, women generally become insulin resistant and many develop diabetes, however a late diagnosis leads to late intervention. **PURPOSE:** To test the hypothesis that body fat and physical activity can be used as early predictors of gestational insulin resistance. **METHODS:** At approximately 19 weeks gestation, 32 nulliparous pregnant women (71% white; aged 27.2 ± 4.5 years) received body composition measures, including 8 skinfolds, bioimpedance (InBody 720), and abdominal adipose tissue via ultrasound, in addition to surveys and 7-day accelerometry (Actigraph GT3x). Sedentary time was computed from accelerometry, while 3 survey questions about time spent sedentary (TV, computer time, sitting time), were summed to create a dichotomous (sedentary Y/N) score. Homeostasis assessment model of insulin resistance (HOMA-IR) was calculated from fasting glucose and insulin at 24-26 weeks. HOMA-IR required log-transformation for normality. **RESULTS:** Adjusting for age and race, HOMA-IR correlated with subcutaneous (SAT; r = .627, p = .003) and intra-abdominal (IAAT; r = .671, p = .002) ultrasound measures, as well as 5 skinfold measures in the trunk region, but most strongly the suprailliac (r = .684, p = .001) and abdominal (r = .681, p < .001) measures. These relationships persisted after further controlling for percent body fat. HOMA-IR correlated with sedentary Y/N from surveys (ρ = .523, p = .015), but not accelerometer measures of activity (r = .034, p = ns) or sedentary time (r = .147,

$p=ns$). Stepwise linear regression revealed the suprailiac skinfold as the strongest independent predictor of HOMA-IR ($R^2=.474, p=.001$) and excluded IAAT, SAT, and abdominal fold. A model including suprailiac and sedentary Y/N was stronger ($R^2=.557, p<.001$). **CONCLUSION:** Subcutaneous abdominal fat distribution is a strong, independent predictor of gestational insulin resistance. Moreover, skinfolds and a brief activity questionnaire may be effective early predictors of gestational insulin resistance, thus making earlier prenatal intervention feasible. Supported by the Office of the Vice President of Research and Center for Excellence in Teaching and Leadership, Kennesaw State University.

1429 Board #104 June 1 9:00 AM - 10:30 AM
Change in Body Mass from Kindergarten to 5th Grade as a Predictor for Body Mass in 5th Grade
 Alexis Malmkar, Kate Heelan, FACSM. *University of Nebraska at Kearney, Kearney, NE.*
(No relationships reported)

Childhood obesity impacts approximately 12.7 million children in the US (Ogden, et al., 2015). Prevalence of obesity among 6-11 year (17.5%) is more than double of toddler-aged children 2-5 year olds (8.9%). Identifying excessive weight gain among school-aged children and implementing healthy living programs in schools may assist the attenuation of excessive weight gain. **PURPOSE:** The purpose of this study was to evaluate changes in body mass (BM) from K through 5th grade and determine its impact on BM in 5th grade. **METHODS:** BM and stature were measured on a single population of 199 elementary school children in 2010 (K) and again in 2015 (5th grade). BMI was calculated by (kg/m^2). BMI percentiles (BMI %tile) were determined using the CDC age- and gender-specific BMI %tiles. Weight status in both K and 5th grade were determined as Normal Weight (5th -84.9th BMI %tile), Overweight (85th -94.9th BMI %tile) and Obese ($\geq 95^{\text{th}}$ BMI %tile). Stepwise multiple regression analysis was computed to determine if change in BM from K to 5th grade, BM, or BMI in K predicted BM in 5th grade. **RESULTS:** 64.77% of students remained in the normal weight classification from K to 5th grade and gained 36.58 \pm 10.67 lbs. 18.13% of students moved into or remained in the overweight weight classification between K and 5th grade and gained 50.55 \pm 7.49 lbs. 13.47% of students moved into or remained in the obese weight classification and gained 73.98 \pm 14.71 lbs. 3.63% of students moved from unhealthy to a healthier weight classification and gained 34.84 \pm 11.13 lbs ($p<0.05$). Change in BM from K-5th grade ($R^2=0.82, p<0.05$), K BM ($R^2=0.02, p<0.05$), and K BMI ($R^2=0.12, p<0.05$) significantly predicted 5th grade BM accounting for 95% the variance ($p<0.05$). **CONCLUSIONS:** Those that remained in an unhealthy weight classification from K to 5th grade gained 50.55% more weight in 5 years, an average of approximately 7.5 more lbs per year compared to a normal weight gain. More alarming is the weight gain among students who moved into an overweight or obese weight classification and gained 73.98 \pm 14.71 lbs in 5 years; more than double of the normal weight gain for growth and maturation. Programs that focus on prevention of excessive weight gain are warranted to assist student in elementary school to avoid unnecessary weight gain and assist obese children to grow into their body mass over time.

C-37 Free Communication/Poster - Bone, Bone Mineral Density, and Microarchitecture

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1430 Board #105 June 1 8:00 AM - 9:30 AM
Local Adaptations of Osteocyte Proteins to Increased and Decreased Mechanical Forces Correlate with Osteoblast Levels
 Corinne E. Metzger, Michael J.M. Junior, Jessica E. Brezicha, Harry A. Hogan, Susan A. Bloomfield, FACSM. *TEXAS A&M UNIVERSITY, College Station, TX.* (Sponsor: Susan A. Bloomfield, FACSM)
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(No relationships reported)

Osteocytes, cells embedded in the mineralized matrix of bone, are believed to be the primary mechanosensors of bone tissue. They signal to both osteoblasts (bone forming cells) and osteoclasts (bone resorbing cells) by releasing certain proteins. Sclerostin, interleukin-6 (IL-6), and insulin-like growth factor-I (IGF-I) are three such proteins that signal to osteoblasts to increase (via IGF-I and IL-6) or decrease (via sclerostin) osteoblast activity. **PURPOSE:** To determine if the osteocyte protein response to mechanical unloading is restricted to the unloaded bone or is a systemic signal. Using a hindlimb unloading (HU) rodent model, we hypothesized the unloaded hindlimb would have altered prevalence of osteocyte proteins while the weight-

bearing forelimb would have no differences. **METHODS:** Male Sprague Dawley rats (6-mo old) were subjected to HU ($n=7$) for 28 days. Age-matched controls (CON; $n=7$) had normal weight-bearing activity on all four limbs for 28 days. The unloaded distal femur (DF) and the weight-bearing proximal humerus (PH) were compared in HU vs CON. **RESULTS:** Immunohistochemical staining of the cancellous region to quantify %positive osteocytes revealed 19% higher %sclerostin+ osteocytes in the DF in HU, but 30% lower %sclerostin+ at the PH. Both %IGF-I+ and %IL-6+ osteocytes were lower at the DF (by 29% and 25%, respectively), but higher at the PH by 94% and 48%. Staining for osterix, a marker of osteoblasts, showed 60% lower %osterix+ cancellous bone surface in HU in the DF; however, the PH had 48% more %osterix+ surface in HU. All comparisons were statistically significant at $p<0.05$. **CONCLUSION:** After 28 days of HU, the unloaded DF had higher sclerostin osteocyte prevalence and lower IL-6 and IGF-I osteocyte prevalence as well as lower osteoblast surface as expected with unloading. Our results indicate that the osteocytes in the PH are signaling osteoblasts to increase formation, which is an unexpected finding based on the conventional notion that the forelimbs of HU animals are normally loaded and not overloaded. The opposite response of osteocyte proteins and osteoblast surface in bones within the same animal that are experiencing both unloading and loading indicates a precise, localized mechanism by which osteocytes sense mechanical strain and signal to local cells to adapt to those changes.

1431 Board #106 June 1 8:00 AM - 9:30 AM
Influence Of 25(OH)D, Parathyroid Hormone And Cytokines On Bone Resorption During Acute Vigorous Running
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(No relationships reported)

Athletes who undergo intense exercise routinely have been reported to demonstrate significant decrease in bone mineral density (BMD). Training-induced repeated exposures to increased bone resorption after a vigorous aerobic exercise may lead to decreased BMD. Parathyroid hormone (PTH) has been shown to be associated with increased bone resorption during exercise. In addition, low level of basal serum vitamin D (25(OH)D) has been reported to increase PTH. Furthermore, in differentiation / activation of osteoclasts (increase in bone resorption), cytokines have been reported to be involved. Thus, although various factors are associated, the mechanisms for exercise-induced increase in bone resorption are still unclear. **PURPOSE:** The purpose of this study was to examine relationship between basal 25(OH)D status, PTH and cytokine responses on exercise-induced bone resorption. **METHODS:** Seven healthy male subjects (age: 22.7 \pm 1.8 years old, BMI: 21.4 \pm 1.9 kg/m^2 , $\text{VO}_{2\text{max}}$: 56.1 \pm 3.5 $\text{ml}/\text{kg}/\text{min}$) participated in this study. Subjects performed treadmill running for 90-min at 75% of $\text{VO}_{2\text{max}}$. Blood samples were collected pre, post, 1hr-post and 1day-post exercise for measurement of glucose, lactate, PTH, CTX (bone resorption marker), M-CSF, TNF- α . Serum 25(OH)D level was assessed at baseline before exercise. **RESULTS:** Serum 25(OH)D at baseline was 27.9 \pm 4.8 ng/ml . Although CTX was increased by 5.9 \pm 23.7% at post-exercise, it was not statistically significant. PTH was significantly increased post-exercise ($P=0.05$), but it was reduced below pre level at 1hr-post ($P=0.05$). Correlations between cytokines (M-CSF and TNF- α) and CTX were not statistically significant. PTH and 25(OH)D at baseline showed a negative correlation ($r=-0.81, P=0.03$). However, basal 25(OH)D and PTH at either post, 1hr-post, or 1day-post was not correlated significantly. On the contrary, there were significant correlations between PTH and CTX at pre ($r=-0.76, P=0.05$), post ($r=0.81, P=0.03$) and 1day-post ($r=0.82, P=0.04$). Furthermore, post PTH and 1hr-post CTX showed a positive correlation ($r=0.77, P=0.04$). **CONCLUSION:** Exercise-induced bone resorption demonstrated a strong relationship with PTH response. However, basal 25(OH)D and cytokines were not associated with exercise-induced bone resorption.

1432 Board #107 June 1 8:00 AM - 9:30 AM
Associations Between Vitamin D and Tibial Density and Trabecular Microarchitecture in Army Infantry Recruits
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Serum 25-hydroxyvitamin D (25(OH)D) concentrations ≥ 50 nmol/L are advocated for optimal bone health. In military recruits, low 25(OH)D concentrations have been associated with increased stress fracture risk during initial training, but little is known

of the effect of vitamin D status on bone density and microarchitecture in young healthy men. **PURPOSE:** To investigate the relationship between total serum 25(OH) D and bone density, structure and trabecular (Tb) microarchitecture of the distal tibia using high-resolution peripheral quantitative computed tomography (HR-pQCT) in young male British Army recruits. **METHODS:** 324 healthy British Army infantry recruits (age, 22 ± 3 years; height, 1.77 ± 0.06 m; body mass, 75.5 ± 10.2 kg) provided informed consent. In week one of training, scans were performed at the distal tibia of the non-dominant leg using HR-pQCT (Xtreme CT, Scanco Medical, Switzerland), and a blood sample was drawn for measurement of total serum 25(OH)D and intact parathyroid hormone (iPTH). Participants were enrolled onto the study across all seasons. Participants were stratified into two groups based on their total serum 25(OH) D concentrations: Sufficient (≥50 nmol/L) and Deficient (<50 nmol/L), and were also assessed with total serum 25(OH)D as a continuous variable. **RESULTS:** 39.5% of participants were classified Deficient (*n* = 128) and 60.5% as Sufficient (*n* = 196). There were no significant differences between groups in bone density, structure or Tb microarchitectural parameters (*P* > 0.05). Cortical area (151 ± 28 vs 145 ± 26 mm², *P* = 0.057, ES = 0.22) and sub-endocortical Tb density (301 ± 34 vs 294 ± 29 mg HA/mm³, *P* = 0.058, ES = 0.22) tended to be higher in the Sufficient than the Deficient group. Serum 25(OH)D was negatively associated with iPTH (*r* = -0.271; *P* < 0.0001), and positively associated with cortical area (*r* = 0.183; *P* < 0.01), cortical thickness (*r* = 0.147; *P* < 0.0001), Tb density (*r* = 0.127; *P* < 0.05), and Tb volume to tissue volume ratio (*r* = 0.128; *P* < 0.05). **CONCLUSION:** Total serum 25(OH)D < 50 nmol/L was not associated with impaired bone density or Tb microarchitecture of the distal tibia in young healthy men. These findings suggest that vitamin D status is not a key factor influencing bone strength. The role of vitamin D in stress fracture risk warrants further investigation.

Supported by UK MoD (Army)

1433 Board #108 June 1 8:00 AM - 9:30 AM
**Bone-specific Physical Activity Questionnaire (BPAQ)
 Score Associations with Proximal Femur Geometry
 from DXA-derived 3D Analysis**

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The bone-specific physical activity questionnaire (BPAQ) was developed to account for the lifetime influence of habitual mechanical loading on the skeleton. It has been previously shown that BPAQ scores predict DXA-derived bone mass at clinically important sites and exhibit high inter- and intra-rater reliability. Recently, software was developed to determine three dimensional (3D) parameters of the proximal femur from standard DXA scans, from which the influence of physical activity on bone geometry can be examined. **PURPOSE:** The aim of the current study was to determine the relationship of lifetime bone-relevant physical activity to morphometric parameters of the proximal femur from novel 3D analysis of standard DXA scans. **METHODS:** Healthy men and women from the local community underwent proximal femur DXA scans (Medix DR, Medilink) and completed the BPAQ. Scans were analysed using the novel 3D software (DMS Group, France) to derive cortical and trabecular volume and cortical thickness at the femoral neck (FN) and total hip (TH). Lifetime bone-relevant physical activity was determined from the BPAQ and group tertiles were compared using one-way ANOVA. **RESULTS:** A total of 234 participants were recruited (53.6 ± 19.1 yrs, 167.7 ± 9.3 cm, 71.5 ± 15.2 kg), of whom 33.3% were men (*n* = 78). Participants in the highest BPAQ tertile exhibited more robust parameters of bone geometry than the lowest BPAQ tertile for trabecular volume (FN = 12.78 ± 3.38 cm³ vs. 10.95 ± 2.46 cm³; TH = 75.36 ± 18.66 cm³ vs. 63.43 ± 14.43 cm³, *p* < 0.001), cortical volume (FN = 2.14 ± 0.58 cm³ vs. 1.73 ± 0.44 cm³; TH = 13.57 ± 3.42 cm³ vs. 11.06 ± 2.54 cm³, *p* < 0.001), total volume (FN = 14.90 ± 3.85 cm³ vs. 12.69 ± 2.77 cm³; TH = 88.92 ± 21.60 cm³ vs. 74.63 ± 16.55 cm³, *p* < 0.001) and total cortical thickness (FN = 1.11 ± 0.20 mm vs. 0.99 ± 0.19 mm, *p* < 0.001). **CONCLUSIONS:** Lifetime bone-relevant physical activity is associated with more robust bone geometry at the proximal femur; in particular, bone volume and cortical thickness. Those properties are typically associated with greater bone strength, and thereby reduced fracture risk. These findings emphasize the importance of lifelong bone-relevant exercise for maintaining a healthy skeleton and confirm the sensitivity of the BPAQ to exercise-related geometric adaptation.

1434 Board #109 June 1 8:00 AM - 9:30 AM
Skeletal Characteristics of Competitive Female Rowers

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Weight-supported activities, such as rowing, are not commonly prescribed for fracture prevention. However, rowing requires large magnitudes of internal loading, thus it has

potential to induce positive skeletal adaptations, especially in the hip and radius, two common fracture sites. **PURPOSE:** To examine skeletal health and body composition in college aged competitive female rowers. **METHODS:** In this cross-sectional study, 24 rowers and 24 age and body mass (±2yrs and 5lbs) matched physically active controls were compared. DXA was used to measure body composition and areal BMD (aBMD) of the total body, lumbar spine, hips and forearms, and hip structural analysis variables. pQCT was used to assess bone characteristics and bone strength of the tibiae (4%, 38%, 66%) and radii (4%, 66%) sites. **RESULTS:** Age- and height-adjusted aBMDs were not significantly different between groups (*p* > 0.05), but rowers had greater hip cross-sectional moment of inertia (*p* ≤ 0.05). Rowers had greater tibiae 4% total area, trabecular area, and periosteal circumference (PeriC) (*p* ≤ 0.05). Also, total bone content and area, cortical area, PeriC, iPolar and SSI were greater at the tibiae 38% and 66% sites for rowers (*p* ≤ 0.05). Controls had significantly greater 38% tibiae cortical density than rowers (*p* ≤ 0.05). Rowers had significantly greater forearm muscle cross sectional area (*p* ≤ 0.01) at the 66% radial site, and greater PeriC at the 4% radial site (*p* ≤ 0.05). **CONCLUSIONS:** Rowers had greater tibiae bone area and strength compared to controls, but there were no group differences in aBMD or most radial bone variables. Our findings suggest that competitive rowing has osteogenic potential and may be particularly beneficial for improving bone quality at the tibiae even when compared to physically active controls.

Table 1. Group comparisons of mean bilateral skeletal characteristics (means±SE)

	Rowers (n=24)	Controls (n=24)
Hip Cross-sectional moment of inertia (mm ⁴)	13256±495.6*	11841.5±409.8
38% Tibia Strength-Strain Index (mm ³)	1887.8±61.9*	1705.1±44.8
38% Cortical Density (mg/cm ³)	1153.9±4.3	1168.1±3.2*
66% Tibia Strength-Strain Index (mm ³)	2852.5±109.4*	2587.3±69.9
4% Radial Periosteal Circumference (mm)	63.7±0.9*	60.8±1.0
66% Radial muscle CSA (mm ²)	3557.0±106.3**	3108.1±88.3

* *p* < 0.05 and ** *p* < 0.01 significant differences between groups.

1435 Board #110 June 1 8:00 AM - 9:30 AM
**Bone Mineral Monitoring with Dual-energy X-ray
 Absorptiometry (DEXA) in University Female Soccer
 Players**

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Soccer practice usually has high intensity movements involving sprints and change of direction; these implicate great strength over the bone structure having influence in the bone mineral since they facilitate bone stimulation, getting the appropriate parameters. Several studies show soccer practice or training, amateur as well as professional, lead to effective adaptations in the bone mass, as well as increases in bone mineral content (BMC) and bone mineral density (BMD). **PURPOSE:** The evaluation of changes in BMC and BMD during 4-month period, competition training of university, female, soccer players. **METHODS:** Body measurements were made at the beginning and at the end of 4-month training to 19 soccer players (20.87 ± 1.88 years old), through DEXA where BMC and BMD of arm, leg, trunk and total body were obtained. They were evaluated fasting at the morning, where every subject used a minimum of clothes for measurement. They also received informed consent explaining the test protocol, after that their height was measured. For the statistical analysis, the software SPSS version 21.0 was used. The Pearson product-moment correlation coefficient method was used. **RESULTS:** Meaningful increases were found from the initial take to the final take of BMC of arms and legs (*p* < 0.01), and meaningful decrease on trunk and total body (*p* < 0.01). Regarding BMD, significant increases were seen in legs and trunk (*p* < 0.01), however in total body obtained a significant decrease (*p* < 0.01) and not significant in arms (*p* = 0.252), all of this during a 4-month study. **CONCLUSIONS:** Significant changes of lower limbs BMC and BMD are associated to the impact of kicking the ball, the sprints and the jumps that exist in soccer practice.

1436 Board #111 June 1 8:00 AM - 9:30 AM
**The Feature of Bone Mineral Density Between High
 Altitude And Sea Level In Inhabitants**

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PURPOSE: The main purpose of this study was to investigate the characterise of high altitude (HA) and sea level (SL) habitation on body composition (BC) and bone mineral density (BMD). **METHODS:** Total of 799 subjects aged from 20-69

years were included in this study. Three hundred sixty one healthy subjects including 129 males and 232 females were living in Qinghai-Tibet Plateau (QHTP) 2260m above sea level and 438 participants including 323 males and 115 females, were from Sendai of Japan (SJ) 46m above sea level. We divided all subjects into 5 groups according to their age (20-29, 30-39, 40-49, 50-59, 60-69). BC and BMD were tested by InBody720. The differences between HA and SL are analysed by independent T test. The statistical difference level was defined as $\alpha=0.05$. All data were expressed as mean \pm SD. **RESULTS:** BMD of the HA residents was significantly higher than that of the SL residents regardless of gender (Males: HA 103.7 ± 10.98 g/cm² > SL 99.4 ± 11.14 g/cm², $p < 0.01$) (Females: HA 108.5 ± 11.06 g/cm² > SL 104.1 ± 12.43 g/cm², $p < 0.01$). There was no significant difference in BMD of young males aged 20-29 in different living altitude. However, in 30-39 and 40-49 age groups, male HA residents showed higher BMD than SL folks (30-39: HA 102.5 ± 9.29 g/cm² > SL 96.7 ± 10.68 g/cm², $p < 0.05$) (40-49: HA 104.8 ± 10.35 g/cm² > SL 98.9 ± 11.06 g/cm², $p < 0.05$). HA residents, aged from 20-29 and 60-69, had significantly greater BMD compared to SL female residents. (20-29: HA 110.9 ± 13.15 g/cm² > SL 101.2 ± 14.12 g/cm², $p < 0.01$) (60-69: HA 112.5 ± 12.41 g/cm² > SL 101.3 ± 11.37 g/cm², $p < 0.01$). Body fat percentage (BFP) of the HA residents was significantly higher than that of the SL residents regardless of gender (Males: HA $25.6 \pm 6.65\%$ > SL $22.2 \pm 7.01\%$, $p < 0.01$) (Females: HA $32.3 \pm 5.86\%$ > SL $28.7 \pm 6.77\%$, $p < 0.01$). There was significant difference in BFP of males aged 30-39 and 50-59 age groups, who lives in HA demonstrated higher BFP than SL. (30-39: HA $26.4 \pm 6.80\%$ > SL $20.9 \pm 7.00\%$, $p < 0.01$) (50-59: HA $27.2 \pm 5.81\%$ > SL $24.2 \pm 5.76\%$, $p < 0.05$). **CONCLUSIONS:** Inhabitants living in high altitude demonstrated higher bone density compared to the residents on sea level in the same age. Thus, living in plateau area might reduce the risk of diseases caused by insufficient bone density.

1437 Board #112 June 1 8:00 AM - 9:30 AM
Bone Quality in Weight and Non-Weight Bearing Sports in Male Collegiate Athletes
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Bone quality has been correlated with lifetime physical activity. The accrual and maintenance of bone has been shown to be related to the type of sport, length of participation, weight bearing (WB) or non-weight bearing (NWB) activity, and the multidirectional forces applied. **PURPOSE:** To determine if there are differences between weight bearing and non-weight bearing sports on bone quality in male collegiate athletes. **METHODS:** Ten male collegiate athletes (20.8 \pm 1.2yrs), with no history of musculoskeletal injuries within the last 12 months, were selected from each NCAA Division II men's soccer, football, cross country, swimming, and USA cycling Division I teams (n=50). For analyses, men's soccer, football, and cross country were considered WB, and swimming and USA cycling were considered NWB. A bone specific physical activity questionnaire (BPAQ) and a general demographic health questionnaire were collected for each athlete to determine eligibility for the study, as well as their history of physical activity and general demographic information that was relative to bone health. Using the Achilles InSight Ultrasonometer, broadband ultrasound attenuation (BUA), speed of sound (SOS), and stiffness index (SI) were measured on both heels for each athlete. The BUA, SOS, and SI were compared between sport, WB vs. NWB activities, and foot dominance using a two-way ANOVA with repeated measures. **RESULTS:** No significant differences were found between dominant and non-dominant foot for sports or WB vs. NWB activities. There were significant differences between BUA scores for sports and WB vs. NWB activities $p=0.026$ and $p=0.015$, respectively. The SOS scores were significant for sports and WB vs. NWB activities ($p<0.001$). SI scores were found to have a significant difference between sports type and WB vs. NWB activities ($p<0.001$). **CONCLUSION:** Weight bearing vs. non-weight bearing sports have significant effects on bone health in male collegiate athletes.

1438 Board #113 June 1 8:00 AM - 9:30 AM
Bone Mineral Density - Is It Lower In Synchronized Swimmers Compared To Competitive Swimmers?
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In female athletes bone mineral density (BMD) is typically 5-15% higher than in the non-athletic population, depending on the type and amount of impact on the bones. Other environmental factors that can affect female athletes' BMD include nutritional habits, energy availability, calcium intake and menstrual cycle patterns. Synchronized swimming (SS) is a unique sport characterized, among other things, by many hours of non-weight bearing exercise and a requirement for leanness. **Purpose:** To compare BMD in SS with a sport that is similar in terms of mechanical stress on the bones,

but does not require extreme leanness such as competitive swimming (CS). We hypothesized that SS will have lower BMD compared to CS. **Methods:** 14 women ages 20-40 years with a history of at least 5 years of intensive training in SS during puberty were compared to 14 women of the same age, who were CS. Participants completed questionnaires about their medical, sports, gynecological & dietary history, and were tested for BMD (lumbar spine, left hip & total body) in a DEXA machine. BMD T-score and Z-score were compared between groups and correlated to the data obtained by the questionnaires. **Results:** The prevalence of osteopenia of the lumbar spine was high in both groups (43% of SS & 50% of CS). SS had higher left hip BMD than CS (0.8525 vs. 0.7485 g·cm⁻², $p = 0.012$). SS were significantly leaner at puberty than CS (BMI 18.7 ± 1.3 and 21.5 ± 2.1 kg·m⁻², respectively, $p < 0.0001$), but both groups had sufficient calcium intake (>1100 g/day) and only one subject in each group had disordered eating. There were no significant differences in age of menarche (SS=13.6 and CS = 13.1 years) or in prevalence of menstrual irregularities. Average training hours per week for both groups was 24, but SS spend significantly ($p = 0.024$) more time in "out of water" training compared to CS (8 ± 3.5 and 5 ± 2.5 h·week⁻¹, respectively). **Conclusions:** In refutation of our primary hypothesis, SS were not at increased risk for osteoporosis compared to CS, and their hip BMD was even higher than CS. These findings might be attributed to longer out of water practice time that might offset the negative effects low body weight in SS. While encouraging girls and adolescent females to be physically active, precautions should be taken to avoid osteopenia in non-weight bearing disciplines such as SS & CS.

1439 Board #114 June 1 8:00 AM - 9:30 AM
The Effect of Soccer Training on Tibia Bone Properties in Healthy Young Females
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Tibia stress fracture (TSF) is very common in military recruits. Female Soldiers experience a higher rate than their male counterparts. TSF occurs frequently in basic training due to repetitive impact loading from tasks such as load carriage. Common TSF sites are at distal and middle thirds of the tibia. To date, it is unknown whether training involved multi-axial loading (e.g. soccer) could help improve tibia quality and potentially increase bone's resilience on TSF. **Purpose:** To examine the effect of soccer history on tibia mechanical properties. **Methods:** 20 female soccer players (20 \pm 1 yr) and 20 mass and height matched sedentary women (21 \pm 1 yr) completed a pQCT scan on their tibias at seven locations along the bone shaft. Cortical bone density and mechanical strength of the bone at 14%, 38%, 66%, and centers of the proximal, middle, and distal thirds of the bone shaft were examined. One-way ANOVAs were performed. **Results:** Significant differences in area moments of inertia and bone strength index were found ($p<0.05$). The area moments of inertia along the anteroposterior, mediolateral, and longitudinal axes of the soccer players' tibia were 33.5%, 24.7%, 18.4% greater than those of the sedentary women, respectively. In addition, the bone strength index of the soccer players was 19.6% higher than that of the sedentary women. Significant differences in cortical bone density were also found ($p<0.01$). Sedentary women possessed an average of 2.2% higher cortical bone density in all seven locations of the bone shaft than those of the soccer players. **Conclusion:** Participants with a soccer history had enhanced tibia mechanical properties, including greater bone strength, but reduced cortical bone density when compared to sedentary controls. These results suggest a co-adaptation of intracortical bone remodeling and bone formation modeling during training such that bone geometry is optimized without excessive increases in bone density, which would be metabolically expensive. Enhanced mechanical properties in soccer players could make the tibia more resilient to unaccustomed mechanical loading, such as load carriage during military training. Future studies should examine whether enhanced bone mechanical properties result in reduced bone strains and a lower risk of TSF. US ARMY #W81XWH-08-1-0587; #W81XWH-15-1-0006.

1440 Board #115 June 1 8:00 AM - 9:30 AM
Serum Sclerostin Levels Are Positively Correlated with Bone Mineral Density in Chinese Young Adults
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Sclerostin, exclusively secreted by osteocytes, is a potent inhibitor of the Wnt signaling pathway and bone formation. While it is well-recognized that differences in bone mineral density (BMD) and fracture rates exist between Asians and Caucasians, little

is known about serum sclerostin concentrations and its relationship with BMD in Chinese young adults. **PURPOSE:** 1) To compare sex differences in serum sclerostin in Chinese young adults; 2) To investigate associations between serum sclerostin and bone characteristics (areal BMD (aBMD), volumetric BMD (vBMD), bone strength). **METHODS:** Fifty-three Chinese men (n=28) and women (n=25) aged 18 to 35 yrs, who had been living in the US \leq 5 years, participated in this study. Body composition and aBMD of the total body, lumbar spine and hips were measured by DXA. vBMD and bone strength of non-dominant tibia at 4%, 38% and 66% sites were measured by peripheral Quantitative Computed Tomography (pQCT). Serum levels of sclerostin were measured by ELISA. **RESULTS:** Serum sclerostin was significantly higher in males compared to females ($p=0.003$). However, no significant differences were found after adjusting for total body bone mass. There were significant positive associations ($r = 0.39$ to 0.54 , $p < 0.01$) between serum sclerostin and total body bone mass, BMD at total body, lumbar and hips, bone strength at 4% of tibia. After adjusting for total body bone mass, serum sclerostin levels remained significantly correlated with BMD at all sites and bone strength at 4% of tibia. **CONCLUSION:** Serum sclerostin levels were positively correlated with BMD and bone strength in Chinese young adults after controlling for total body bone mass, which is consistent with previous population based studies in US Caucasian and Chinese postmenopausal women.

Table 1. Bone Mineral Density and Sclerostin Levels in Chinese Young Adults (Mean \pm SE)

	Men (n=28)	Women (n=25)	Total (n=53)
Total BMD (g/cm ²)	1.249 \pm 0.017***	1.134 \pm 0.023	1.195 \pm 0.016
Lumbar Spine BMD (g/cm ²)	1.218 \pm 0.084	1.183 \pm 0.146	1.202 \pm 0.016
Left Proximal Femur BMD (g/cm ²)	1.119 \pm 0.133 **	0.979 \pm 0.183	1.053 \pm 0.024
Bone Strength Index at 4% Tibia (mm ³)	143.7 \pm 4.9***	88.0 \pm 7.3	117.4 \pm 5.8
Sclerostin (ng/mL)	0.442 \pm 0.021**	0.353 \pm 0.019	0.400 \pm 0.015

** $p < 0.01$ and *** $p < 0.001$ significant differences between men and women, respectively

1441 Board #116
Abstract Withdrawn

1442 Board #117 June 1 8:00 AM - 9:30 AM
Physical Activity During Youth is Associated with Adult Bone Microarchitecture
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The bone-specific physical activity questionnaire (BPAQ) provides a summary index of skeletal loading (SKL) by combining activity/sport duration with ground reaction forces and loading rate per activity. Whereas BPAQ has been associated with areal BMD, few studies have evaluated the association between BPAQ and bone microarchitecture. Further, despite knowledge that exercise during adolescence may have optimal effects on bone accrual, no studies have examined the association between early-life SKL and adult bone microarchitecture. **PURPOSE:** We determined the ability of a BPAQ-like SKL index reflecting physical activity during adolescence to predict bone microarchitecture in young adults. **METHODS:** We conducted a cross-sectional study of young (mean \pm SD] 24.6 \pm 3.0 years) Caucasian men (n=50) and women (n=50). Cortical (Ct) and trabecular (Tb) volumetric bone density (vBMD), microarchitecture, and estimated bone strength (by micro-finite element analysis) were assessed at the distal tibia (4% of tibial length) using high-resolution pQCT (82 μ m³ voxel size). Physical activity questionnaires were administered and a SKL index derived based on the effective load stimuli associated with each activity and the duration the subject participated in the activity during ages 11 to 14. We used generalized linear regression to determine associations between SKL score and bone outcomes, adjusting for age in addition to BMI, weight, and their interaction. **RESULTS:** We found that the SKL score in adolescence was significantly associated with Ct.vBMD and Tb.vBMD in men and women respectively (M: $r^2 = 0.33$, $p = 0.045$; W: $r^2 = 0.33$, $p = 0.036$). In men, Ct.thickness, Ct. area fraction, and ultimate failure load were significantly associated with SKL score (all $p < 0.05$). However among women, failure load was the only other bone outcome associated with SKL score ($p = 0.037$). **CONCLUSION:** These findings suggest that among Caucasian men, physical activity during adolescence is associated with improved cortical bone architecture later in life. Conversely, among Caucasian women, loading during adolescent years is associated with improved trabecular vBMD. The sex-specific association between physical activity and bone microarchitecture may contribute to the greater incidence of stress fracture in women versus men.

1443 Board #118 June 1 8:00 AM - 9:30 AM
Effect Of Low-magnitude Different-frequency Whole-body Vibration On Subchondral
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PURPOSE: To investigate the effects of different vibration frequencies of low-magnitude whole-body vibration (WBV) on subchondral trabecular bone microarchitecture, cartilage degradation and metabolism of the tibia and femoral condyle bone, and joint pain in an anterior cruciate ligament transection (ACLT)-induced knee osteoarthritis(OA) rabbit model. **METHODS:** Ninety adult rabbits subjected to unilateral ACLT were divided into six groups: Group 1, ACLT control group; Group 2, WBV (5 Hz) + ACLT; Group 3, WBV (10 Hz) + ACLT; Group 4, WBV (20 Hz) + ACLT; Group 5, WBV (30 Hz); and Group 6, WBV (40 Hz). Pain was tested via weight-bearing asymmetry. Subchondral trabecular bone microarchitecture was examined using *in vivo* micro-computed tomography. Knee joint cartilage was evaluated by gross morphology, histology, and ECM gene expression level (aggrecan and type II collagen [CTX-II]). Serum bone-specific alkaline phosphatase, N-mid OC, cartilage oligomeric protein, CPII, type I collagen, PIIANP, G1/G2 aggrecan levels, and urinary CTX-II were analyzed. **RESULTS:** After 8 weeks of low-magnitude WBV, the lower frequency (10 Hz and 20 Hz) WBV treatment decreased joint pain and cartilage resorption, accelerated cartilage formation, delayed cartilage degradation especially at the 20 Hz regimen. However, the higher frequencies (30 Hz and 40 Hz) had worse effects, with worse limb function and cartilage volume as well as higher histological scores and cartilage resorption. In contrast, both prevented loss of trabeculae and increased bone turnover. No significant change was observed in the 5 Hz group. **CONCLUSIONS:** Our data demonstrate that the lower frequencies (10 Hz and 20 Hz) of low-magnitude WBV increased bone turnover, delayed cartilage degeneration, and caused a significant functional change of the OA-affected limb in ACLT-induced OA rabbit model but did not reverse OA progression after 8 weeks of treatment.

1444 Board #119 June 1 8:00 AM - 9:30 AM
Tibial Density and Trabecular Microarchitecture in Army Recruit Stress Fracture Cases and Matched Uninjured Controls
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Stress fractures are common overuse injuries experienced by military recruits during initial training. Lower cross sectional area of the tibia in stress fracture cases compared with uninjured controls supports an important role of bone structure in injury predisposition. With the advent of high resolution techniques, other determinants of bone strength can now be evaluated in the development of stress fracture injury. **PURPOSE:** To investigate differences in bone density and trabecular (Tb) microarchitecture at the distal tibia using *in vivo* high-resolution peripheral quantitative computed tomography (HR-pQCT) between stress fractured and uninjured British Army infantry recruits. **METHODS:** 324 British Army infantry recruits were followed through 26 weeks of infantry training. Twenty-one recruits were diagnosed with a stress fracture injury of the lower limb (22 \pm 3 years, 73.3 \pm 8.3 kg, 1.78 \pm 0.06 m, 593 \pm 68 s 1.5 km run time), and matched to 21 non-injured controls (22 \pm 3 years, 74.2 \pm 10.0 kg, 1.77 \pm 0.06 kg, 588 \pm 58s 1.5 km run time) in the same training platoon. Groups were matched for age, height, body mass and aerobic fitness (1.5 km run time). Scans at the distal tibia of the dominant leg were performed on all volunteers using HR-pQCT (Xtreme CT, Scanco Medical, Switzerland) in week one of training. **RESULTS:** No significant differences were observed in bone density or Tb microarchitecture between stress fracture cases and uninjured controls ($P > 0.05$). A subgroup of seven cases suffering stress fractures to the tibia had higher Tb bone density (245 \pm 32 vs 209 \pm 28 mg HA/cm³, $P = 0.042$), higher sub-endocortical Tb density (320 \pm 21 vs 282 \pm 32 mg HA/cm³, $P = 0.047$) and higher Tb volume to tissue volume ratio (0.204 \pm 0.027 vs 0.174 \pm 0.023, $P = 0.042$) than uninjured controls. **CONCLUSION:** Young healthy men suffering stress fracture in training do not differ in their bone structure or Tb microarchitecture at the distal tibia from uninjured matched counterparts. Our understanding of bone microarchitecture in the development of stress fractures is limited by the utility of high resolution techniques to distal sites. Future studies should explore phenotypic characteristics in stress fracture cases at specific sites of injury, which typically develop at the distal third of the tibia in military recruits.
Supported by UK MoD (Army)

- 1445 Board #120 June 1 8:00 AM - 9:30 AM
Vertical Jump Test as a Health-Promotion Screening Tool for Predicting Bone Strength in Young Adults
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 (No relationships reported)

There are bone mineral density (BMD) testing recommendations for women ≥ 65 years and men ≥ 70 years to diagnose osteoporosis, but no such recommendations exist for screening purposes in the healthy adult population. A potential screening tool for bone strength is a peak vertical jump test. Vertical jump height can be used as a proxy for muscle power, an influential factor in determining bone mass and geometry (i.e., bone strength). **PURPOSE:** This study examined the relationship between muscle power and bone strength, and the capacity of a peak vertical jump test to identify young adults with below-average areal BMD (aBMD). **METHODS:** In total, 303 young adults (18-22 years, 136 males, 167 females) participated in this study. Total hip and femoral neck (FN) aBMD were assessed by dual x-ray absorptiometry (DXA) and DXA images were used to calculate FN section modulus values. Indices of bone strength were assessed at the tibia with peripheral quantitative computed tomography. Cortical bone area and density-weighted polar section modulus strength-strain index were assessed at 38% midshaft site and bone strength index was assessed at 4% midshaft site. Muscle power was predicted using vertical jump and the Sayers equation. Pearson bivariate and partial correlations examined associations among bone strength outcomes and muscle power. Logistic regression examined the probability of below-average bone strength based on muscle power. Receiver Operating Characteristic (ROC) curve analysis examined the sensitivity-specificity tradeoff and the accuracy of a peak vertical jump test as an aBMD assessment tool. **RESULTS:** The odds ratio of below-average height-adjusted FN aBMD decreased 5.4% for females and 3.6% for males per 50 Watts of power. ROC analysis showed the best cut point to identify individuals with below-average aBMD was 5,038 Watts in males (sensitivity = 73.7%; specificity = 62.4%; AUC = 0.709, 95%CI = 0.572-0.847) and 3,261 Watts in females (sensitivity = 71.4%; specificity = 58.9%; AUC = 0.708, 95%CI = 0.586-0.829). These values correspond to vertical jump heights of 54.4 cm and 36.2 cm for males and females. **CONCLUSION:** We found acceptable sensitivity and specificity and moderate discriminate ability for muscle power, assessed with a peak vertical jump test, to identify young adults with below-average aBMD.

- 1446 Board #121 June 1 8:00 AM - 9:30 AM
RANK Gene Polymorphism Is Associated With Incidence Of Stress Fractures In Japanese Female Endurance Athletes
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 (No relationships reported)

In female endurance athletes, stress fractures are induced by repeated mechanical loading and various factors are involved in the development of stress fracture. The receptor activator of nuclear factor-kappa B (RANK) and its ligand (RANKL) are a member of the tumour necrosis factor superfamily and stimulate mature osteoclasts to resorb bone. However, effect of development of stress fractures on RANK and RANKL gene polymorphisms remains unclear in Japanese female endurance athletes. **PURPOSE:** This study aimed to clarify whether single nucleotide polymorphisms (SNPs) within the RANK and RANKL genes were associated with the incidence of stress fracture in Japanese female endurance athletes. **METHODS:** Twenty-four Japanese elite female long-distance runners (20 \pm 1 years, 160 \pm 4 cm, 48 \pm 4 kg, 15 \pm 4 %fat, Mean \pm SD) participated in a cross-sectional study. All subjects were investigated the onset number of stress fractures and medial tibial stress syndrome in the student period of the university from high school by using a questionnaire. SNPs of rs3018362 in RANK gene and rs1021188 in RANKL gene were determined by real-time PCR with Taqman probe. **RESULTS:** The onset number of stress fractures in the student period of the university from high school was significantly higher in the AA genotype of rs3018362 in RANK gene compared with the GA and GG genotype individuals (P<0.05). Moreover, the onset number of stress fractures and medial tibial stress syndrome in a student period of a university was significantly higher in the AA genotype of rs3018362 in RANK gene compared with other genotype individuals (each P<0.05). However, the rs1021188 in RANKL gene polymorphism had no impact on differences of the onset number of stress fractures and medial tibial stress syndrome. **CONCLUSION:** These results suggest the association between SNPs of rs3018362 in the RANK gene polymorphism and the incidence of stress fracture in Japanese female endurance athletes. Supported by Grants-in-Aid for Scientific Research (#26282199 and 16K13059, M. Iemitsu)

- 1447 Board #122
Abstract Withdrawn
- 1448 Board #123 June 1 8:00 AM - 9:30 AM
Measurement of Radial Bone Strength as Related to Common Muscle Function Tests in College Athletes
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The functional muscle-bone unit, described by the mechanostat theory, illustrates a dependence of bone strength on muscle size and strength. A recent study reported significant correlations between muscle power and both SSIP and cortical area ($r=.69-.78$) (Janz, 2015). Bone adaptation in response to mechanical loading is site specific. A loading stimulus to the lower limbs should not have an effect on the bones of the upper limbs.

PURPOSE: To investigate the relationship between common muscle function tests (Relative Grip Strength, 1 Rep Max of Leg Extensors, Peak Power-vertical jump) and bone strength in the radial diaphysis of Division II athletes.

METHODS: Eighty-six Division II athletes, 56 females and 30 males (age 20.2 \pm 1.7, height (m) 1.7 \pm 0.1, body fat % 17 \pm 7.4) performed a relative grip strength (RGS) test using a hand dynamometer, a one repetition maximum leg extension test (1RM), and a peak power vertical jump test (PP) using a Vertec. Moment of inertia (J), cortical area (Ct.Ar), cortical bone mineral density (cBMD), and strength-strain index (SSI) were measured using peripheral Quantitative Computed Tomography (pQCT) to determine bone strength at the 66% radial site. Correlation analysis determined muscle-bone relationships.

RESULTS: RGS, 1RM, and PP were all significantly correlated with Ct.Ar, J, and SSI. However, none of the muscle function measures were correlated with cBMD. Both RGS and 1RM were significantly correlated with SSI but RGS had a larger R2 value for all measurements: SSI (RGS [R2=0.3333, p<0.0001], 1RM [R2=0.2332, p<0.0001]), Ct. Ar. (RGS [R2=0.2638, p<0.0001]), 1RM (R2=0.2142, p<0.0001), J (RGS [R2=0.3609, p<0.0001]), 1RM (R2=0.1733, p=0.0008). Peak Power had the largest R2 values of all 3 measurements SSI (R2=0.5338, p<0.0001), Ct. Ar. (R2=0.4156, p<0.0001) J (R2=0.4802, p<0.0001).

CONCLUSIONS: The muscle-bone unit can be measured using functional muscle measurements; RGS, 1RM and PP all strongly correlated with bone strength. Interestingly PP, a lower limb measurement explained the most variance in the bone strength of the upper limb. Muscle function seems to have the greatest effect on the geometry of the bone and little influence on cBMD. Lower limb muscle power calculated by vertical jump assessment could provide a means to monitor and assess bone health.

- 1449 Board #124 June 1 8:00 AM - 9:30 AM
Changes In Tibial Bone Microarchitecture Following 8 Weeks Of U.S. Army Basic Combat Training
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BACKGROUND: Stress fractures affect up to 5% of men and 20% of women undergoing basic combat training (BCT), a physically demanding program that involves repetitive loading of the lower extremities. Animal studies have demonstrated adaptive microarchitectural bone formation following repetitive loading. This adaptive response may reduce the risk of injury. However, no studies have evaluated changes in bone microarchitecture following BCT, due to limitations with *in vivo* measurement techniques. Recent development of high-resolution peripheral quantitative computed tomography (HRpQCT) allows for assessment of bone microarchitecture *in vivo*, in humans. **PURPOSE:** To determine if changes in bone microarchitecture, indicative of adaptive bone formation, occur in female recruits following U.S. Army BCT. **METHODS:** HRpQCT (XtremeCT II, Scanco Med) images of the distal tibia (4% of tibia length) were collected before and after 8 weeks of BCT. We used linear mixed models for each outcome of interest to estimate the mean difference and its 95% confidence interval (CI) in each microarchitectural bone measurement from pre- to post-BCT. Covariates were decided *a priori* and included race/ethnicity, age, and body mass index. **RESULTS:** Data were collected on 91 female recruits (37 African American, 40 Caucasian, 14 Other) with baseline age = 21.5 \pm 3.3 yrs and BMI = 23.7

± 2.8 kg/m². Mean total volumetric bone mineral density (Tt.vBMD) [1.79% (95% CI: 1.32, 2.25); $p < 0.001$], trabecular vBMD [2.01% (1.44, 2.58); $p < 0.001$], trabecular number [1.21% (0.48, 1.94); $p < 0.05$], trabecular thickness [1.13% (0.76, 1.50); $p < 0.001$], and trabecular bone volume/total volume [1.87% (1.31, 2.43); $p < 0.001$] all increased significantly with BCT, whereas trabecular spacing decreased significantly [-1.09% (-1.61, -0.56); $p < 0.001$]. **CONCLUSIONS:** We observed modest but statistically significant improvements in trabecular bone microarchitecture at the distal tibia after 8 weeks of Army BCT. The changes we observed are consistent with adaptive bone formation. This new bone formation may be an important physiological response to military training and may play a role in prevention of stress fracture. Future studies are needed to determine the relationship between training-related changes in bone microarchitecture and stress fracture risk.

1450 Board #125 June 1 8:00 AM - 9:30 AM

Higher Occurrence Rates Of Foot Sesamoids And Accessory Bones In Wrestlers By Ct And 3d-reconstruction

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(No relationships reported)

The sesamoids and accessory bones of feet are complicated and small but important in regulating pressure, frictions and direction of muscular traction. Multi-slice CT and 3D reconstruction becomes available for exhibiting bones' morphology. **PURPOSE:** To investigate the morphological features of podalic sesamoids and accessory bones in professional wrestlers by CT and 3D reconstruction. **METHODS:** 9 male Guangdong wrestlers served as subjects (height: 168.2 \pm 2.1 cm; weight: 66.8 \pm 4.2 kg; age: 18.3 \pm 2.4 y) lying on back, and their feet were scanned by 64-slice spiral CT continuously along both feet transect for cross-sections of bones according the set: bone tissue window, 140kv power, 0.656mm pixel size, 0.45mm layer distance. Based on the data with the Dicom3.0 standard, the 3D model was constructed by Mimics (Version 10) through the processing of standardized coordinate system of bone, reconstruction, threshold-value segmentation, regional growth, edge segmentation and alternative editing, etc). **RESULTS:** 53 sesamoids and 10 accessory bones are in the 18 feet. 36 sesamoids bones are below the first metatarsal bones while 17 in the great toe joints, with 2 to 3 sesamoids per foot. In 89% of the feet, the outer-side sesamoids of the first metatarsal bone are larger than the inner-side ones. The sesamoids occurrence rate of the first metatarsal is 100% and the interphalangeal joint is 94.4%, which is much higher than those of other studies. The occurrence rate of accessory navicular bone is 16.7% and that of the triquetral sesamoids is 22.2%. The average volume of the outer-side sesamoids is 434.87mm³, while the inner-side is 386.94mm³. The average surface area of the outer-side sesamoids is 298.8294m², while the inner-side ones is 274.15 m². The average volume of sesamoids on the toe joints is 55.49 mm³ with average surface area of 74.24 m². The average volume of triquetral bones is 703.01 mm³ with average surface area of 417.41 m². In all accessory bones, the triquetral bone in the right foot is biggest with volume 941.21 mm³, while the interphalangeal bone is smallest with 45.98 mm³. **CONCLUSIONS:** CT and 3D reconstruction may be effective for investigating the small bones. The sesamoids and accessory bones in feet of wrestlers could be common than no sportsmen, which is related to the acquired influence of Professional training.

1451 Board #126 June 1 8:00 AM - 9:30 AM

Calcium Lost Through Sweat: Is There Evidence of Bone Remodeling Due to Cutaneous Calcium Loss during Bikram Hot Yoga?

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It has been hypothesized that sweating during high-intensity exercise causes a disruption in calcium homeostasis leading to bone resorption and low bone mineral density in endurance athletes. **PURPOSE:** In order to investigate the acute effect of calcium loss during excessive sweating, biochemical markers of bone remodeling were measured before and after a 90 min session of Bikram hot yoga. The purpose of this study was to separate the effect of vigorous exercise and the effect of a bout of excessive sweating on markers of bone resorption by measuring serum ionized calcium (Ca²⁺), cutaneous calcium, and parathyroid hormone (PTH) before and after a Bikram hot yoga session. **METHODS:** Participants were female yogis ($N = 8$), who attended a mean (\pm SD) of 4.3 (1.3) Bikram yoga sessions weekly for the last 2.6 (1.6) years. A Bikram hot yoga session consists of performing 26 postures in 90 min at 105 °F and 40% humidity. Nude body weight was measured before and after the yoga session. Serum concentrations of PTH, and Ca²⁺ were measured before and after the yoga session ($n = 5$). Sweat was collected after the session by saturating chromatography paper with sweat from the participants' thigh during the final yoga

pose, while participants were inside the studio. To estimate the total amount of calcium loss during exercise, an estimate of the volume of sweat and sweat calcium concentration were obtained. **RESULTS:** Participants mean age was 47.4 (3.7) years. Mean estimated sweat loss was 1.6 (.6) L eliciting a -1.5% to -3.8% ($M = -2.3 \pm .92\%$) decrease in participants' body weight. Mean Ca²⁺ in sweat was 3.78 \pm 1.8 mg/dl and the mean total calcium lost was 63.1 \pm 32.8 mg. PTH did not increase from pre (17.0 \pm 1.7) pg/ml to post (16.7 \pm 1.6) pg/ml yoga session, $t(4) = 0.47$, $p = .67$, 95% CI [-1.0, 1.4]. A Wilcoxon test for nonparametric data indicated that serum Ca²⁺ increased from pre- ($mdn = 10.7$ mg/dl) to post- ($mdn = 11.5$ mg/dl) yoga session, $z = -2.0$, $p = .04$. **CONCLUSION:** A disruption in calcium homeostasis was not observed in a bout of excessive sweating during a 90 min Bikram hot yoga session. Sweat loss did not trigger an increase in PTH. This data suggests that the isolated effect of cutaneous calcium loss during low to moderate intensity exercise does not stimulate markers of bone resorption. Thus, high-intensity, non-loading exercise must play a role in remodeling.

1452 Board #127 June 1 8:00 AM - 9:30 AM

Predictors of Bone Mineral Density Among Intercollegiate Female Athletes

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PURPOSE: The purpose of this investigation was to determine the degree to which the confirmation of an eating disorder (ED), body mass index (BMI), percent body fat (PBF), and episodes of amenorrhea (EA) influence the bone mineral density (BMD) status of Division I-A female athletes. **METHODS:** Fifty National Collegiate Amateur Athletes (NCAA) females from a variety of intercollegiate sports (volleyball, soccer, track, tennis, golf, cheerleading, and softball) volunteered to participate. The athletes ranged in age from 18 to 35 ($M = 20.4$; $SD = 3.07$). All participants completed a demographic questionnaire, the Eating Attitudes Test-26 (Garner, Olmsted, Bohr, & Garfinkel, 1982), and signed an informed consent to participate. Following the written exercises, the subjects succumbed to anthropometric measurements (height, weight, and BMI), PBF determined by Lange calipers at three locations (abdomen, supraillium and triceps), and endured four regional scans (right/left radius and ulna and right/left femoral neck) on a Hologic QDR 4500W (S/N 49865) software version 11.2.5 dual x-ray absorptiometry. Four independent regression analyses were executed to determine the effect of BMI, PBF, EA, and ED scores on each of the four BMD measurements. **RESULTS:** The BMD of the dominant and non-dominant arm were significantly related to PBF and BMI ($p < .05$), whilst only BMI was significantly related to the BMD of the dominant and non-dominant femoral neck ($p < .05$). **CONCLUSIONS:** Only BMI was found to be a significant predictor of BMD for all four BMD sites. Although, BMI is not a consistent parameter from which body composition can be ascertained in athletes. PBF was a significant predictor for the forearms but not for each femoral neck. PBF was negatively correlated with the BMD at all four sites. Lean mass was not measured in this investigation to contrast the PBF results. It is therefore difficult to determine if PBF was significant due to increased lean mass or if this phenomena was due to a chronic energy deficit which could compromise PBF. The International Olympic Committee consensus group (De Souza, et al., 2014) called this chronic energy deficit RED-S (relative energy deficit in sport).

1453 Board #128 June 1 8:00 AM - 9:30 AM

Reduced Lean Mass and Fat Mass Exacerbate Effects of Estrogen Deficiency on Bone

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Lean mass is a stronger predictor of bone geometry in loaded limbs than fat mass in exercising women; however, estrogen exposure likely modulates the relationship between lean/fat mass and bone. We recently demonstrated that energy and estrogen status interact to impact vBMD, bone geometry and estimated bone strength (eBS) but that energy deficiency was often only detrimental in the presence of estrogen deficiency. This suggests that estrogen deficiency increases the vulnerability of bone to metabolic disruptions that accompany energy deficiency. We hypothesize that the impact of lean/fat mass on bone is dependent on estrogen status. **PURPOSE:** To compare the predictive value of lean mass index (LMI, kg*m⁻²) and fat mass index (FMI, kg*m⁻²) on vBMD, geometry, and eBS in the tibia in estrogen replete and estrogen deficient women. **METHODS:** Exercising women ($n = 60$, 18-30 yrs were grouped by 1) Estrogen deficient (E_D, $n = 27$): oligo/amenorrheic <6 cycles/12 mo, and 2) Estrogen replete (E_R, $n = 33$): eu/oligomenorrheic ≥ 6 cycles/12 mo. Body

composition was assessed via DXA. vBMD, bone geometry, and eBS were assessed at the 4% (distal) and 66% (proximal) tibia via pQCT. Multivariate stepwise regression determined predictors of bone outcomes. **RESULTS:** LMI was a positive predictor of distal tibia total, trabecular, and cortical vBMD in E₂D women only, accounting for 28-36% of the variance (p<0.004). LMI was a positive predictor of distal tibia cortical area in E₂R women (R²=0.137, p=0.037). FMI was not predictive of bone outcomes in E₂R women but was a positive predictor of cortical area at the distal tibia in E₂D women (R²=0.162, p=0.038). At the proximal tibia, FMI and LMI were positive predictors of total vBMD (R²=0.494) and cortical thickness (R²=0.571) in E₂D women only (p<0.015). LMI was a positive predictor of total area (R²=0.353) and negative predictor of cortical vBMD (R²=0.141) in E₂R women only (p<0.044). FMI and LMI were positive predictors of distal tibia BSI in E₂D women (R²=0.435, p<0.029). LMI positively predicted BSI in E₂R women but explained less variance (R²=0.152, p=0.027). **CONCLUSIONS:** In the absence of adequate estrogen exposure, reduced fat or lean mass results in significant detriments to bone health in exercising women. It appears that in the face of reduced fat or lean mass, estrogen may be protective to bone.

1454 Board #129 June 1 8:00 AM - 9:30 AM
Association between Bone-Specific Physical Activity Scores and Measures of Areal and Volumetric Bone Mineral Density and Bone Markers in Middle-Aged Premenopausal Women

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The bone-specific physical activity questionnaire (BPAQ) has been shown to be related to areal bone mineral density (aBMD), but its relation to bone architecture and bone markers has not been well studied. **PURPOSE:** The purpose of this study was to investigate the relationship between a total BPAQ score (tBPAQ), aBMD, volumetric BMD (vBMD, mg/cm³), and bone markers in middle-aged premenopausal women. **METHODS:** Thirty-four premenopausal women (44.4 ± 4.1 years; 161.7 ± 5.4 cm; 69.9 ± 11.1 kg) were recruited for this study. aBMD of L1-L4 and dual proximal femur (TH; total hip, FN; femoral neck) were measured using Dual Energy X-ray Absorptiometry. We assessed vBMD of tibia 4% (ToD; total vBMD, trabecular vBMD), 38% (ToD, CoD; cortical vBMD, SSI; strength strain index), and 66% (ToD, CoD, SSI) by peripheral quantitative computed tomography. Bone formation (Bone ALP) and bone resorption (TRAP5b) markers were assessed. The tBPAQ was used to obtain a comprehensive account of lifetime physical activity related to bone health. **RESULTS:** Spearman's correlation showed significant (p<0.05) positive relationships between tBPAQ and aBMD of right FN(r=.370) and left femur (TH, r=.373; FN, r=.372) and L1-L4 (r=.371), but no significant relationship was found for the right TH (p>0.05). There were no significant correlations between vBMD variables and tBPAQ. Also, no relationships were found between tBPAQ and bone ALP and TRAP5b (p>0.05). When tBPAQ, bone free lean body mass (BFLBM), calcium intake, and age were included in a stepwise multiple linear regression analysis, BFLBM was the only predictor of tibia 38% and 66% SSI, accounting for 16% (p=0.012) and 27% of the variance (p=0.001), respectively. **CONCLUSION:** The tBPAQ score-derived physical activity had positive relationships with FN, TH, and L1-L4 aBMD in healthy middle-aged premenopausal women, but no significant associations were found between tBPAQ and both vBMD and bone markers. Table 1. tBPAQ and aBMD (g/cm²)

Variables	Mean ± SD	Range
tBPAQ	24.3 ± 24.8	1.1 - 75.5
L1-L4	1.222 ± .129	.97 - 1.50
R_TH	1.015 ± .112	.8 - 1.2
R_FN	.988 ± .107	.73 - 1.22
L_TH	1.015 ± .102	.77 - 1.21
L_FN	.984 ± .096	.74 - 1.14

R, right; L, left

1455 Board #130 June 1 8:00 AM - 9:30 AM
Bone Mechanical Strength Deficits Following a Contusion Spinal Cord Injury in Rats

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Sublesional bone loss occurs rapidly following spinal cord injury (SCI) and contributes to a 20-100 fold greater bone fracture risk. **PURPOSE:** To determine the time course of bone strength deficits at different femoral test sites in a rodent contusion SCI model. **METHODS:** Sixty 16-week old male Sprague-Dawley rats received SHAM surgery or T9 laminectomy plus severe (250 kilodyne) contusion SCI using a computer-guided impactor and were euthanized 1-, 2-, or 3-months (m) post-surgery. Hindlimb locomotion was assessed weekly using the BBB locomotor scale and bone strength was assessed *ex vivo* at the distal femur, femoral midshaft, and femoral neck. SCI vs SHAM comparisons were made at each time point using independent t-tests. **RESULTS:** SCI animals exhibited persistent hindlimb locomotor deficits [BBB score < 6 (0-21 scale), p < 0.01 vs SHAMs at all time points], characterized by an inability to support the hindlimbs in stance or to perform hindlimb weight supported stepping. Bone strength deficits were observed at all testing sites after SCI in a somewhat variable pattern. At the distal femur, maximal breaking load (N) was 19% lower at 1-m (p < 0.05), 10% lower at 2-m (p < 0.05), and 16% lower at 3-m (p < 0.01) in SCI vs SHAM animals using a cantilever bending test. In addition, displacement at max load was 29% lower at 1-m (p < 0.05) and 22% lower at 3-m (p < 0.05). At the femoral neck, maximal breaking load was 22% lower at 1-m in SCI vs SHAM (p < 0.05), but was not different at 2-m or 3-m post-surgery. At the femoral midshaft, maximal breaking load was not different at 1-m post-surgery, but was 11% lower at 2-m (p < 0.05), and 23% lower at 3-m (p < 0.05) in SCI vs SHAMs, using a 3-point breaking test. No other differences in displacement or stiffness were observed among groups. **CONCLUSION:** In our SCI model, femoral skeletal integrity is compromised 1-m post-injury, with strength deficits dependent upon the skeletal site and the tests that were utilized. The distal femur cantilever test yielded less variability and typifies a common site of fracture in humans after SCI, suggesting this test is clinically-relevant. Interventions focused on preventing bone loss after SCI should initiate therapy soon after the injury occurs to ensure maintenance of skeletal integrity. Supported by VA RR&D SPIRE 1121RX001373-01 to JFY.

1456 Board #131 June 1 8:00 AM - 9:30 AM
Race/Ethnicity-related Differences In Bone Mass, Microarchitecture And Strength Among Young Adult Men And Women

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Stress fractures are common among military personnel. Notably, prior studies report that White or Caucasian military recruits have 1.5-2 fold greater risk of stress fracture, than their Black or African American counterparts. Yet, little has been done to characterize race/ethnicity-related differences in bone macrostructure, microstructure and bone mineral density (BMD) among young adults. **PURPOSE:** We aimed to determine differences in bone mass, structure and strength between young Black or African American, and White or Caucasian adults. **METHODS:** We enrolled 184 young (mean±SD) 24.2±3.4 yrs women (n=51 Black, n=50 White) and men (n= 32 Black, n=51 White) in this cross-sectional study. We used dual-energy X-ray absorptiometry (DXA) to determine areal BMD (aBMD) at the femoral neck (FN), total hip (TH) and lumbar spine (LS). High-resolution pQCT (HR-pQCT, 82 μm³ voxel size) was used to assess bone microarchitecture and strength by micro-finite element analysis (FEA) at the distal tibia (4% of tibial length). We used two-way ANOVA to compare bone outcomes, adjust for age, height and weight and detect race by sex interactions. **RESULTS:** Our ANOVA revealed no race by sex interaction for any bone outcome. In both women and men, after adjusting for covariates, Blacks had significantly greater FN aBMD (9.1%, p<0.01) but no difference in LS aBMD compared to Whites. HR-pQCT revealed greater cortical area (10.3%, p<0.01)

volumetric BMD (vBMD;4.9%, $p<0.05$) and thickness (12.0%, $p<0.01$), and less cortical porosity (18.2%, $p<0.01$) in Blacks compared to Whites. Blacks also had greater trabecular thickness (7.1%, $p<0.01$) but other trabecular parameters, total area, and total vBMD were similar to Whites. FEA-estimated failure load was significantly higher (9.5%, $p<0.01$) among Blacks compared to Whites. **CONCLUSION:** These findings demonstrate substantial race-related differences in bone microarchitecture and estimated strength between young adult Black and White men and women. Advantageous bone strength in Blacks appears attributable to denser, less porous, and thicker cortices compared to Whites. This advantage in bone microstructure may contribute to lower stress fracture risk among Black men and women compared to their White counterparts.

C-38 Free Communication/Poster - Cardiorespiratory Physiology and Rehabilitation

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1457 Board #132 June 1 9:00 AM - 10:30 AM Weekly Effect of Exercise-Based Cardiac Rehabilitation on Perceived Stress and Mood States in Cardiac Patients

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PURPOSE: To determine the weekly effect of exercise-based CR on perceived stress and mood states in patients with coronary artery disease (CAD).

METHODS: Twenty-one patients with CAD (age = 58.3 ± 10 years, weight = 76.5 ± 13 kg, BMI, 28 ± 4.7 kg/m², VO₂max = 12.4 ± 3.7 ml/kg/min), were measured every week for eight weeks on perceived stress and mood states (fatigue, vigor, tension, friendship, anger and depressed state), using the scale of perceived stress (EEP-10) and the profile of mood states (POMS). Functional exercise capacity and estimated VO₂max were obtained based on the 6-minute walk test (6MWT) at pre and post CR. A repeated measure ANOVA was used to determine outcomes differences. Effect sizes were also calculated and probability was set at level $p<0.05$.

RESULTS: Patients reduced stress ($F_{(8-160)} = 7.72$, $P < 0.01$, $\eta^2 = .279$) from (11.5 ± 4.3 to 5.7 ± 4.3 score) 50% post CR. Stress was reduced at week 1 from (11.5 ± 4.3 to 8.0 ± 4.6, $P = 0.049$) and was maintained subsequently. Fatigue decreased ($F_{(8-160)} = 4.3$, $P = 0.016$, $\eta^2 = .178$) from (6.3 ± 5.2 to 2.6 ± 2.3, score), 58% after CR. The change in fatigue was observed until week 7 from (6.3 ± 5.2 to 3.1 ± 3.8, $P = .010$). Vigor increased ($F_{(8-160)} = 7.1$, $P = 0.0019$, $\eta^2 = .263$) from (12.2 ± 4.6 to 16.0 ± 3.6, score), 31% more post CR. The improvement in vigor was observed until week 5 from (12.2 ± 4.6 to 3.6 ± 16.1, $P = 0.009$) and it was maintained afterward. Tension decreased ($F_{(8-160)} = 7.8$, $P = 0.005$, $\eta^2 = .281$) from (6.0 ± 4.5 to 2.4 ± 2.8 score), 60% less post CR. The decrease in tension was observed at week 3 from (6.0 ± 4.5 to 3.2 ± 3.1, $P = 0.037$) and it was remained at week 5, 6 and 8 ($P = 0.004$, $P = 0.005$, $P = 0.005$), respectively. Friendship only improved 12.5% at week 5 from (15.2 ± 3.1 to 17.1 ± 2.7, $P = 0.015$). In addition, VO₂max improved 21.7% from (12.4 ± 3.7 to 15.1 ± 3.9 ml/kg/min, ES = 0.68, $P < 0.01$) after CR. Similarly, the 6MWT distance improved 26% from (444 ± 86 to 559 ± 88 m, ES = 1.2, $P < 0.01$). **CONCLUSION:** Our eight-week exercise-based CR was effective on reducing the levels of perceived stress and improving the mood states of vigor, fatigue and tension. Perceived stress improved at week one, tension decreased at week three and vigor and friendship took five weeks to change. We need more studies to evaluate if these benefits persist long after completing a cardiac rehabilitation program.

1458 Board #133 June 1 9:00 AM - 10:30 AM Effects of Exercise Training on Systolic and Diastolic Function of Mice with Diabetic Cardiomyopathy

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PURPOSE: Diabetic cardiomyopathy account for most of the diabetic death according to clinical data, and prevention and treatment of diabetic cardiomyopathy are still among the most challenging health problems today. To explore the possible therapeutic

intervention of diabetic cardiomyopathy, a designed exercise training program was applied to mice model with diabetic cardiomyopathy in this study, followed by systolic and diastolic heart function measurement with echocardiography.

METHODS: Sixteen C57BL6 mice with diabetic cardiomyopathy induced by high fat and high glucose diet were divided randomly into exercise training group (Ex) and control group (Ctr). Exercise training protocol included moderate treadmill running and resistant exercise alternately for 8 weeks. Small animal echocardiography was used to measure heart function at the end of study, with ejection fraction (EF), left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD), stroke volume (SV) for the systolic function, and blood flow peak velocities of the early peak at the mitral valve (E), peak velocities of the atrial peak at the mitral valve (A), the ratio of E/A for the diastolic function measurement. The myocardial performance index (MPI) was also measured by PW Doppler at the mitral valve. **RESULTS:** After 8 weeks' exercise training, EF of Ex mice showed significant increase (68.99±2.04 vs 60.41±2.31, $P<0.05$), while LVEDD (3.62±0.16 vs 3.71±0.20, $P<0.05$) and LVESD (2.28±0.14 vs 2.26±0.08, $P>0.05$) showed no significant difference when compared with Ctr mice. There was no significant difference for the SV between Ex and Ctr mice (0.038±0.003 vs 0.034±0.003, $P>0.05$). Blood flow Doppler at the mitral valve showed that E (709.73±34.69 vs 441.51±17.46), A (443.77±32.62 vs 523.67±21.90) and E/A (1.63±0.62 vs 0.85±0.05, $P<0.01$) were all significant improved at Ex mice when compared with Ctr mice. The MPI (0.86±0.09 vs 0.97±0.09, $P>0.05$) between two groups had no significant difference.

CONCLUSIONS: The above data indicated that 8 weeks' exercise training could improve the heart function of mice with diabetic cardiomyopathy, especially the diastolic heart function.

1459 Board #134 June 1 9:00 AM - 10:30 AM Performance and Physiological Improvements in Treadmill Walking after 12 Sessions of Phase Two Cardiac Rehabilitation

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The benefit of cardiac rehabilitation (cardiac rehab) after a heart attack has been shown to decrease mortality and increase quality of life. **PURPOSE:** To determine the changes in treadmill walking time, speed and distance as well as pre- and post-exercising blood pressure (BP) and heart rate (HR) over the first 12 of 36 cardiac rehab sessions.

METHODS: De-identified data from the charts of 16 post-myocardial infarction patients (13 men, 3 women; 58 ± 7 yrs, 83.8 ± 17.1 kg) who began the UNM Hospital Phase 2 cardiac rehab program between June and August of 2016 were evaluated. At intake, all patients participated in a modified Bruce protocol which was terminated when the patients reached a rating of perceived exertion (RPE) of 15 on the 6-20 Borg scale. Test results were used to prescribe patients' respective initial walking speeds for the program. Patients walked at least twice weekly at their designated speed. Walking time and speed were adjusted regularly to keep an RPE of 13. Treadmill walking time, speed, distance, and heart rate (HR) were recorded and analyzed across the 1st, 6th, and 12th sessions through separate applications of the repeated measures ANOVA technique with post-hoc Bonferroni adjustment. The changes between pre- and post-walking bout blood pressure (BP) and HR were analyzed using individual *t*-tests. Statistical significance was set at $p < .05$. **Results:** On average, the mean walking time (12.7, 18.6, 22.5 min), speed (2.6, 2.8, 3.1 mph) and distance (0.6, 0.9, 1.1 mi) increased with session number ($p<0.01$). Walking distance was different between the sessions ($p<0.01$). Walking speed differed between the 1st and 12th and between the 6th and 12th sessions ($p<0.03$). The walking duration was different between the 1st and 6th and between the 1st and 12th sessions ($p<0.01$). Heart rate while walking at an RPE of 13 was 104, 99, and 102 bpm for the 1st, 6th, and 12th session, respectively. Post-walking bout systolic BP was lower compared to pre-bout in the 1st and 6th session ($p=.03$) as was diastolic BP in the 12th session ($p=.04$).

CONCLUSION: Patients significantly improved their treadmill walking time, speed and distance over the course of 12 Phase 2 cardiac rehab sessions. Clamping a cardiac rehab treadmill walking RPE at 13 may elicit similar improvements for Phase 2 patients resembling those in this study.

1460 Board #135 June 1 9:00 AM - 10:30 AM

Impact Of Depression Or Anxiety On Enrollment In Cardiac Rehabilitation In Veterans

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Patients in Cardiac Rehabilitation (CR) vary significantly with respect to comorbidities. Depression and/or anxiety (DA) are risk factors for cardiovascular disease (CVD), and also increase risk for secondary events once CVD is established. Whereas CR includes home-based (HB-CR) as well as facility-based (FB-CR) options, little is known about whether DA status influences enrollment in HB-CR vs FB-CR programs.

PURPOSE: We compared patients with DA and with No-DA (NDA) in respect to HB-CR vs. FB-CR enrollment in a Veterans Healthcare System (VHS) center which offered both programs.

METHODS: In a quality improvement project we evaluated 239 Veterans at baseline before beginning CR. Patients were evaluated for medical and physical risks to determine a recommendation for either FB-CR or HB-CR. Patients who demonstrated moderate or high medical or physical risk were advised to pursue FB-CR; however patients ultimately made the decision on whether to enroll in CR. A patient deemed moderate or high medical or physical risk would not be allowed to choose HB-CR, but this risk assessment was independent of DA status. At baseline patients completed the 8-item Personal Health Questionnaire Depression Scale (PHQ-8) and the Generalized Anxiety Disorder 7-item scale (GAD-7). 6 Minute Walk Distance (6MWD) and Gait Speed (GS) were also assessed as metrics of physical function.

RESULTS: Patients with baseline depression (PHQ-8≥10) and/or anxiety (GAD-7≥10) (N=56) were more likely to enroll FB-CR (67.9% vs. 48.6%, p=0.028) than NDA (N=183) patients. Conversely, NDA patients were more likely to enroll HB-CR (24.6% vs. 8.9%). Patients with DA also had lower 6MWD (278 ± 100 vs. 314 ± 92.5, p=0.0179) and GS (1.08 ± 0.28 vs. 1.21 ± 0.29, p=0.0068) than NDA.

CONCLUSIONS: Veterans with DA are more likely to enroll in FB-CR and have lower baseline values of physical function than Veterans with NDA. However, it is unknown if and how DA patients are better served with FB-CR. Future studies are indicated to clarify utility of FB- vs. HB- CR for DA as HB-CR programs continue to proliferate in the VHS and in many cases now supplant FB-CR options.

1461 Board #136 June 1 9:00 AM - 10:30 AM

Effect Of Aqua-walking On Cad Risk Factors And Fitness In Older Adults

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Effect of Aqua-Walking on CAD Risk Factors and Fitness in Older Adults.

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PURPOSE: Exercise training is considered the cornerstone intervention in the multidisciplinary approach to managing coronary artery disease (CAD) risk factors in both primary and secondary prevention programs. However, older adults often have limitations to walking due to osteoarthritic pain. The purpose of this study was to examine the effect of aqua-walking versus traditional over-ground walking on CAD risk factors and cardiorespiratory fitness in older adults with osteoarthritis in the lower extremity. **METHODS:** Sixty older adults who had undergone percutaneous coronary intervention (PCI) or had the presence of CAD risk factors were recruited from a Senior Wellness Center. Those who had exercise limitations due to osteoarthritis (n= 20) were assigned to aqua-walking program (AW), while those without arthritic problems (n= 40) were randomly assigned to either Treadmill/Track-walking (TW) program or control group (Con). Assessments were performed before and after 24 weeks of medically supervised exercise training for both TW and AW groups.

RESULTS: There were significant differences between groups for the change in body fat (%BF = TW -2.5 + 3.0 %, AW -2.4 +2.9 %, Con -0.4 +2.0%, p<0.05), total cholesterol (TC = TW -22.9 + 40.6 mg/dL, AW -27.2 + 37.3 mg/dL, Con 14.0+44.5 mg/dL, p<0.05) and cardiorespiratory fitness expressed as VO₂peak (TW 2.4 +3.8 ml/kg/min, AW 2.0 +3.0 ml/kg/min, Con -2.5 + 3.8 ml/kg/min, p<0.05) over 24 weeks. However, there were no significant differences between TW and AW groups for change in these measures. There was no significant difference between the three groups for

the change in other risk factors, including bodyweight (BW), body-mass index (BMI), fasting HDL-C, LDL-C, and triglycerides (TG), systolic and diastolic blood pressure (SBP DBP) and resting HR and psychosocial factors. **CONCLUSION:** Given the similar magnitude of change in important CAD risk factors and cardiorespiratory fitness, aqua-walking appears to be a feasible alternative exercise modality to over-ground walking and can be recommended for the older adults with CAD and osteoarthritis.

1462 Board #137 June 1 9:00 AM - 10:30 AM

Facility- and Home-Based Cardiac Rehabilitation Achieve Similar Magnitude of Functional Improvements

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Background: Cardiac rehabilitation (CR) has been demonstrated to increase functional capacity in patients with cardiovascular disease (CVD). However, research has found only 14 to 31% of eligible patients participate in facility-based (FB) CR; participation appears to be even lower within the Veteran Administration (VA) with only 8 to 10% of eligible Veterans participating. Home-based (HB) CR may be a viable alternative to expand CR utilization. In a VA quality improvement project, we compared functional gains achieved in FB-CR versus HB-CR for Veterans with CVD.

Methods: Veterans diagnosed with CVD were assessed pre- and post- CR including medical and functional assessment [6 Minute Walk Distance (6MWD), Gait Speed (GS) and Timed Up and Go (TUG)]. Low risk patients were given the option to participate in the FB- or HB-CR program. Moderate and high risk patients participated only in FB-CR. FB-CR entailed standardized exercise training and education; 1 to 3 hospital-based sessions per week over 12 weeks (range of 24-36 sessions). HB-CR entailed an initial onsite exercise education session and then verbal exercise review/ reinforcement and education over the phone, one session per week for 12 weeks. After 12 weeks, patients in both groups were reassessed.

Results: As shown in the Table, significant improvements in 6MWD, GS, and TUG were evident for both FB- and HB-CR. Similar magnitude of changes were achieved in both CR groups.

TEST	FB-CR			P-Value Pre vs Post	HB-CR			P-Value Pre vs Post	P-Value (BETWEEN GROUPS)
	PRE	POST	Change		PRE	POST	Change		
6MWD	296 ± 103	337 ± 88	41 ± 75	0.02	362 ± 70	408 ± 74	46 ± 73	0.02	0.94
GS	1.19 ± 0.28	1.25 ± 0.29	0.06 ± 0.27	0.29	1.35 ± 0.23	1.45 ± 0.26	0.09 ± 0.19	0.08	0.24
TUG	11.4 ± 3.6	10.6 ± 3.6	0.8 ± 2.6	0.19	9.1 ± 2.4	8.3 ± 2.1	0.8 ± 1.9	0.096	0.22

Conclusion: FB- and HB-CR were associated with similar improvements in key functional metrics, suggesting that both programs achieve valuable functional gains in patients that ranged in CVD severity. This extends the promise of HB-CR as a format of CR that not only has the potential to increase participation, especially for the many eligible patients who are curtailed by logistics, but to achieve similar efficacy. Functional recovery after a cardiovascular event is a critical step towards improved quality of life and reduced disability.

THURSDAY, JUNE 1, 2017

1463 Board #138 June 1 9:00 AM - 10:30 AM

Anthracycline Chemotherapy and Cardiovascular Function and Fitness in Breast Cancer PatientsSaowalak Siripanya¹, Napa Parinyanitikul¹, Hirofumi Tanaka, FACSM², Daroonwan Suksum¹. ¹Chulalongkorn University, Bangkok, Thailand. ²The University of Texas at Austin, Austin, TX.

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Chemotherapy using anthracyclines is among the most effective pharmacological therapy available in the treatment of cancer. However, they are often accompanied by profound adverse complications of cardiovascular system called cardiotoxicity. Some of these side effects can lead to progressive cardiovascular diseases. Currently, it is not known if anthracycline chemotherapy is associated with vascular dysfunction and cardiovascular fitness impairment in breast cancer patients.

PURPOSE: To investigate the association between anthracycline chemotherapy and cardiovascular functions in breast cancer patients.

METHODS: Fifteen breast cancer patients aged 45±3 years were compared with fourteen age-, sex-, and body composition-matched healthy females. The anthracycline chemotherapy treatment consisted of 4 cycles of doxorubicin (60 mg/m²) and cyclophosphamide (600 mg/m²) repeated every 3 weeks. Breast cancer patients had been undergoing second or third cycle of chemotherapy treatments.

RESULTS: There were no significant group differences in height, body fat, resting heart rate, systolic and diastolic blood pressure. Maximal oxygen consumption was not different between cancer patients and healthy controls (26.7±1.4 vs. 26.6±0.9 ml/kg/min). Ankle-brachial index was not different but carotid artery intima-media thickness was higher (p<0.05) in cancer patients than in healthy controls (0.50±0.02 vs 0.45±0.01 mm). Brachial-ankle pulse wave velocity, an index of arterial stiffness, was greater (p<0.05) in cancer patients than in healthy controls (1325±48 vs. 1158±38 cm/sec).

CONCLUSIONS: These results suggest that anthracycline chemotherapy is associated with vascular stiffening in breast cancer patients. Prospective intervention studies are needed to confirm the findings from this cross-sectional study.

Supported by Government research budget Chulalongkorn University 2016 and The 100th Anniversary Chulalongkorn University Fund for Doctoral Scholarship.

1464 Board #139 June 1 9:00 AM - 10:30 AM

Effects Of Different Types Of Chemotherapy On Cardiopulmonary Fitness In Patients With Breast CancerChing-Ying Tseng¹, Hsin-Fu Lin², Chiao-Nan (Joyce) Chen³, Yi-Ching Huang⁴, Jui-Chi Lin⁵, Yi-Hung Liao⁶. ¹Koo Foundation Sun Yat-Sen Cancer Center, Taipei, Taiwan. ²Department of Athletics, National Taiwan University, Taipei, Taiwan. ³Department of Physical Therapy, Chang Gung University, Taoyuan, Taiwan. ⁴Taipei College of Maritime Technology, New Taipei, Taiwan. ⁵Taipei Medical University-Shuang Ho Hospital, Ministry of Health and Welfare, New Taipei, Taiwan. ⁶Department of Exercise and Health Sciences, National Taipei University of Nursing and Health Sciences, Taipei, Taiwan.

(No relationships reported)

Two most popular adjuvant chemotherapeutic regimens, including cyclophosphamide, doxorubicin, and fluorouracil (CAF) and doxorubicin plus cyclophosphamide followed by taxanes (AC→T), are currently used for treating the early stages breast cancer. However, it has not been clear whether the cardiopulmonary fitness and cardiovascular responses would be perturbed by the administrations of these chemotherapeutic regimens. **PURPOSE:** To investigate the effects of the administrations of CAF and AC→T on cardiopulmonary fitness and cardiovascular responses in patients with early stage breast cancer. **METHODS:** Twenty-seven patients with early stages of breast cancer (age: 45.0±1.5 yrs; Stage I-II) voluntarily participated in this study, and they were assigned to either CAF (n=12) or AC→T (n=15) group depending on oncological specialists' clinical decisions. Their cardiopulmonary fitness (measured by resting heart rate and six-minute walking test) and cardiovascular response (measured by pulse wave velocity - PWV) were assessed at before and after receiving adjuvant chemotherapy. **RESULTS:** There were no differences in all measurements between CAF and AC→T groups at baseline. In the completion of adjuvant chemotherapy, the participants in AC→T group showed significantly higher resting heart rate by ~14.9% than CAF group. Although the walking speed, distance, and metabolic equivalent of task (MET) during six-minute walking test were not different between groups, the AC→T group exhibited a remarkably higher relative stress in response to exercise test (measured by the % of maximal heart rate - %MHR; AC→T: 68.8%MHR vs. CAF: 59.4%MHR, p<0.05) in compared with those with CAF treatment. There was no difference in PWV between CAF and AC→T groups at the end of chemotherapy. **CONCLUSION:** We demonstrated that doxorubicin plus cyclophosphamide followed by taxanes (AC→T) increased resting heart rate and relative stress to the 6-minute

walking test at the end of chemotherapy. However, the PWV was not different between two adjuvant chemotherapeutic groups. Our data suggest that, in compared to CAF, AC→T might cause greater adverse effects on cardiopulmonary fitness but not cardiovascular functions in patients with early stage breast cancer.

1465 Board #140 June 1 9:00 AM - 10:30 AM

Rating of Perceived Exertion As A Tool For Prescribing And Self-regulating High-intensity Interval Exercise In Type 2 Diabetes: A Pilot Study

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PURPOSE: Rating of perceived exertion (RPE) scale is an inexpensive tool for prescribing and self-regulating moderate exercise in different populations. However, its use for prescribing and self-regulating high-intensity interval training (HIIT) in type 2 diabetes mellitus (T2DM) patients has not been studied. Our purpose was to investigate the usefulness of 6-20 RPE scale for prescribing and self-regulating HIIT in individuals with T2DM. **METHODS:** Ten (2 men) T2DM patients (age = 50.7 ± 8.9 yr; BMI = 31.4 ± 10.1 kg/m²) performed a cardiopulmonary exercise testing (CPX) to determine their maximal and reserve heart rate (HR). Subjects then performed HIIT sessions (25 min on a motorized treadmill) prescribed and regulated by their HR response to CPX (HIIT_{HR}: 4 min of warm-up and 21 min of jogging/running at 85% (1 min) alternating with walking at 50% (2 min) of reserve HR) and by RPE (HIIT_{RPE}: 4 min of warm-up and 21 min of jogging/running at 15-17 (1 min) alternating with walking at 9-11 (2 min) on the 6-20 RPE scale) in random order (3 to 7 days of interval between interventions). Exercise HR, speed and distance throughout the 25 min were compared between HIIT_{RPE} and HIIT_{HR} sessions. **RESULTS:** No significant differences were observed in HR during low- and high-intensity intervals between HIIT_{RPE} and HIIT_{HR} sessions (Figure 1.A). Exercise speed during low- and high-intensity intervals (Figure 1.B), as well as exercise distance also did not differ between HIIT_{RPE} (1.4 ± 0.1 km) and HIIT_{HR} (1.6 ± 0.1 km) sessions. **CONCLUSIONS:** No significant differences were observed in exercise HR, speed and distance between HIIT sessions prescribed and regulated by RPE or HR. This finding suggests that the 6-20 RPE scale may be a useful tool for prescribing and self-regulating HIIT in T2DM patients.

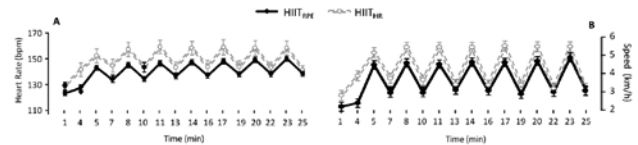


Figure 1: Exercise heart rate (A) and speed (B) during high-intensity interval exercise session prescribed and regulated by rate of perceived exertion (HIIT_{RPE}) and heart rate (HIIT_{HR}). No significant differences were observed between sessions.

1466 Board #141 June 1 9:00 AM - 10:30 AM

Blood Pressure Responses To Isometric Exercise; Safety Considerations For Exercise PrescriptionJim Wiles¹, Katrina A. Taylor¹, Damian Coleman¹, Rajan Sharma², Jamie M. O'Driscoll¹. ¹Canterbury Christ Church University, Canterbury, United Kingdom. ²St George's Healthcare NHS Trust, London, United Kingdom.

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Purpose: Research demonstrates that isometric exercise (IE) training can reduce resting blood pressure (BP). Few studies have investigated the relative safety of prescribing IE. The aim of this study was to evaluate the BP responses in pre-hypertensive males during a novel IE wall squat protocol to help establish IE training as a viable option in the prevention and treatment of hypertension. **Methods:** Twenty-six physically inactive pre-hypertensive (BP of 120-139 mmHg systolic and/or 80-90 mmHg diastolic) males (45 ± 8 years; 1.78 ± 0.07 m; 89.7 ± 12.3 kg; mean ± SD), visited the laboratory on two occasions separated by 72 hours. On each occasion heart rate (HR) and BP were measured at rest and continuously throughout exercise. In visit 1 participants completed an incremental isometric wall squat exercise test in continuous stages, starting at 135° of knee flexion, decreasing by 10° every 2 minutes until 95° (final stage). Exercise was terminated upon completion of the 10-minute test or upon volitional fatigue. The relationship between knee joint angle and mean HR was used to calculate the participant-specific knee joint angle required to elicit a target HR of 95% HR_{peak}. This angle was then used to determine exercise intensity for a wall squat training session consisting of 4 x 2 minute bouts (visit 2). **Results:** Systolic BP responses during the exercise test and training were 173 ± 21 mmHg vs. 171 ± 19 mmHg respectively (p>0.05). These responses were positively related (r=0.73, p<0.05) with ratio limits of agreement of 0.995 x/± 1.077. Diastolic

BP responses were 116 ± 14 mmHg and 113 ± 11 mmHg during the exercise test and training ($p > 0.05$). These values were also positively related ($r = 0.42$, $p < 0.05$) with ratio limits of agreement of $0.99 \times \pm 1.107$.

No participant in either protocol recorded systolic BP values > 250 mmHg. Diastolic BP values > 115 mmHg were recorded in 12 participants during the incremental test and in 6 participants during the training session. No adverse effects were reported.

Conclusion: Based on the current ACSM guidelines for aerobic exercise termination, systolic BP does not reach the upper limit during IE in this population. Diastolic BP briefly exceeds 115 mmHg in some participants during these exercise protocols. Future research is required to ascertain if IE requires modified BP termination guidelines.

1467 Board #142 June 1 9:00 AM - 10:30 AM

Impaired Critical Speed in Mice with Sickle Cell Anemia: Implications for Therapeutic Development

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Sickle cell anemia results in impaired cardiorespiratory function and exercise tolerance likely due to a combination of central and peripheral abnormalities stemming from deranged hemoglobin (Hb). A transgenic mouse model of sickle cell anemia has been developed to help elucidate the mechanisms of vascular and organ damage, but a valid and reproducible measurement of exercise capacity and the severity of impaired physical function have yet to be determined in this model. **Purpose:** Therefore, the purpose of this investigation was to measure the speed/duration relationship, known as critical speed (CS), and the anaerobic work capacity (AWC, the finite work capacity available above CS) in healthy wild type mice (WT) and mice expressing human HbSS (BERK).

Methods: Following ethical approval from the institutional animal care and use committee (University of Colorado, Denver), six young-adult female mice (WT, $n = 3$ and BERK, $n = 3$) performed 3-5 constant-speed treadmill tests that resulted in fatigue within the range of 1.5 to 20 min. Time to fatigue vs. treadmill speed were fit to a linear and hyperbolic model.

Results: Speed and time to exhaustion for both groups conformed to a hyperbolic relationship (WT: $r^2 = 0.98 \pm 0.01$, BERK: $r^2 = 0.98 \pm 0.02$, $p > 0.05$) which corresponded to a linear 1/time function (WT: $r^2 = 0.97 \pm 0.02$, BERK: $r^2 = 0.94 \pm 0.03$, $P > 0.05$). CS was significantly lower in BERK mice when compared to the WT control (WT: 34.8 ± 1.3 , BERK: 23.2 ± 1.5 m/min, $p < 0.05$) with no differences between linear and hyperbolic models ($p > 0.05$ for both). Additionally, AWC was significantly higher (WT: 1456.2 ± 237.2 , BERK: 2639.2 ± 106.8 , $P < 0.05$) in BERK relative to WT.

Conclusions: Exercise tolerance, as measured via CS, was severely reduced in BERK mice when compared to WT. Considering that CS represents the highest sustainable rate of aerobic metabolism and the lower CS in BERK mice, these data suggest that sickle cell disease impacts aerobic capacity which may be due to a disruption in the tight matching between oxygen delivery and utilization within the skeletal muscle. In this regard, these results call for future investigations into the mechanisms by which this disease impacts skeletal muscle vascular and metabolic control so that targeted therapies can be developed and employed.

Funding:

NIH-NHLBI T32HL007171

NIH-R01HL125642

1468 Board #143 June 1 9:00 AM - 10:30 AM

Algorithm For Predicting Disease Likelihood From Noninvasive Submaximal Cardiopulmonary Exercise Testing

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(No relationships reported)

Cardiopulmonary exercise testing with non-invasive respiratory gas exchange has largely been utilized in specialty clinical practices. However, it remains challenging to interpret the large array of measures due to the complexities of the data. **Purpose:** The purpose of the study was test a simplified automated algorithm for data predicting disease likelihood in patients with known chronic cardiopulmonary pathologies.

Methods: For the present study, patients with heart failure (HF, $n = 12$), pulmonary arterial hypertension (PAH, $n = 11$), chronic obstructive lung disease (OLD, $n = 16$) and restrictive lung disease (RLD, $n = 12$) as well as a healthy cohort of subjects ($n = 19$) were recruited. They underwent an incremental step-test (step frequency was 60, 80 and 100 per min). During exercise, HR and SpO₂ were assessed via pulse-oximetry and breathing pattern and respiratory gas exchange were obtained via breath by breath respiratory analysis system (SHAPE Medical Systems Inc., St. Paul, USA). A custom-developed algorithm for each disease pathology was developed based on existing

literature to guide disease likelihood and severity. **RESULTS:** Each specific panel of measures for disease entity (HF, PAH, OLD and RLD) adequately differentiated disease group ($p < 0.05$) as well as healthy cohort ($p < 0.05$). However, given the high degree of coexisting disease in these patient populations the algorithm often identified coexisting disease but ranked primary disease accordingly. **CONCLUSIONS:** We have developed an automated algorithm for identifying primary and coexisting disease likelihood in an attempt to simplify and increase accessibility to clinical cardiopulmonary exercise testing. This type, automated algorithm combined with a simplified approach to testing can help guide decision making and streamline a traditionally complex and often time consuming process.

1469 Board #144 June 1 9:00 AM - 10:30 AM

Water Depth Affects Energy Expenditure of Aquatic Walking in People Post-Stroke

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(No relationships reported)

Hemiparetic gait is one of the major characteristics in people post-stroke, contributing to limited functional mobility and excessive energy expenditure (EE) during walking. Previous research reported that aquatic walking decrease EE as compare to overground walking. However, the influence of water depth during aquatic walking on the cardiorespiratory responses, particularly among people post-stroke, is unknown. **Purpose:** To investigate the influence of different water depths on cardiorespiratory responses during pool floor walking in people post-stroke. **Methods:** Nine participants post-stroke (4 males/5 females; age 55.25 ± 13.76 years) completed six minutes of walking at a matched gait speed in four different conditions: chest-depth, waist-depth, thigh-depth water, and overground. Data collection was completed on four separate visits with at least 48 hours in between. The order of walking conditions was randomized. A moveable floor pool was used to adjust the water depth. EE, oxygen consumption (VO₂), and minute ventilation (VE) were measured with a telemetric metabolic system. **Results:** Repeated measures ANOVA revealed no significant differences in EE ($p = .16$), VO₂ ($p = .14$), and VE ($p = .08$). However, a systematic trend was found among four walking conditions. A trend of increase in all variables was noted as the water depth decreased from chest-depth to thigh-depth water. In addition, walking at waist-depth water (EE=4.45 Kcal/min, VO₂=10.79 ml/min/Kg, VE=26.25 l/min) showed similar results in all variables compared to overground walking (EE=4.33 Kcal/min, VO₂=10.54 ml/min/Kg, VE=24.67 l/min). **Conclusion:** Our findings suggest that people post-stroke may benefit from gait training in the chest-depth water as it reduces EE, mostly due to buoyancy. When walking in the waist-depth water, the effects of buoyancy and water resistance appear to counteract with each other, resulting in no difference in EE among people post-stroke.

1470 Board #145 June 1 9:00 AM - 10:30 AM

Blunted Autonomic Response To Orthostasis In Individuals With Intellectual Disabilities Compared To Controls: Preliminary Results

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Individuals with intellectual disabilities (ID) have limited cardiorespiratory capacity, not explained by lack of motivation or lack of understanding the testing procedures. Previous research suggests these limits in cardiorespiratory capacity may be due to autonomic dysfunction in individuals with ID, but this has not been tested.

Purpose: To compare the autonomic response to standing up (a basic clinical autonomic function test) of individuals with ID to a control group without ID. **Methods:** : Thirteen individuals with ID and 12 individuals without ID were instrumented with an ECG-lead and finger-plethysmography for continuous heart rate and blood pressure recordings. After resting supine they moved to a standing position and returned to the supine position, each for 10 min. The last five minutes of every position was used to calculate time-domain and frequency-domain heart rate variability and blood pressure variability measures, common non-invasive indices of autonomic function.

Results: : Individuals with ID showed different responses compared to individuals without ID for R-R-interval (RRI), root mean square of successive differences (RMSSD), the proportion of times the change in consecutive intervals exceeds 50 milliseconds (pNN50), power in the high frequency of heart rate variability (RRI HF), spontaneous baroreflex sensitivity (sBRS) and power in the low frequency of blood pressure variability (SAP LF) ($p < 0.05$; Table).

Conclusions: These preliminary results suggest a blunted response to standing up in individuals with ID, but our findings need to be confirmed with a larger sample.

1471 Board #146 June 1 9:00 AM - 10:30 AM
Ambulatory Blood Pressure Responses To Home-based Isometric Exercise Training In Pre-hypertensive Males

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 (No relationships reported)

Purpose: Arterial hypertension is associated with excess cardiovascular disease mortality and remains a significant global public health problem. Isometric exercise training (IET) has been shown to reduce resting blood pressure (BP) in normotensive, pre-hypertensive and hypertensive populations; however the effects of IET on 24-hour ambulatory blood pressure (ABP) are less clear. Therefore, the aim of this study was to measure clinic and ABP responses to a programme of IET.

Methods: In a randomised crossover controlled trial, 24 physically inactive pre-hypertensive males (aged 44.6±7.7 years) completed 4 weeks of home-based isometric wall squat training (4 x 2 min contractions 3 times per week). Clinic and ABP were measured pre and post the control and IET period.

Results: The isometric exercise training programme produced significant (mean and 95% confidence intervals [CI]) reductions in clinic systolic (12.35 mmHg; 95% CI 10.94-14.23), diastolic (6.24 mmHg; 95% CI 4.01-8.12) and mean (8.01 mmHg; 95% CI 6.04-9.64) BP (all p<0.001). In addition, IET produced significant (mean and 95% CI) reductions in ambulatory systolic (11.83 mmHg; 95% CI 10.26 - 13.52), diastolic (5.57 mmHg; 95% CI 3.05 - 6.29) and mean (5.67 mmHg; 95% CI 4.13 - 7.82) BP (all p<0.001). There were no significant changes during the control period.

Conclusion: A short-term programme of home-based IET was associated with clinically significant reductions in resting and ABP. The impact these responses have on long-term cardiovascular events, end organ damage and mortality requires further research.

1472 Board #147 June 1 9:00 AM - 10:30 AM
Association of Six Minute Push Test Distance and Measures of Cardiorespiratory Fitness in Spinal Cord Injury

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 (No relationships reported)

Introduction: The 6-minute push test is often used to estimate cardiorespiratory fitness in people who have spinal cord injury (SCI). **Purpose:** To characterize the relationship between 6-minute push distance (6MPD) and measures of cardiorespiratory function obtained during cardiopulmonary exercise tests (CPET) in people with SCI. **Methods:** Subjects were 15 individuals with SCI who reported an inability to lift their legs against gravity (Age: 34.5 ± 10.5 years; BMI: 25.5 ± 3.6 kg/m²; paraplegic: N=12, tetraplegia: N=3, incomplete injury: N=5, complete injury: N=10). Each subject performed a CPET to volitional exhaustion using a Monark arm ergometer during which pulmonary gas exchange variables were measured. 6MPD was recorded as the total distance covered while propelling a wheelchair over a 30-meter loop in a corridor for 6-minutes. Pearson product moment correlation coefficients were used to assess the relationship between all study variables. **Results:** 6MPD was 524.1 ± 122.1 m, VO_{2peak} was 17.5 ± 6.3 ml/kg/min and RER was 1.15 ± 0.16. CPET duration averaged 450.6 ± 200.6 seconds and relative peak workload reached at the end of exercise was 0.96 ± 0.48 Watts/kg. The 6MPD correlated significantly with VO_{2peak} (r=0.58; P=0.023), RER (r=0.70; P=0.003), peak exercise time (r=0.70; P=0.004), peak workload (r=0.66; P=0.008). **Conclusion:** CPET is currently accepted as the gold standard for measuring cardiorespiratory fitness. The strong correlation between cardiorespiratory fitness measured by CPET and 6MPD suggested that 6MPD might be an adequate field test for measuring cardiorespiratory fitness in people who have SCI.
 Funding: DoD Award #W81XWH-14-1-0613

1473 Board #148 June 1 9:00 AM - 10:30 AM
Physiological, Perceptual And Affective Responses During Community-Based Cardiac Rehabilitation
 Nicola R. Hurley. Dublin City University, Dublin, Ireland.
 (No relationships reported)

Physiological, perceptual, and affective responses during community-based cardiac rehabilitation

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BACKGROUND: Cardiac rehabilitation (CR) is a multifaceted intervention that aims to optimise cardiovascular disease (CVD) risk reduction. International guidelines identify exercise as an integral component of CR and recommend that CR participants exercise at an intensity corresponding to 50- 80% VO₂max to achieve maximal health benefits.

PURPOSE: To characterize the physiological, perceptual, and affective responses during self-regulated exercise in a community-based CR (CBCR) program.

METHODS: Twenty-six men (mean ± SD; age 67.6 ± 6.2 years, BMI 28.8 ± 3.2 kg·m⁻²; VO_{2peak} 25.3 ± 5.8 ml·kg⁻¹·min⁻¹) with stable CVD, who were attending a community based CR program for at least 6 months, were recruited. Participants performed a graded treadmill exercise test with a 12-lead ECG to measure VO_{2peak} and heart rate (HR)peak. Participants subsequently undertook two CR classes, separated by ≥ 7 days, during which expiratory gases and HR were continuously measured using a portable open circuit spirometry and telemetry system, respectively. Rating of perceived exertion (RPE) was recorded during and affective state (AS) recorded after the 60min exercise class. Classes involved a combination of aerobic exercises and resistance training. Exercise intensity was self-regulated during each CR class. **RESULTS:** During the CR class participants exercised at an exercise intensity corresponding to 62.6 ± 8.4% VO_{2peak} and 75.8 ± 10.5% HRpeak. The mean affect score was +3 (good) and the mean RPE was 13 (somewhat hard). **CONCLUSION:** When allowed to self-regulate their exercise intensity during CBCR, participants select an intensity that they perceive to be somewhat hard and that provides a high level of positive affect. The self-regulated exercise intensity is within the physiological range considered safe and effective to optimise CVD risk reduction.

1474 Board #149 June 1 9:00 AM - 10:30 AM
Stratification of Patients in Cardiac Rehabilitation as Novel Programs Develop

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 (No relationships reported)

Purpose: While cardiac rehabilitation (CR) programs such as home-based (HB) and hybrid (H) are widely touted for convenience and adherence, it remains unclear which patients are best suited for these models. Current standards of risk stratification are modeled for traditional facility-based (FB) CR and based primarily on cardiovascular (CV) risk. We evaluated baseline differences between patients enrolling in HB vs. H vs. FB vs. No-CR.

Methods: In a retrospective quality improvement analysis of 295 Veterans assessed for CR we evaluated comorbidities, distance to facility, physical function (6 minute walk distance [6MWD], gait speed [GS], tandem stand [TS]), and health literacy (Rapid Estimate of Adult Literacy in Medicine [REALM]) to compare Veterans enrolled in HB, H, FB, and no CR.

Results: Patients enrolling in HB care tended to reside farther from facilities. FB-CR was highly preferred by HF patients, while post-CABG patients were more likely to enroll in HB or H- CR. Patients enrolling in HB/H CR had better physical function than patients in FB-CR. Patients that did not enroll in any CR exhibited significantly poorer health literacy. HF, depression, and T2DM differed in their distribution of CR programs, but other comorbidities had little impact on treatment pathways.

	HB	H	FB	No-CR	Global P-Value	HB vs. H	HB vs. FB	H vs. FB	FB vs. No-CR	HB/H vs. No-CR
# Patients	53	51	168	23						
Age	66 (45-80)	66.0 (44-85)	67.0 (40-92)	68 (60-91)	0.24	0.92	0.23	0.15	0.45	0.11
Miles From Facility	86 (6-197)	16 (3-95)	26 (1-228)	70 (1-235)	<0.01	<0.01	<0.01	0.04	0.04	0.17
HF	1 (1.9%)	4 (7.8%)	37 (22.0%)	2 (8.7%)	<0.01	0.02	<0.01	<0.01	0.98	<0.01
CABG	30 (56.6%)	23 (45.1%)	54 (32.1%)	10 (43.5%)	0.16	0.70	0.06	0.17	0.16	0.74
Depression	6 (11.3%)	18 (35.3%)	38 (22.6%)	5 (21.7%)	0.03	<0.01	0.02	0.26	0.97	0.73
T2DM	14 (26.4%)	26 (51.0%)	72 (42.9%)	8 (34.8%)	0.01	0.01	<0.01	0.97	0.48	0.72
HTN	39 (73.6%)	41 (80.4%)	114 (67.9%)	16 (69.6%)	0.53	0.37	0.20	0.90	0.62	0.37
CKD	5 (9.4%)	6 (11.8%)	26 (15.5%)	3 (13.0%)	0.38	0.70	0.12	0.27	0.79	0.49
CAD	41 (77.4%)	42 (82.4%)	108 (64.3%)	15 (65.2%)	0.83	0.48	0.95	0.38	0.74	0.97
COPD	10 (18.9%)	7 (13.7%)	33 (19.6%)	4 (17.4%)	0.50	0.48	0.49	0.14	0.84	0.59
6MWD	354 ± 77.7	334 ± 76.9	275 ± 94.3	251 ± 123	<0.01	0.20	<0.01	<0.01	0.43	<0.01
GS	1.31 ± 0.22	1.27 ± 0.24	1.09 ± 0.31	1.00 ± 0.32	<0.01	0.31	<0.01	<0.01	0.40	<0.01
TS	26.0 ± 8.05	26.3 ± 7.89	20.7 ± 10.8	15.9 ± 13.9	<0.01	0.84	<0.01	<0.01	0.22	<0.01
REALM	6.22 ± 1.58	6.22 ± 1.53	5.82 ± 1.94	3.84 ± 3.40	<0.01	0.99	0.19	0.19	<0.01	<0.01

Conclusion: Functional metrics constituted the most significant differences between patients who attended HB/H vs. FB, whereas CV risk is the more significant factor between HB vs H. These data suggest that further refinement of risk assessment for HB/H-CR may be warranted to determine minimum thresholds of functional capacity that enable HB/H-CR to be feasible and successful.

C-39 Free Communication/Poster - Concussion I

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1475 Board #150 June 1 9:00 AM - 10:30 AM
Proposing A New Method Of Administering The King-devick Test For Concussion Assessment
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(No relationships reported)

The King Devick Test (KD) is a rapid number naming test that is intended to screen for sport-related concussion (SRC). This assessment compares an athlete's pre-injury performance (i.e., baseline) to their performance post-concussion (PC). Baseline administration guidelines for the KD recommend administering the assessment twice and recording the faster of two error-free trials. However, PC administration guidelines recommend administering the KD only once following a suspected SRC, and if the athlete performs slower than their baseline or makes an error, a SRC should be suspected. It is unclear why PC administration of the KD only includes one trial in contrast to the baseline administration. No study to date has investigated the clinical utility of a second PC trial on the KD. **PURPOSE:** To compare the clinical utility of the KD between a first and a second PC trial for detecting SRC. **METHODS:** Thirty high school athletes with SRC (22 male, 8 female, age: 15.6 ± 1.1 years) completed two trials of the KD at baseline and at the same time point within 7 days following SRC. Baseline KD performance (the faster of two error-free trials) were compared to PC trial 1 (i.e., recommended administration) and PC trial 2. A one-way repeated measures ANOVA was performed to compare baseline between both PC trials. **RESULTS:** Following the recommended administration guidelines (i.e., comparing baseline to PC trial 1) resulted in 87% (26/30) of athletes being classified as having a possible SRC. However, comparing baseline to PC trial 2 resulted in 53% (16/30) of the sample being classified as having a SRC. The same four athletes that scored better than baseline at PC trial 1 also scored better than baseline at PC trial 2. However, there were an additional ten athletes that scored better than baseline on PC trial 2, despite scoring worse than baseline on PC trial 1. A significant difference was reported ($p <$

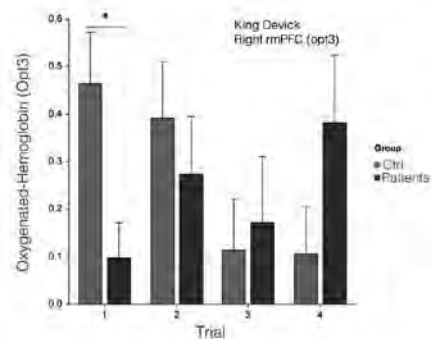
0.01) between baseline (44.27 ± 8.08 secs) and PC trial 1 (55.70 ± 17.79 secs), but there was no significant difference ($p = 0.07$) between baseline (44.27 ± 8.08 secs) and PC trial 2 (50.47 ± 17.30 secs). There were no significant differences in errors between baseline, PC trial 1, and PC trial 2 ($p = 0.57$). **CONCLUSION:** A second trial for the KD assessment of concussion should be utilized during PC administration when making clinical decisions regarding SRC.

1476 Board #151 June 1 9:00 AM - 10:30 AM
The Use Of Functional Near-Infrared Spectroscopy (fNIRS) For Assessing Cognitive Workload During King-Devick Test After Concussion

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(No relationships reported)

PURPOSE
Functional near-infrared spectroscopy (fNIRS), a noninvasive and portable neuroimaging modality that detects changes in blood oxygenation related to human brain function, is a promising tool to address the current lack of objective biomarkers to identify pathophysiological changes associated with concussion. We sought to determine the utility of fNIRS to detect and differentiate cortical brain activity between concussed and healthy subjects when they performed the King-Devick test. **METHODS**
We conducted a prospective case-control study of 19 concussed subjects and 9 healthy controls who completed the King-Devick test while wearing an fNIRS headband that recorded anterior prefrontal cortex oxygenation changes with 12 channels/4 optodes at 4Hz sampling rate. Linear mixed model analysis was performed to compare oxygenation changes in the two cohorts. **RESULTS**
There were significant differences across increasing difficulty of the King-Devick test conditions when comparing concussed subjects with healthy controls in both the left prefrontal cortex ($F_{1,26} = 9.906, p < 0.005$) and right prefrontal cortex ($F_{1,25} = 7.965, p < 0.01$). Among this pilot cohort, healthy controls showed significantly higher levels of oxygenation changes upon initiation of the King-Devick test compared to concussed subjects, but had decreased oxygenation changes over each successive test card. This pattern was not mirrored in concussed subjects who maintained consistent levels of oxygenation changes in the left prefrontal cortex and increasing levels in the right prefrontal cortex over the course of the test. **CONCLUSION**
Our preliminary experimental results suggest that fNIRS detects changes in cerebral blood oxygenation between concussed and healthy subjects. Further investigation into the utility of this neuroimaging modality for quantifying changes in cognitive workload after injury and over the course of recovery is warranted.

Figure 1. Comparison of oxygenation changes in the right prefrontal cortex between concussed subjects and healthy controls during trials of the King-Devick test ($F_{1,25} = 7.965, p < 0.01$).



1477 Board #152 June 1 9:00 AM - 10:30 AM

Test-Retest Reliability of a Clinical Cognitive Assessment over Varying Time Intervals

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(No relationships reported)

The test-retest reliability of clinical concussion assessment tools has been established over varying time intervals on multiple platforms, but few studies have evaluated the effect of multiple time intervals between assessments in the same population. As concussions occur variably following baseline assessments, understanding the effect of different time intervals on the stability of computerized neurocognitive has high clinical value.

PURPOSE: To determine the test-retest reliability of a computerized neurocognitive test (CNS Vital Signs) over two different time intervals in Division I athletes.

METHODS: Sixty-nine collegiate athletes were administered the CNS Vital Signs twice. The test-retest interval was 4 months in one subcohort (n=38, 19M, 19F) and 12 months in a second subcohort (n=31, 21M, 10F). The reliability (ICC_{2,k}) for each cognitive domain's standard score was analyzed. **RESULTS:** CNS Vital Signs scores ranged from low to high reliability (0.338-ICC_{2,k} < 0.971). Using a cutoff of ICC_{2,k} > 0.70 to indicate high reliability, a greater percentage of domains demonstrated high reliability (46%) in the 12-month interval compared to the 4-month interval (31%). **CONCLUSION:** As concussion management requires serial testing, high test-retest reliability is needed. Although ICC_{2,k} values were similar between time intervals, a higher number of domains in the 1-year interval met the reliability standards required for clinical care (ICC > 0.70) and no domains displayed low levels of reliability (ICC < 0.40). Should clinicians choose to complete multiple healthy baselines, a 1-year interval between assessments is recommended.

Supported by the NOCSAE

Domain	4-Month Interval (n=38)		1-Year Interval (n=31)	
	ICC2.k	SEM	ICC2.k	SEM
Neurocognitive Index	0.678	5.469	0.949	4.451
Composite Memory	0.508	9.446	0.742	8.243
Verbal Memory	0.506	11.582	0.633	12.238
Visual Memory	0.598	7.996	0.586	9.411
Psychomotor Speed	0.715	6.930	0.661	6.566
Reaction Time	0.756	5.933	0.809	5.729
Complex Attention	0.659	12.093	0.971	14.247
Cognitive Flexibility	0.719	8.207	0.539	8.295
Processing Speed	0.599	8.833	0.527	9.105
Executive Function	0.489	15.074	0.569	7.632
Reasoning	0.621	9.318	0.732	7.763
Simple Attention	0.338	16.859	0.971	47.889
Motor Speed	0.808	6.093	0.662	5.647

1478 Board #153 June 1 9:00 AM - 10:30 AM

Impact of Diagnosed Sleep Disorder on Baseline Concussion Assessments in Collegiate Athletes

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Research suggests at least 27% of college students are at risk for at least one sleep disorder. Adolescents with sleep-related symptoms and reduced sleep duration perform worse on baseline neurocognitive testing, although this effect size is small and samples have not included older or collegiate-level athletes. Previous research has not taken into consideration the effects of previously diagnosed sleep disorders on performance of preinjury baseline assessment. **PURPOSE:** The purpose of the current study was to compare athletes with and without a history of diagnosed sleep disorders on commonly used baseline concussion assessments. **METHODS:** All participants completed

baseline testing including: the Balance Error Scoring System (BESS), Brief Symptom Inventory (BSI), Immediate Post-Concussion Assessment and Cognitive Testing (ImpACT), Post-Concussion Symptom Score (PCSS), Standardized Assessment of Concussion (SAC) and Vestibular/Ocular Motor Screening (VOMS). A total of 632 NCAA student-athletes participated in the study including 316 with previously diagnosed sleep disorders and 316 with no history of sleep disorder, matched for age, sex, sport, concussion history and race. Both groups were 19.87 years old (SD = 1.36), consisted of 176 males (55.7%), with 119 athletes (37.7%) previously having sustained a concussion, and represented a multitude of sports. **RESULTS:** A series of one-way ANOVAs with Bonferroni corrections revealed significant differences between groups on BESS (F(1, 535) = 4.02, p = .045), BSI somatization (F(1,623) = 11.41, p < .01), BSI depression (F(1, 623) = 13.59, p < .01), BSI anxiety (F(1, 623) = 20.97, p < .01), BSI global severity index (F(1, 623), p < .01) and PCSS (F(1, 396) = 22.86, p < .01). Specifically, the diagnosed sleep disorder group scored worse on the BESS and reported higher BSI and PCSS symptoms. No differences were noted between groups on VOMS, ImpACT neurocognitive measures, and SAC. **CONCLUSION:** Collegiate student-athletes with sleep disorders may have elevated affective and concussion symptoms at baseline that could affect interpretation of post-injury impairment and symptoms. Clinicians should assess diagnosed sleep disorders during pre-participation sport physicals and consider them when interpreting post-injury assessments.

1479 Board #154 June 1 9:00 AM - 10:30 AM

Quantitative Electroencephalography in the Evaluation of Concussive Head Injury in Adolescents

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(No relationships reported)

PURPOSE: Reliable quantitative methods are needed to evaluate concussion-related morbidity. Electroencephalographic event-related potentials (ERPs) are being investigated for documentation of post-brain injury changes in the acute and chronic setting. Previous studies demonstrated attenuation of ERPs in the setting of concussion; however, no investigation of an exclusively adolescent population has been performed. The p300 ERP is related to decision-making, specifically evaluation and categorization of external stimuli. This study evaluated reliability and utility of p300 ERP in adolescent concussion.

METHODS: Control subjects were recruited from local soccer clubs. Subjects with concussion were recruited from our institution's concussion program. Data collection included medical history, symptom inventory (Health and Behavior Inventory - HBI), and qEEG (p300 latency and amplitude, auditory reaction time). Data was collected pre- and post-season for controls and at each clinic visit for concussion subjects. **RESULTS:** Control subjects did not demonstrate changes in p300 amplitude or HBI scores from pre- to post-season testing. Auditory reaction time was slower at post-season testing in females (311ms vs 384ms, p=0.0003), but faster in males (401ms vs 365ms, p=0.043). Concussion subjects demonstrated significantly lower p300 amplitude (14.5 µV vs 19.4 µV, p=0.024) and auditory reaction time (456ms vs 374ms, p=0.0005) relative to controls. HBI scores in concussion subjects were significantly elevated relative to controls (27 vs 8, p < 0.0001).

CONCLUSIONS: p300 ERP amplitude demonstrated stability in adolescents over a sports season. Sex differences existed for controls for p300 amplitude and auditory RT, which need further exploration to establish normative values. Concussion subjects had significant differences in p300 amplitude, auditory reaction time, and HBI scores compared to controls. Additional study is needed to describe recovery of p300 amplitude and auditory reaction time in adolescent concussion. **ACKNOWLEDGEMENTS:** Supported by University of Colorado Department of Orthopedics internal grant award and AAPM&R Foundation for Research Molinar Pediatric Research Award.

1480 Board #155 June 1 9:00 AM - 10:30 AM

Effect of Modifying Factors on Sports-Related Concussion Recovery in Youth Athletes Under Clinical Management

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(No relationships reported)

Several modifying factors may affect recovery from a sports-related concussion (SRC) including sex, concussion history (hx), and attention deficit hyperactivity disorder (ADHD). For example, female athletes take longer to recover and concussion hx increases risk for future concussions. Further, those with ADHD exhibit greater symptomatology at baseline and post-concussion, which has been associated with

prolonged recovery. While sex differences are strongly supported, discrepancies exist for the effect of concussion hx and a paucity of research exists on the effect of ADHD on SRC. **PURPOSE:** To examine the relationship between sex, concussion hx, and the presence of ADHD with recovery from SRC. **METHODS:** A retrospective chart review of patients (n = 219; 75 females, 144 males; age range: 11-19 yr; mean ± SD; 15±2) presenting with a diagnosed SRC to a concussion clinic from Jan - Dec 2014 was conducted. Recovery was defined as number of days from date of injury to date of return to play progressions. **RESULTS:** ADHD was present in 18.3% (n = 40). A greater proportion of males reported ADHD (males, 82.5%; females, 17.5%; $\chi^2 = 0.014$). Average recovery time was 20.9±14.3 days. A significant difference in recovery was observed by sex (males, 19.3±14.4 days; females, 23.9±13.8 days; p = 0.035). No significant difference was observed for recovery based on concussion hx (- hx, 21.0±14.7; +hx, 20.9 ± 13.6 days; p = 0.993). Furthermore, no significant difference was observed for recovery based on ADHD status (+ADHD, 21.3±13.3; -ADHD, 20.8±14.6 days; p = 0.864). **CONCLUSION:** These data support an effect of sex on recovery duration, but suggest that concussion hx or ADHD alone do not contribute to prolonged recovery following SRC. Given that patients in this study were managed by medical professionals, it is possible that early intervention and management of the injury in a clinical setting can minimize effects of prior history or ADHD on recovery. Further study is warranted to determine if clinical management may alleviate effects of modifying factors.

1481 Board #156 June 1 9:00 AM - 10:30 AM
Clinical Reaction Time Performance in a Concussed Pediatric Population
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Purpose: The puck-drop (PD) test has been used to assess clinical reaction time (CRT) and has been proposed as a tool to aid in the diagnosis and management of sports concussion. The simplicity of the test and low cost make it an attractive tool in the management of these injuries; however, it is not known whether the test discriminates between concussed and non-concussed patients. The purpose of this study is to determine the discriminatory utility of the PD test to differentiate acutely concussed pediatric athletes relative to an uninjured cohort. **Methods:** Patients (ages 8-18) who remained symptomatic on presentation to a sports medicine clinic and diagnosed with a concussion were eligible for study inclusion. Patients with concomitant injuries that precluded completion of the PD test were excluded. Testing was conducted in accordance with protocols established in the literature. Two practice trials were conducted. The distance of stick transversal was recorded as well as the number of drops and failed attempts. Eight successful trials were completed for each hand. Children with hands too small to circumvent the puck diameter were accommodated by starting at 10 cm above the puck base. **Results:** 196 concussed (m-103, f-93) and 463 healthy (m-178, f-285) subjects were included in this study. The average CRT for right/left hands for healthy and injured subjects were 229.7±21.6ms/229.6±21.8ms, and 243.4±29.4ms/242.3±29.8ms, respectively. Injured patients were categorized by age and compared to healthy controls. Although significant associations were noted between age and CRT among healthy and concussed subjects overall (both hands), no statistical difference was found between control and concussed groups by age. **Conclusion:** This study demonstrated the association of age on CRT in both concussed and healthy subjects; however, the CRT of injured subjects did not differ from age matched healthy controls for either hand. Thus, CRT measured at the time of clinic presentation did not appear to have a discriminatory effect for diagnostic purposes. Future studies will need to examine the time point of CRT measurement, larger sample size, and longitudinal follow up to evaluate associations with recovery.

1482 Board #157 June 1 9:00 AM - 10:30 AM
Association Between Concussion History, Demographic Characteristics, And Sensory Organization In Collegiate Athletes
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 (No relationships reported)

Sensory organization is affected following sport-related concussion (SRC) and may be affected as a result of previous concussions and key demographic factors, such as football participation, where subconcussive impacts are prevalent. **PURPOSE:** The primary purpose of this cross-sectional study was to examine the association between previous concussion history, other key demographics such as football participation, and sensory organization during a dynamic posturography task.

METHODS: Collegiate varsity athletes (n=227) participating from a single NCAA Division I university between 2014 and 2016 (mean age: 19.3±1.0) were enrolled in our study. During standardized baseline testing, participants completed a demographic questionnaire and the Sensory Organization Test (SOT; Natus Inc, Clackamas, OR). Primary outcomes were the SOT composite equilibrium score (COMP) and the three SOT ratio scores (Vestibular, Visual, Somatosensory). Separate multivariable linear regression models were run for each outcome. Concussion history (no/yes), football participation (no/yes), sex (male/female), and age served as predictor variables. Alpha level was adjusted to 0.017 to account for multiple comparisons. **RESULTS:** Fifty-five (24.2%) athletes reported a concussion history, 44 (19.4%) were football athletes, and 146 (64.3%) were male. In the multivariable models the following significant associations were identified: 1) football athletes had lower COMP scores compared to non-football athletes (FB:73.3±8.0 vs. No FB:77.2 ±7.5; Wald Chi Square=9.1; p=0.003); and 2) football athletes also had statistically, but not clinically higher Somatosensory ratio scores compared to non-football athletes (FB:99.3±3.9 vs. No FB:98.1±3.1; Wald Chi Square=8.3; p=0.004). While not statistically significant, Visual ratio scores (FB:81.8±14.2 vs. No FB: 86.3±10.4; Wald Chi Square=4.9; p=0.026) were lower in football athletes compared to non-football athletes. No other associations were observed with SOT outcomes (p>0.017). **CONCLUSION:** Football athletes have worse overall balance when compared to non-football athletes, as indicated by their COMP SOT scores. Future research should examine if these differences are related to subconcussive impact exposure or other sport-specific factors.

1483 Board #158 June 1 9:00 AM - 10:30 AM
Hurt or Injured?: Adolescent Athlete Decision-Making Post Sport Related Concussion
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Adolescents are more vulnerable to concussion consequences due to disturbance of physiologic processes during brain maturation. Reports suggest up to 50% of adolescents do not seek healthcare post-sport related concussion (SRC). Failure to report results in treatment delays and leads to premature return to activities, potentiating risk for prolonged symptoms or subsequent injury. **PURPOSE:** The purpose of this study was to explore influential factors and pivotal decision points within adolescent athletes health decision-making (DM) process to seek healthcare post-SRC. **METHODS:** Grounded theory, a qualitative interpretation of participants' words rather than statistical analysis, was used to examine salient concepts within athletes' DM process. Twelve adolescent athletes representing several sports were recruited to participate in semi-structured interviews to describe their SRC experience. **RESULTS:** SRC DM occurred within context of sport culture encouraging to "push through pain." The central perspective, known as the Dark Cloud, reflects literal and symbolic facets of SRC before and after the point of impact. Participants distinguished between hurt or injured, influencing symptom reporting. Athletes made sense of symptoms through crucial conversation with a trusted person to weigh options about concussion reporting. Participants who continued play with symptoms described prolonged cognitive and physical impairment, depression and anxiety. Individual, social, community, and policy factors influenced adolescent athletes' SRC DM. **CONCLUSIONS:** Symptom reporting and connection with healthcare providers were influenced by the dark cloud of concussion. The Dark Cloud reflected factors before and after the point of impact. These factors ranged from blackouts, a dark room to avoid light and sensory stimulation, isolation from social support and physical activities, clouded judgment, foggy thoughts, dark mood and being in the dark about SRC symptoms. Athletes distinguished between the concept of injured versus hurt, with injury interfering with an athlete's ability to participate in athletics, whereas an athlete may continue play while hurt. The distinction between hurt and injured was crucial to understanding an athlete's perception about continued participation after forceful impact(s).

1484 Board #159 June 1 9:00 AM - 10:30 AM
Comparison Of Concussion Outcomes In College Students
 Natalie A. Kramer¹, Prakash Jayabalan², Kelly Iwanaga Becker¹, Kristin E. Abbott¹. ¹Northwestern University, Evanston, IL. ²Rehabilitation Institute of Chicago, Chicago, IL. (Sponsor: Jeffrey Mjannes, FACSM)
 (No relationships reported)

PURPOSE: The aims of our study were to investigate the time to symptom resolution in students with a concussion at a collegiate institution and identify 'at-risk' subsets of the population. **METHODS:** Retrospective chart review of students who presented to the college health service and were diagnosed with a concussion during the

2014-2015 academic year. For analyses, descriptive statistics, independent samples t-tests, linear and binary regression were utilized. **RESULTS:** The average duration of symptoms for all subjects was 17.89 days (SD 17.05). Subjects who were playing varsity-level sports had significantly shorter duration of concussion-related symptoms (mean 11.5 days) compared to club (18.61 days, $p < 0.001$) and recreational level (22.59 days, $p < 0.001$) athletes. Female students had a longer duration of symptoms compared to male students (20.79 days vs. 14.60 days, $p < 0.001$) and graduate students had more than two weeks longer duration of symptoms compared to undergraduates (16.12 vs. 31.20). Linear regression analyses showed that a history of a seizure disorder was associated with longer time to symptom resolution by 32 days compared to those without a similar history. In binary regression analysis, those with a prior history of concussion were twice as likely to have symptoms for longer than 28 days than those without. An interaction variable between subjects with a history of concussion and club sport participation demonstrates that this population's odds of having symptoms lasting longer than 28 days increases by a factor of 25 compared to their counterparts. **CONCLUSION:** The findings in our study highlight the difficulty in treating subjects with concussions at a high level academic institution, due to both the academic rigors of the institution and the differing needs of the student population. The study also provides insight into 'at-risk' subsets of the student population. Factors such as level of sport, year in school, athlete vs non-athlete, pre-morbid conditions and sex may affect outcome and this needs to be an important consideration for the physician managing the concussed college student. Our study also suggests the potential need for improved resources for the general population of university students who suffer a concussion.

1485 Board #160 June 1 9:00 AM - 10:30 AM
Relationship Between Initial Post-concussion Presentation And Health-related Quality Of Life At One Month Post-injury In Pediatric Concussion Patients

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Prognostic indicators of outcomes following sport-related concussion (SRC) managed in the primary care setting are understudied.

PURPOSE: This study examines the relationship between acute post-concussion measures and one-month parent reported health-related quality of life in pediatric concussion patients. **METHODS:** This was a prospective cohort presenting to 3 clinics of a single practice group from December 2014-September 2016. Included were patients 8-18 years, presenting within 3 days of a SRC, who consented to participate, and whose parents completed a one-month follow-up. Participants completed a standardized initial visit, including a clinical exam, a symptom checklist, the Immediate Post-Concussion and Cognitive Test (ImPACT™), and a near point convergence screening. Parents completed a one-month follow-up about their child [PedsQL™ Quality of Life Inventory (QOL) and the PedsQL™ Multidimensional Fatigue Scale (MDF)]. We assessed univariate relationships between demographics, initial presentation measures, and one-month follow-up QOL and MDF. Variables significant in univariable analyses ($p < 0.05$) were included in multivariable regression models. **RESULTS:** A total of 180 patients met initial inclusion and completed the one-month follow-up [% follow-up = 75% (180/240 eligible at initial visit)]: 100 (55.9%) were male, 136 (88.9%) Caucasian, and 28 (15.6%) were injured in football. Median age was 15 years (IQR: 13.0, 16.0). In the QOL model, a 10 point estimated increase in symptom severity score (Beta=-1.825; 95% CI: -3.335, -0.314) and no previous head injury (Mean Difference: -5.751; 95% CI: -11.089 -0.412) were associated with worse one-month QOL. A 0.06 point increase in initial visit ImPACT™ Reaction Time (Beta=-2.120; 95% CI: -3.898 -0.343) was associated with worse one-month MDF in the MDF model. **CONCLUSION:** Clinicians should be mindful of acute symptom burden and those with no history of concussion when considering potential for worse one-month post-injury QOL outcomes. Those with initial longer reaction times may be more likely to experience fatigue over the first month following concussion. Clinicians may need to consider early intervention in patients with these characteristics.

Funded in part by the National Operating Committee on Standards for Athletic Equipment.

1486 Board #161 June 1 9:00 AM - 10:30 AM
Lower Neck Strength Among Youth Soccer Players Is Associated With An Increased Prevalence Of Concussion

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Reported Relationships: H. Paquin: *Royalty; ABC-Clio publishing, Wolters Kluwer. Contracted Research - Including Principle Investigator; National Football League Players Association, National Hockey League Alumni Association.*

Previous studies suggest that neck strength is associated with concussion incidence, but few studies investigate other athletic skills as a risk factor for sports concussion.

PURPOSE: Determine the association between concussion history and sex with neck strength, agility, and cardiovascular function among soccer players.

METHODS: We conducted a cross-sectional study of soccer players who underwent an injury prevention evaluation at a sports injury prevention center between April 2013 and June 2016. We compared normalized neck strength, vertical jump height, front plank time, pro-agility test time, and estimated VO2 max between soccer players with and without a history of concussion. For normalized neck strength, we used the ratio of neck strength (assessed via dynamometry) to mass (n/kg) as our primary outcome variable in each direction to adjust for body size. We performed 2-way MANOVAs investigating the main effects and interaction of concussion history and sex on each set of outcome variables (neck strength in 4 directions; physical ability measurements).

RESULTS: A total of 243 soccer players participated in the study, 167 (69%) of which reported no concussion history and 76 (31%) who reported a prior history of diagnosed concussion. The mean age was 13.9 (SD = 2.3) years of age, ranging from 8 to 18, and consisted of 153 (63%) females. Females had lower neck cervical flexion strength (1.51±0.4 n/kg vs. 1.71±0.4 n/kg; $p = .001$), cervical extension strength (1.73±0.6 n/kg vs. 1.99±0.6 n/kg; $p = .017$), dominant side cervical rotation strength (1.25±0.5 n/kg vs. 1.46±0.5 n/kg; $p = .011$), and non-dominant side cervical rotation strength (1.20±0.4 n/kg vs. 1.42±0.4 n/kg; $p = .007$) than males. Those with a history of concussion had lower neck cervical extension strength (1.67±0.5 n/kg vs. 1.88±0.6 n/kg; $p = .026$) and lower dominant side cervical rotation strength (1.19±0.4 n/kg vs. 1.37±0.5 n/kg; $p = .026$) than those without a history of concussion. No significant differences were observed for vertical jump height, pro-agility test time, front plank time, or estimated VO2 max.

CONCLUSIONS: Youth soccer players with a history of concussion exhibit significantly lower normalized neck strength than those without a history of concussion. This represents a potential target for concussion prevention strategies.

1487 Board #162 June 1 9:00 AM - 10:30 AM
Concussions and Vestibular Changes: Concussion Mechanism and Neurocognitive Performance

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It is estimated that 5-10% of athletes will experience a concussion during any given sport season. Athletes experience concussions actively (making a tackle) or statically (being hit by a baseball pitch). Research has shown that vestibular impairments, such as dizziness or postural instability, are common symptoms following concussion.

However, research has not explored whether the mechanism of concussion is a determinant of whether an athlete does or does not experience vestibular deficits.

PURPOSE: The purpose of this study is to examine both mechanism and history of concussions in relation to vestibular symptoms following injury and neurocognitive performance. **METHODS:** ImPACT™ was used to determine neurocognitive performance and surveys to determine concussion history, vestibular symptoms following a concussion and mechanism of concussion in 95 club athletes. Of the athletes tested, 22 were previously concussed with 9 having vestibular symptoms (VS) and 13 having no vestibular symptoms (NVS) in a previous concussion. Of the previously concussed athletes 5 occurred stationary and 14 occurred during various activity levels (active, moderately active, highly active). **RESULTS:** Significant differences in visual memory were found between the concussion groups with the VS group having lower visual memory than the NVS ($p < 0.05$). Significant differences were also found in mechanism of concussion with the stationary group having lower visual memory scores than the comparison groups ($p < 0.05$). **CONCLUSIONS:** History of concussion with vestibular symptoms and mechanism of concussion is related to lower scores in visual memory. Further research on concussion mechanism and vestibular symptoms is needed as it may influence concussion management.

1488 Board #163 June 1 9:00 AM - 10:30 AM

Utility of the Vestibular/Ocular Motor Screening (VOMS) Tool During High School Sport Participation

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Reported Relationships: P.R. Worts: Contracted Research - Including Principle Investigator; Florida State University's Institute of Sports Sciences and Medicine.

The Vestibular/Ocular Motor Screening (VOMS) Tool has previously demonstrated the ability to identify differences between healthy and concussed participants in clinical populations, with an 89% positive prediction value. However, there is little information on incidence of clinically significant change in healthy athletes. **PURPOSE:** To identify rates of change scores on the VOMS in a sideline testing environment with healthy adolescent athletes, within an 89% PPV, allowing for an 11% false positive rate. **METHODS:** Seventy-eight healthy athletes (15.77 ± 1.39 years) were administered the VOMS three times during their sport season; prior to their sport season (T1) and at a later date, before practice (T2) and within 5 minutes of removal from sport practice (T3). Descriptive statistics and multivariate base rate analyses were performed using Microsoft Excel. **RESULTS:** Multivariate base rate analyses reveals that a change of 2+ symptom provocation on any 1, 2, or 3 VOMS items achieved a false positive rate of 21%, 14%, and 10% respectively. Using a change of 3+ symptom provocation on any 1, 2, or 3 VOMS items achieved a false positive rate of 13%, 9%, and 6% respectively. Using a change of 4+ symptom provocation on any 1, 2, or 3 VOMS items achieved a false positive rate of 9%, 6%, and 3% respectively. The false positive rate using NPC distance ≥5 cm ranged from 21% to 32% across the three times. In the context of sport participation (T3), a more valid clinical metric during sport participation would be using a change of 2+ symptom provocation on 3 VOMS items, 3+ on 2 VOMS items, or 4+ on 1 VOMS item. **CONCLUSIONS:** To our knowledge, this is the first study to examine the utility of multivariate base rates in interpreting VOMS change scores in the context of a structured high school sport practice. Our findings suggest interpretation of clinical change on the VOMS using a change of 2+ on 3 VOMS items, 3+ on 2 VOMS items, or 4+ symptom on 1 VOMS item would obtain a false positive rate of ≤11%, whereas a NPC distance of ≥5 centimeters greatly increases the rate of false positive.

C-40 Free Communication/Poster - Epidemiology of Injury and Illness

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1489 Board #164 June 1 8:00 AM - 9:30 AM

The Financial Cost of Obesity in Thoracic Trauma

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Obesity affects 34% of Americans over the age of 20 and contributes to more than \$200 billion per year in healthcare costs. Trauma medicine is a large contributor to annual expenditure. Each year, between 150,000 and 300,000 rib fracture patients are admitted to U.S. trauma centers. Obesity increases risks of morbidity and mortality in these patients but information concerning the effect of obesity on individual patient billing in this population is limited. **PURPOSE:** We examined the effect of obesity on medical costs in rib fracture patients. **METHODS:** We analyzed the patient registry and financial records of a Level 2 trauma center. All patients with ≥1 rib fracture admitted between 2010 and 2014 (n=1,007) were included. Dependent variables were cost to the patient (patient billing) and cost to the hospital (hospital expense). Independent variables were whether patients were obese and the characteristics of injury, measured by injury severity score, whether fractures were unilateral or bilateral, the presence of a pulmonary contusion, and the presence of a pneumothorax. Linear regressions tested the effect of obesity and injury severity on patient billing and hospital expense. **RESULTS:** Obese and non-obese patients were similar in age and injury severity. When controlling for severity, obesity predicted an increase of \$29,725 (35%) in patient billing (95% CI: \$10,983 to \$48,467, p=0.002) and \$3,963 (36%) in hospital expense (95% CI: \$960 to \$6,965, p=0.010). These models explained 31% (p<0.001) and 28% (p<0.001) of the variance in cost respectively. **CONCLUSIONS:** Among rib fracture patients admitted to a Level 2 trauma center, obesity predicted an increase of about 35% in the cost of delivering care, both to the patient and to

the hospital. While the prophylactic benefits of exercise are well documented in minimizing risk of preventable conditions such as cardiovascular disease and diabetes, these benefits may also minimize financial stress in unexpected conditions such as thoracic trauma.

1490 Board #165 June 1 8:00 AM - 9:30 AM

The American Experience with an Emerging Adolescent Collision Sport: Rugby-7s

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Reported Relationships: R. Ma: Contracted Research - Including Principle Investigator; USAR New England and Empire GU RFU's and National Operating Committee on Standards for Athletic Equipment.

Purpose: Rugby-7s is a popular global collision sport known to have a high injury incidence. There is a lack of data on the youths involved in the new Olympic format particularly in the United States (USA). Rugby-7's growth in the USA has occurred mainly in the amateur population. An understanding of how playing injuries occur will help develop prevention programs and promote safe growth of youth Rugby-7s. **Methods:** A prospective epidemiology study of 3, 804 Under-19 USA Rugby-7s players (13-19 years of age; injured male 256; and female 61) in USA Rugby sanctioned tournaments (2010-2014). Incidence (per 1000 player-hour (ph)), severity (days absence) and biomechanism of injuries were captured via the Rugby Injury Survey & Evaluation (RISE) Report methodology. **Results:** Overall injuries (medical attention and time-loss) among the U19 population were found at 81.9/1000ph (n=172), with time-loss injuries at 33.3/1000ph (n=70; 95% CI: 25.9-42.1) and medical attention injuries at 48.6/1000ph (n=102, 95% CI: 39.6-58.9) (P=0.013). Males experienced higher rates of injuries (backs 81.8/1000ph, n=77; forwards 56.7/1000ph, n=40; RR: 1.16, P=0.053) than females (backs 65.6/1000ph, n=17; forwards 77.1/1000ph, n=15; RR: 0.93, P=0.642) (RR: 0.96, P=0.332). Time-loss injuries resulted in a mean severity of 35.4 days (females 29.6 days; males 37.6 days; P=0.494). Most injuries were acute (93%; RR: 2.3, P<0.001) and in the tackle (80.3%; RR: 1.6, P<0.001). Injuries most commonly involved the joints or ligaments (40%) and the lower extremities (39%). High incidences of head and neck injuries including concussions (overall 26%) and upper extremity injuries (29%) were seen among the USA youth population. **Conclusions:** USA youths playing Rugby-7s tournaments had lower rates of injury (33.3/1000ph) than USA amateur adult Rugby-7s (49.2-55.4/1000ph) and international adolescent boys' Rugby-15s (35-57.2/1000ph). The majority of match injuries occurred during the tackle (80.3%), and rates of head, neck, and upper extremity injuries were elevated, which emphasizes the need for proper safe tackling techniques in USA youth. This study establishes the need for continued epidemiological research to document age-based injury rates and patterns that will help develop evidence-based injury prevention initiatives.

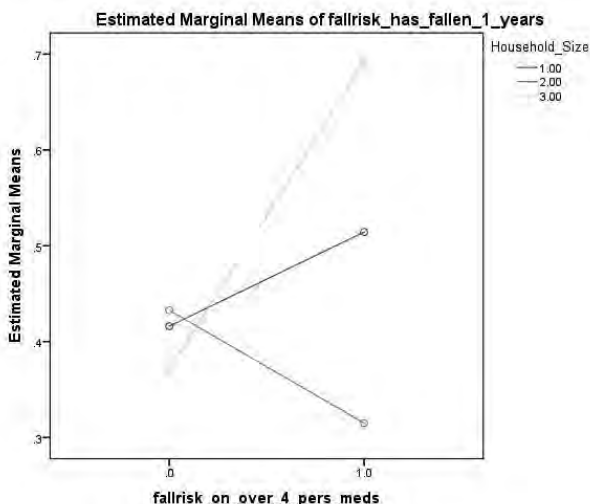
1491 Board #166 June 1 8:00 AM - 9:30 AM

Interaction Between Household Size And Fall Injury Status In Aged Individuals As It Relates To Fall History

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Falls in the elderly are a significant problem in developed countries and numerous risk factors have been linked to falls. Two such risk factors include poly-pharmacology and household size. **PURPOSE:** To investigate both pharmacology status and household size as it related to history of falls in individuals over the age of 65 years. **METHODS:** The Comprehensive Falls Risk Screening Instrument (CFRSI) and brief a self-report medical history questionnaire were completed by 403 individuals over the age of 60 (71.2 ± 5.7 yrs) at 26 testing sites across the United States. Three data points of interest were collected from these instruments and included: 1) the number of individuals currently living in the household; 2) the current number of prescribed medications being taken by the individual; and 3) history of falls in both the last year. Data were analyzed using a 2x3 ANOVA with fall history as the dependent variable

and medication status and household size as the independent variables. **RESULTS:** Although ANOVA results indicated no main effect for either household size ($F_{2,387} = 2.102$, $p = 0.124$) or medication status ($F_{1,387} = 2.287$, $p = 0.131$), a means cross-over interaction for household size and medication status was observed ($F_{2,387} = 3.563$; $p = 0.029$) and is displayed in Figure 1. **CONCLUSIONS:** For those individuals on three or fewer medications, the risk associated with falling was similar across household size with those living by themselves and with a partner being slightly more likely to have a history of fall than those living in households with three or more people. However, for four or more medications, those living with a partner were observed to be less likely to have a history of falling in the past year than those living by themselves. Additionally, those who reported living in households with three or more people were the most likely to fall in the group reporting to take four or more medications.



1492 Board #167 June 1 8:00 AM - 9:30 AM

The Relationship between Experience Level and Age on Perception of Injury Risk in Golf

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(No relationships reported)

INTRODUCTION: In golf, each hole varies in difficulty and distance, which can change how a player approaches each shot. Depending on a player's age, experience level, or injury risk perception, the approach may vary, and a player's score can benefit or suffer due to these perceptions. **PURPOSE:** To examine the relationship between experience level, age, and perception of injury risk in golf. **METHODS:** 1170 subjects (804 women, 366 men; age: 48.8 ± 14.7 years; experience level: 17.85 ± 10.18 years) completed a questionnaire assessing demographic information, golf-specific variables, and golf-specific risk perceptions. **RESULTS:** For all analyses, handicap (low, mid, high), age (young, middle, older), and years of experience (few, mid, high) were divided into three categories, whilst gender (male, female) and injury history (injured, not injured) were divided into two categories. Younger golfers tended to have lower handicaps, and sustained significantly more injuries than other age groups ($p \leq 0.05$). Older golfers tended to play more hours per week, whereas middle-aged golfers tended to practice more hours per week compared to other age groups (both $p \leq 0.01$). With respect to gender, males had lower handicaps ($p \leq 0.05$), more years of experience ($p \leq 0.05$), and both played and practiced more hours per week than females ($p \leq 0.01$). Injured golfers tended to be younger and have higher handicaps than non-injured golfers ($p \leq 0.05$), and tended to both play and practice more often than non-injured golfers ($p \leq 0.05$). There were also significant differences between groups in risk perceptions. Higher handicap golfers had different thoughts on the level of golfer, and which age group, was more at risk of injury compared to other groups ($p \leq 0.05$). There was also a significant difference between younger and older golfers, and injured and non-injured golfers with respect to the age group most at risk of injury ($p \leq 0.01$). Finally, there was a significant difference between injured and non-injured golfers in the perception of injury risk in golf ($p \leq 0.01$). **CONCLUSIONS:** The results from this study highlight how different groups of golfers have differing injury risk perceptions, which are seemingly a result of their golfing experiences. Further, this suggests that diverse educational strategies may be necessary to help reduce injury risk to golfers.

1493 Board #168 June 1 8:00 AM - 9:30 AM

Description of Wrist Fractures in Recreational Snowboarding: Implications for Wrist Guard Design

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Wrist injuries are common in mountain snow sports, particularly snowboarding. Wrist guards have been shown to reduce wrist fractures by upwards of 85%, but only 5-7% of snowboarders wear this protective device. There are no industry standards for the wrist guard design, which likely limits their perceived effectiveness and therefore their use. Wrist fractures have not been thoroughly characterized in the literature. A more detailed understanding of fracture patterns may inform improved design of snowboarding wrist guards. **PURPOSE:** To characterize wrist fracture patterns in greater detail than has previously been done, in order to gain an improved understanding of wrist fracture patterns and inform the design of more effective wrist guards to prevent wrist injuries in snowboarders.

METHODS: In this retrospective chart review, medical records from a large western mountain resort injury clinic were analyzed for demographic and clinical data collected during two consecutive winter seasons. Radiographs were analyzed to further classify fractures. Data analysis was performed using descriptive statistics and the χ^2 test.

RESULTS: We identified 379 wrist injuries over the two winter seasons (age = 22.7 ± 14.1 , male = 53.3%), with the majority being in snowboarders ($n = 307$, 81.0%). 97% of all patients with wrist injuries had radiographs taken, and 64.6% were diagnosed with wrist fracture ($n = 224$ for distal radius fracture, $n = 27$ for ulnar fracture, and $n = 27$ for concomitant radial/ulnar fractures). Snowboarders had a significantly higher percentage of wrist fractures than did skiers (69.1% for snowboarders vs. 46.2% for skiers, $\chi^2 = 12.376$, $p < 0.001$). 71% of all distal radius fractures were AO classification A2; 16% were C1 or C2. 33% of distal radius fractures required reduction. The angle of displacement of the distal radius fragment ranged from 1-61 degrees. 49% of wrist fractures were in skeletally immature patients. 3.3% of all patients with wrist fractures were shown to be wearing wrist guards at the time of injury.

CONCLUSIONS: This study provides greater detail of wrist fracture patterns in snowboarders. These data can inform industry wrist guard standards.

1494 Board #169 June 1 8:00 AM - 9:30 AM

Irritable Bowel Syndrome and Gastrointestinal Issues in Endurance Athletes: Prevalence and Management Strategies

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(No relationships reported)

Gastrointestinal (GI) issues are known to be common among endurance athletes and can impair performance in training and competition. Symptom characteristics, particularly those of the lower GI, are similar to irritable bowel syndrome (IBS). No previous research has examined IBS diagnosis or fit to IBS diagnostic criteria within this population. **PURPOSE:** To determine the prevalence of IBS among endurance athletes as well as their GI symptom management strategies. **METHODS:** A 92-item online questionnaire was previously validated for the purpose of assessing IBS diagnosis, fit to IBS diagnostic criteria (Rome III or Manning), general GI symptoms, and symptom mitigation strategies of endurance athletes. The questionnaire was distributed between December 2015 and October 2016 to the athletes in the U.S. completing a marathon, ultra-marathon, half-distance triathlon, or full-distance triathlon within that calendar year. **RESULTS:** The total prevalence of irritable bowel syndrome among 321 endurance athletes who completed the questionnaire was between 9.0% to 22.1% (medically diagnosed: 1.6%; undiagnosed but meeting the diagnostic criteria: 7.5% fitting Rome III criteria or 20.6% fitting 2 Manning criteria). Significantly more IBS sufferers were undiagnosed ($p = .007$ or $< .001$ for Rome III and Manning, respectively). Only 10.9% of athletes reported seeing a medical professional due to GI issues, while 17.1% had issues which sometimes or often interrupted or prevented their training. Additionally, 65.7% experienced at least one lower GI symptom at a frequency of sometimes or more during training. Almost half (46.7%) of the athletes tried nutritional modifications to help ease their symptoms and 19.0% used over-the-counter medications. **CONCLUSION:** Most endurance athletes that may suffer from IBS are undiagnosed, while even more have GI issues but do not fit IBS diagnostic criteria. The overall prevalence may be greater than that seen in the general population and the percent diagnosed may be lower among endurance athletes. Despite using various methods to manage their symptoms, endurance athletes are still experiencing issues and could potentially benefit from current IBS-mitigating strategies.

Supported by University of Illinois Nutritional Science Margin of Excellence Research and Vision 20/20 Awards.

1495 Board #170 June 1 8:00 AM - 9:30 AM

Comparison Of High School Girls' And College Women's Softball Injury Incidence, 2004/05-2013/14

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Few studies have reported sport injury incidence across age continuums. High School Reporting Information Online (HS RIO) and the National Collegiate Athletic Association Injury Surveillance Program (NCAA-ISP) and have each tracked sports injuries for over 10 years.

PURPOSE: Compare injury incidence in high school (HS) girls' and college women's softball.

METHODS: Athletic trainers (ATs) from an annual average of 100 high schools and 50 NCAA member institutions participated in online injury surveillance from 2005/06 (HS RIO) or 2004/05 (NCAA-ISP) through 2013/14, reporting injury and athlete-exposure (AE) data. Time loss injuries were injuries occurring during a school-sanctioned practice or competition, requiring medical attention, and resulting in participation restriction at least 24 hours. Injury frequencies and rates were calculated. Rate ratios (RR) compared rates between HS and college by event type (competition vs. practice). RRs with 95% confidence intervals (CI) not including 1.00 were considered significant.

RESULTS: ATs reported 1,357 softball injuries in HS and 1,848 in college. Injury rates were higher in college women than HS girls (3.19 vs. 1.16/1000 AE; RR=2.76; 95% CI: 2.57-2.96). Although a nearly even split, the majority injuries occurred during competitions in HS (51.5%) and practices in college (50.7%). Injury rates were higher in college than HS in both competitions (3.82 vs. 1.73/1000 AE; RR=2.21; 95% CI: 2.00-2.44) and practices (2.75 vs. 0.86/1000 AE; RR=3.21; 95% CI: 2.91-3.55). The competition injury rate was higher than the practice injury rate in HS (RR=2.02; 95%CI: 1.82-2.25) and college (RR=1.39; 95%CI: 1.27-1.52). Injury rates for HS practices and competitions remained stable over time. Injury rates for college practices decreased and injury rates for college competitions increased beginning in the 2010/11 academic year.

CONCLUSIONS: Injury rates vary by age group and event type with higher rates seen in college athletes and during competitions. Differences may be due to skill level, intensity of play, or access to athletic health care. Further research is needed to determine the cause of these differences and identify injury prevention initiatives.

1496 Board #171 June 1 8:00 AM - 9:30 AM

Prevalence of Low Back Pain of South Korean Baseball Players in Childhood and Adolescence

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Low Back Pain (LBP) is one of the common injuries that may occur in young baseball players. However, little is known about the prevalence of LBP in childhood and adolescence with taking their individual growth and development into consideration.

PURPOSE: The purpose of this study was to describe the prevalence of LBP in young baseball players. In addition, to clarify occurrence of the LBP, based on the Peak Height Velocity (PHV) age).

METHODS: A total of 293 South Korean male baseball players (12.8 ± 2.1 yrs) (Elementary school (ES)=135, Junior high school (JHS)=135, and Senior high school (SHS)=23) were involved in this surveillance, using a questionnaire (point prevalence, lifetime prevalence, recurrence, and age of onset of LBP). Participants' health records were also collected to investigate an annual increment of height and a history of LBP. From these data, the PHV age was calculated in the visually with ± 1 year of PHV age. The PHV age was defined as age showed the most development increased height.

RESULTS: Among all participants, 60.4% (total 177; 13.5 ± 1.9 yrs) of participants had experience of the LBP. In each school group, the prevalence of LBP followed has point LBP, lifetime LBP, and recurrence of LBP; 20.0%, 40.0%, and 23.7% in ES; 50.0%, 73.5%, and 44.1% in JHS; 65.2%, 82.6%, and 73.9% in SHS, respectively. The most frequent onset of LBP was 12 and 13 years old 22.0% respectively. 22.3% of the LBP occurred at the PHV age, and 23.2% occurred in over 1 year of PHV age (total number of occurrence 112; 14.6 ± 1.4 yrs).

CONCLUSIONS: LBP of the young baseball players occurred in early age compared to previous research. Simultaneously, a great number of LBP onsets was observed at age of PHV were within 1 year. These findings suggested that it is important to clarify the timing of PHV age to prevent the LBP for young baseball players.

1497 Board #172 June 1 8:00 AM - 9:30 AM

Describing the Epidemiology of Golfing Injuries

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Golf is a popular sport worldwide, yet injuries sustained during golf rarely receive the same recognition as sports perceived as violent or strenuous. However, golf injuries have been shown to occur with a high incidence. **PURPOSE:** To examine the injury profile of golfers and describe the epidemiology of the injuries sustained, as well as determining factors associated with injury risk. **METHODS:** Amateur golfers aged 18 years and older who played golf on a regular basis completed a questionnaire documenting their previous 12-month injury status and associated golfing demographics. **RESULTS:** This study consisted of 1170 golfers (804 women, 366 men) with a median age of 51 years, and median handicap of 15. Of the 423 injuries (36.5%), 72.8% impacted the golfers' performance or participation. The lower back was the most frequently injured region (27.6%), with strains, the most frequent type of injury (49.5%). There was a significant association between sustaining an injury and the number of hours of golf practice/week ($\chi^2 = 14.819$, $p = 0.003$). Age, hours of play/week, hours of practice/week, and total golf participation hours/week were all significant, independent predictors of injury. The Hosmer and Lemeshow test indicated an acceptable goodness of fit of the model ($p = 0.878$). Odds ratio (OR) analysis showed that golfers who accumulated more hours of play or practice were 4.37 and 1.96 times more likely to report sustaining a golfing injury ($p \leq 0.001$ and $p = 0.004$, respectively). Whereas golfers who accumulated less than eight, or between eight and 12 hours of golf participation/week were 0.517, and 0.813, times less likely to sustain an injury compared to those who accumulated more than 18 hours/week ($p = 0.007$ and $p = 0.009$, respectively). Finally, older golfers were less likely to report sustaining an injury than younger golfers (OR: 0.745, $p = 0.029$). **CONCLUSIONS:** Injuries occur to golfers of all ages and ability levels, and the injuries sustained have a significant impact upon golfers' lives. Before suggesting that golfers limit their golf participation, other injury prevention avenues must be investigated to ensure that participation in physical activity is not viewed as harmful. Further, prevention strategies need to be investigated in relation to specific characteristics of golfers to attempt to reduce the injury risk.

1498 Board #173 June 1 8:00 AM - 9:30 AM

Association between Body Mass Index and Disability in Individuals with Unilateral Anterior Cruciate Ligament Reconstruction

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Individuals with an anterior cruciate ligament reconstruction (ACL) are susceptible to persistent disability and weight gain following surgery, which may increase the risk of developing osteoarthritis. It is unclear if body mass index (BMI) influences disability following unilateral ACLR. **PURPOSE:** Primarily, we determined the association between BMI and self-reported disability using a subjective knee evaluation form (IKDC) in a cross-section of individuals with a unilateral ACLR. Secondly, we determined if those with low to normal BMI (<25) demonstrated different odds of achieving patient-specific age and gender-matched healthy population average IKDC cutoff scores compared to those with high BMI (≥25). **METHODS:** Height, mass and self-reported disability were measured in 668 individuals (60.9% female, BMI 24.39±3.71 kg/m², IKDC 84.68±11.91%, 21.73±6.17 years old, 30.51±35.45 months post unilateral ACLR). Bivariate Pearson product moment correlations were calculated between BMI and IKDC for the entire sample. Multiple regression analyses were used to determine the impact of covariates (Tegner score, age and months since ACLR) on the observed associations between BMI and IKDC, and the change in R² (ΔR^2) attributed to BMI after accounting for the covariates was determined. We calculated the odds (odds ratios and 95% confidence intervals) for achieving published age and gender-matched healthy population average IKDC scores for those with low (<25; i.e. underweight and normal BMI) versus high BMI (≥25; i.e. overweight and obese).

RESULTS: Lower BMI associated with higher IKDC score ($r=-0.08$, $P=0.04$), but BMI did not uniquely explain variance in IKDC ($\Delta R^2>0.001$, $P=0.57$) after accounting for covariates. Individuals with low BMI demonstrated higher odds ($OR=1.45$ [1.05-1.99]) of achieving population average IKDC scores compared to participants with high BMI. **CONCLUSIONS:** A significant but negligible association between higher BMI and lower IKDC scores was negated after accounting for relevant covariates in individuals with a unilateral ACLR. If individuals are dichotomized based on a BMI cutoff of 25, underweight and normal individuals demonstrate higher odds of achieving normative IKDC scores. On its own, BMI may not be a good clinical predictor of self-reported ACLR outcomes.

1499 Board #174 June 1 8:00 AM - 9:30 AM

Prevalence Of Injuries During Brazilian Jiu-jitsu Training

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Background: Brazilian jiu-jitsu (BJJ) is a martial art that focuses on groundwork, joint locks, and chokeholds instead of kicks and punches. Prior studies have examined injury in the sport during competition but not during training. **Purpose:** To determine the prevalence of injuries sustained during BJJ training. **Methods:** A 27-question research survey was e-mailed to 166 BJJ gyms throughout the United States. Demographic information, belt level, weight class, training hours, competition experience, and injury prevalence data were collected. Survey participants were incentivized by entrance into a random drawing to receive one of four \$25.00 pre-paid credit cards. **Results:** A total of 140 athletes responded to the survey. The majority of respondents were Caucasian ($n=96$) males ($n=121$) with an average age of 30.3 years. Overall, the most common injury locations were to the hand and fingers ($n=70$), foot and toes ($n=52$), and arm and elbow ($n=51$). Skin infections ($n=38$) were the most frequent condition for which athletes sought medical attention followed by injuries to the knee ($n=26$) and foot and toes ($n=19$). The most common non-medically diagnosed injuries occurred to the hand and fingers ($n=56$), arm and elbow ($n=40$), and foot and toes ($n=33$). **Conclusion:** Athletes reported more frequent medically diagnosed injuries to the lower extremity and more frequent non-medically diagnosed injuries to the upper extremity. We hypothesize upper extremity injuries to be more frequent but less severe with the opposite being true for lower extremity injuries. This study highlights the prevalence of training injuries in BJJ and the distribution of injuries by age, belt level, and weight class, which may be used to educate both athletes and physicians.

1500 Board #175 June 1 8:00 AM - 9:30 AM

Start, Middle Or End: When Do Concussions Occur During Practices And Competitions Among Athletes?

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Purpose: To determine injury rates of sports-related concussions (SRC) during the start, middle and end of practice and competitions among high school male and female athletes in the state of Michigan. **Methods:** This was a descriptive epidemiological study using the Michigan High School Athletic Association (MSHAA) Head Injury Reporting System. A total of 284,227 (165,418 males, 118,809 females) student-athletes (years in high school=2.32±1.1) participating in MSHAA sponsored athletic activities (i.e., football, soccer, basketball) during the 2015-2016 academic year. Certified athletic trainers, school athletic administrators, and coaches from MSHAA high schools reported head injury data and overall participation for the 2015-2016 academic year. Using the MSHAA Head Injury Reporting System, athlete exposures (AE), total SRCs and time (i.e., start, middle, end) when a SRC occurred were reported for each concussive injury. An injury rate (IR) was calculated by dividing the number of SRCs in a particular category by the number of participants in that category. IRs were presented with 95% confidence intervals (CI). **Results:** A total of 4,452 SRCs were reported for all sports. Male athletes had a greater risk for an SRC during the middle of practices and competitions ($IR=10.21/1,000$ AEs, 95% CI: 9.5-10.5), followed by the end of practices and competitions ($IR=6.63/1,000$ AE, CI: 6.2-7.0) and start of practices and competitions ($IR=1.92/1,000$ AE, CI: 1.7-2.1). Females also had a greater risk for SRCs during the middle of practices and competitions ($IR=6.50/1,000$ AE, 95% CI: 6.0-7.0), followed by the end of practices and competitions ($IR=4.35/1,000$ AE, CI: 4.0-4.7) and start of practices and competitions ($IR=1.68/1,000$ AE, CI: 1.4-1.9). **Conclusions:** The majority of SRCs occur during the middle of practices and competitions compared to the end and start of practices and competitions. Future research should concentrate on ways to prevent SRCs during the middle of events.

1501 Board #176 June 1 8:00 AM - 9:30 AM

U.S. Rugby-7s Injuries in Levels Of Play: A 5-year Epidemiological Prospective Study Of An Emerging Olympic Collision Sport In A Developing Market

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Purpose: Rugby-7s is an emerging collision sport in the U.S. Due to the sport's high incidence of injury, evidence-based data on competition levels and ages will help guide injury prevention in the U.S. market. **Methods:** The Rugby Injury Survey & Evaluation (RISE) report methodology was used to collect injury incidence (per 1000 player hours (ph)) among competitive levels (Colts/Under-19 (U19), college, senior/adult community, sub-elite, and elite). The U.S. Rugby-7s national circuit (2010-2014) included a total of 24,418 players. **Results:** Overall injury incidence was 107.3/1000 ph (73% men; 27% women) (time-loss: 33.7/1000 ph, $n=502$; medical-attention: 72.9/1000 ph, $n=1068$). Elite players were injured more frequently (overall 155.8/1000 ph; time-loss 47.0/1000 ph) compared to other levels ($P=0.002$). Mean severity among all injuries was 44 days (63% with follow-up data). Injuries were mostly new acute injuries (98%), and occurred during the tackle (U19/Colt 80%, college 68%, senior 70%, sub-elite 69%, elite 71%). Most common time-loss injuries were ligament sprains (32%) in the lower extremity (43%). Head/neck injuries occurred often among all levels (overall 22%, 23.7/1000 ph; time-loss 21%, 7.3/1000 ph). Players who wore mouth guards had lower severity from head/neck injuries than those who did not, in our college and elite population (college 21d vs. 41d; $P=0.045$; elite 11d vs. 25d, $P=0.026$, respectively). Concussion incidence was highest among U19 players (11.4/1000 ph). A higher incidence of injuries were seen on artificial fields (114.2/1000 ph) than natural grass (107.2/1000 ph; $P=0.035$). **Conclusions:** Injury surveillance on U.S. Rugby-7s among playing levels is necessary to obtain evidence-based data to nurture injury prevention. Head/neck injuries were common in all U.S. levels of play, which may highlight the need to evaluate tackling techniques which may decrease injury rates. Concussion rates due to tackling in the U19 playing level supports the need for more resources and education dedicated to these players to reduce injuries. The use of mouth guards among all levels, may reduce severity of head/neck injuries, and should be emphasized as an injury prevention measure in our playing population. Finally, natural grass may be a safer surface for Rugby-7's open-style play.

1502 Board #177 June 1 8:00 AM - 9:30 AM

Epidemiology of Middle School Sports Injuries in the Mid-atlantic Region Of The United States

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Participation in scholastic sport has increased. Yet, limited research describes the incidence of injury at the middle school level. **PURPOSE:** Describe the incidence of injury among middle school sports. **METHODS:** Athletic trainers (AT) attended practices and games at 9 middle schools with 1194 boys and 1008 girls (age 11 to 14 years) participating in 12 sports during 2015-2016. The ATs collected injury and athlete-exposure (AE) data at all events. No-time-loss (NLT) and Time-loss (TL) injuries requiring medical attention were examined. TL injuries resulted in ≥ 24 hours participation restriction. Injury frequencies and rates (IR) were calculated. Rate ratios (RR) compared IR by sex. RRs with 95% confidence intervals (CI) not including 1.0 were considered statistically significant. **RESULTS:** 1270 NLT and TL injuries were reported with an overall IR of 16.6/1000AE; 95% CI: 15.7-17.5. Of these, 62.2% and 37.8% were NLT (10.3/1000AE; 95%CI: 9.6-11.0) and TL (6.3/1000AE; 95%CI: 5.7-6.8), respectively. Overall, girls' basketball (32.0/1000AE) had the highest rate of NLT and TL injuries combined followed by football (23.8/1000AE), wrestling (22.9/1000AE) and girls'

soccer (20.1/1000AE). Sports with the lowest IR were girls' volleyball (6.1/1000AE), cheerleading (7.9/1000AE), baseball (8.8/1000AE), and boys' soccer (11.6/1000AE). Boys and girls IR did not differ (17.8 vs. 16.3/1000AE; RR=1.1; 95%CI: 1.0-1.2); findings were retained when restricted to TL injuries (6.9 vs. 5.6/1000AE; RR=1.3; 95%CI: 1.0-1.5). Games had a higher IR than practices (22.3 vs. 15.5/1000AE; RR=1.4; 95%CI: 1.3-2.3). Most injuries were to the lower (45%) followed by the upper extremity (25%), and the head (18%). The majority were diagnosed as contusions (23%), sprains (14%), and abrasions (13%). Most were due to direct impact (38%), abrasion (10%) and overuse (10%).

CONCLUSIONS: Data provide IR estimates for this understudied population. Most injuries involved NTL. Consistent with prior research, games had a higher IR than practices. Girls' basketball and soccer were among sports having the highest IR. However, no significant differences existed between boys and girls IR. Findings demonstrate differences in IR between games and practices and across middle school sports. Supported by the Potomac Health Foundation.

1503 Board #178 June 1 8:00 AM - 9:30 AM

Seasonal Incidence of Game-Related NCAA Football Injuries on Artificial Turf and Natural Grass

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It is commonly surmised that environmental conditions and concomitant sport use dictate the quality and degree of decline of natural grass over a season of competitive football. Although artificial turf infill systems have been purported to duplicate the playing characteristics of natural grass while maintaining surface quality throughout a season of play, no long-term studies have specifically compared injury incidence rates between the two surfaces. **PURPOSE:** To quantify seasonal incidence of game-related collegiate football injuries on artificial turf versus natural grass. **METHODS:** 32 NCAA Division I/FBS colleges were evaluated from August to January over 7 competitive seasons. Injury incidence rates (IIR) were expressed using injuries per 10 team games = (number of injuries ÷ number of team games) x 10. **RESULTS:** Of the 1,176 collegiate games documented, 609 team games (51.8%) were played on artificial turf versus 567 team games (48.2%) played on natural grass. A total of 5,395 injuries were documented with 2,342 (43.4%) occurring on artificial turf, and 3,053 (56.6%) on natural grass. Analyses per 10 team games indicated a significant seasonal injury incidence effect (Likelihood Ratio = 46.065; p<0.0001) between surfaces by month. Subsequent post hoc analyses indicated a significant lower seasonal incidence of injury while competing on artificial turf (p<0.05) in August/September [37.4 (95% CI, 36.2-37.9) vs 47.3 (45.9-47.9)], October [41.9 (95% CI, 40.6-42.5) vs 61.7 (59.3-62.4)], and November [37.0 (95% CI, 35.7-37.6) vs 60.2 (58.9-60.5)] when compared to injuries reported on natural grass, respectively. No significant seasonal injury incidence by surface, however, was observed post season, December/January [34.0 (95% CI, 29.6-35.6) vs 37.5 (33.7-38.5)] on artificial and natural grass, respectively. **CONCLUSION:** With significant seasonal IIR differences existing between these surfaces during seasonal play, further investigation is warranted to quantify seasonal influence across injury category, severity of injury, injury mechanism and situation, specific extremity joints/muscles, elective medical procedures, turf age, and environmental factors. The findings of this study may be generalizable only to this level of football competition and this specific artificial surface.

1504 Board #179 June 1 8:00 AM - 9:30 AM

An Epidemiological Injury Profile Of Sub-elite U.S. Rugby-7s (USA Rugby National Club Championships)

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Reported Relationships: V. Lopez Jr: Contracted Research - Including Principle Investigator; Grant Support from USA Rugby Empire and New England RFU, and National Operating Committee on Standards for Athletic Equipment (NOCSAE).

Purpose: There is a lack of injury data on the collision sport of U.S. Rugby-7s, which hinders development of evidence-based injury prevention protocols. The aim was to determine match injury incidence and risk factors at the highest level of amateur U.S. Rugby-7s. **Methods:** This was a prospective epidemiology study of sub-elite U.S. Rugby-7s players (960 men, 888 women) representing competitive regions at the USA Rugby National Club 7-a-side Championships (including four, two-day tournaments over 2011-2014). Incidence (per 1000 player-hour (ph)) and biomechanism of injuries were captured via the Rugby Injury Survey & Evaluation (RISE) Report methodology. **Results:** Overall injuries were found at 205.3/1000 ph (n=244) (time-loss 59.7/1000 ph, n=71; medical attention 142.2/1000 ph, n=169; P<0.001). Among backs, males (n=26; 74.3/1000ph) encountered more time-loss injuries than females (n=13; 49.5/1000 ph; P=0.063). Most injuries were acute (95%) and occurred during the tackle (73%). Shoulder tackles resulted in the most match injuries (61%). Recurrent time-loss injuries (21%) occurred frequently (backs 28%; forwards 8%; P=0.044). Main injuries were lower extremity ligament sprains (71%). Knee injuries occurred more frequently in females (18.4%) than males (3.1%; P<0.001). Head/neck time-loss injury rates (30%), occurred more often in males (41%) than females (11%; RR=1.5; P=0.002). The overall concussion rate in this population was 6.1% (12.6/1000ph). **Conclusions:** Understanding injury rates in U.S. sub-elite amateur competitors, which often make up the U.S. national candidate pool, provides fundamental level of play data, to guide injury prevention protocols to the U.S. rugby playing population. U.S. sub-elite players head/neck injury rates were found higher, than elite international male Rugby-7s (5%), Under-20 Rugby-15s (12%) and elite women Rugby-15s (26%). Education on tackling techniques are areas to consider to reduce the risk of head/neck injury rates, including concussions, which were higher in this U.S. tournament series cohort (12.6/1000ph) than elite international Rugby-7s (8.3/1000ph) or Rugby-15s (5.4/1000ph). Furthermore, education on return to play protocols and post-tournament injury care would decrease recurrent injury rates seen in the U.S. amateur population.

1505 Board #180 June 1 8:00 AM - 9:30 AM

A 4-year Epidemiological Analysis Of Tournament Match Injuries In Men's Collegiate Rugby-7s

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Reported Relationships: L.S. Myers: Contracted Research - Including Principle Investigator; USAR New England and Empire GU RFU's and National Operating Committee on Standards for Athletic Equipment.

Purpose: Rugby-7s, an Olympic collision sport, is played with a high incidence of injury. U.S. collegiate Rugby-7s, due to its club status, has a lack of data to support the development of prevention protocols. **Methods:** This is a prospective epidemiology study using the Rugby Injury Survey & Evaluation (RISE) Report methodology to capture injury rates (per 1000 player-hour (ph)). USA Sevens Collegiate Rugby-7s Championship Invitational (1786 athletes) over 2012, 2014-2016 competitive divisions (championships men and women, men's collegiate, and men's small colleges) were evaluated for match injuries. **Results:** Injuries overall were found at 139.4/1000ph (n=151) (time-loss 31.4/1000ph, n=34; medical attention 108.0/1000ph, n=130; <0.001). Backs (38.9/1000ph) had higher rates of time-loss injuries than forwards (17.3/1000ph; RR: 2.2, P=0.040). Mean severity of injuries were 75.7 days (backs 63.7 days; forwards 127.5 days; P=0.078). Injuries overall were acute (87%) and occurred during the tackle (72%) and running/open play (17% overall; from 13% in 2012, 22% in 2014, 43% in 2015, 9% in 2016). Shoulder tackles led to more injuries than other tackle types (65%; RR: 1.9). Recurrent injuries were observed at 29% of all injuries (39.8/1000ph). Most common time-loss injuries were concussions (26%) and lower extremity ligament injuries (50%). Overall head/neck injuries occurred at high proportions (29%; RR: 2.62), including concussions at 12% of all injuries (16.7/1000ph; RR: 1.3 P=0.148). **Conclusions:** One concern with the expansion of U.S. Rugby-7s was the increasing risk of head and neck injuries in collegiate Rugby-7s between 2012 and 2014, 2015 and 2016 (RR: 2.17, 4.7, 3.3, respectively). Elevated head/neck injury rates in the current study have been found to be higher than the literature in international elite males Rugby-7s (5%) and U-20 Rugby-15s (12%). The largest injury increase was seen in running/open play, possibly due to the variability of training regimens among programs. Developing institutional support as other collegiate sanctioned sports can help guide instruction on tackling, and a standardized conditioning program, which may decrease injury rates at the collegiate playing level.

1506 Board #181 June 1 8:00 AM - 9:30 AM

Statin Use Predicts Fall Risk Among Older Adults

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(No relationships reported)

In the United States, 30–60% of older adults fall each year; 10–20% of these falls result in injury, hospitalization, or death. Better prevention of falls in this population may be facilitated by broader identification of risk factors. The use of statins has emerged as a potential risk factor, but the data are conflicted. **PURPOSE:** To examine the relationship between statin use and falls among community-dwelling older adults. **METHODS:** We evaluated the patient registry of a Level 1 trauma center. All patients aged ≥65 years who were admitted in the Emergency Room (and discharged to home) for falls in 2015 were included (n=615). Many of these patients had been previously admitted for falls and many were later readmitted for falls. We analyzed predictors of both prior admission and readmission with linear regressions. Independent variables were self-reported balance problems, diagnosis of dementia, and the use of statins. **RESULTS:** On average, patients admitted for falls were 79.9 ± 9.3 years old and 28% (n=173) were taking statins. Our collection of predictors explained 14.2% of the variance in the number of previous admissions for falls (p<0.001). Among this population, the use of statins predicted more previous admissions for fall-related injuries (95% CI: 0.07–0.50, p=0.010). This same model maintained its significance when predicting admissions for future falls (p<0.001) and the use of statins continued to predict a greater number of readmissions (95% CI: 0.04–0.36,

p=0.015). **CONCLUSION:** More than 25% of all Americans age ≥40 years are taking cholesterol-lowering medication; 93% of those medications are statins. Although evidence is conflicted, our data support the finding that statin therapy increases the risk of falls in older adults. Exercise may function as a prophylactic measure, enhancing lipid profiles and decreasing the need for statins while also improving balance, coordination, and mobility, reducing the risk of fall-related injuries.

1507 Board #182 June 1 8:00 AM - 9:30 AM

Age At First Energy Drink Use As A Predictor of College Student High-Risk Driving Behaviors

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(No relationships reported)

Age at first use has been studied extensively as a predictor for issues with substances, but remains relatively unexplored in energy drinks. **PURPOSE:** To examine the relationship of age at first energy drink use and high-risk motor vehicle driving behaviors among college students (n=552). **METHODS:** Age at first energy drink use was measured using a standard continuous scale self-reported question. Logistic and bivariate regressions were used to examine the relationship of age at first energy drink use to past 30-day alcohol-related high-risk driving behaviors. Participants responded to the following: 1) I have driven a motor vehicle when I knew I was over the .08 blood alcohol concentration (BAC) driving limit; 2) I have driven a car when I knew I had too much alcohol to drink to drive safely; 3) I have been a passenger when I knew the driver had consumed too much alcohol to drive safely. **RESULTS:** Age at first energy drink use was inversely proportionate to each risky driving behavior measured. The odds of engaging in driving while over the .08 BAC limit decreased by 10.8% (OR=.89; p=.002) as age at first energy drink use increased by one year; Participants odds of driving when perceiving they had consumed too much alcohol to drive safely decreased by 8.4% (OR=.92; p=.009) as age at first energy drink use increased by one year. The odds of being a passenger in a car with a driver who had consumed too much alcohol to drive safely decreased by 11.9% (OR=.88; p=.000) as age at first use increased by one year. Age at first energy drink use was a significant predictor of past 30-day risky driving behaviors including driving when one perceives they have consumed too much alcohol to drive safely (B=-.041; p=.036; R²=0.008), and driving while perceiving a BAC over .08 (B=-.10; p=.001; R²=0.009). **CONCLUSION:** Results suggested using energy drinks at an earlier age predicted high-risk motor vehicle behaviors including driving after consuming too much alcohol, driving over the .08 BAC limit, and knowingly riding with a driver who had consumed too much alcohol to drive safely.

1508 Board #183 June 1 8:00 AM - 9:30 AM

A Comparison of Injury Rates In Boys' And Girls' Youth Lacrosse

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Participation in youth lacrosse is increasing. To date, limited research has compared the incidence and severity of injuries among boys' and girls' youth lacrosse players. **PURPOSE:** Compare the incidence and severity of injury in boys' and girls' youth lacrosse. **METHODS:** Athletic trainers (ATs) attended games and practices during the 2015 and 2016 seasons for 12 youth lacrosse leagues in four states with 1090 male and 408 female players. ATs collected injury and athlete-exposure (AE) data at all events. Injuries occurring during league events and requiring medical attention were included. Time loss (TL) injuries were those resulting in participation restriction ≥24 hours. Injury frequencies and rates were calculated. Rate ratios (RR) compared rates by sex. RRs with 95% confidence intervals (CI) not including 1.00 were considered statistically significant. **RESULTS:** A total of 241 and 59 total injuries were reported in boys' and girls' youth lacrosse, respectively. Of these, 17.0% and 18.6% were TL, respectively. Boys had a higher injury rate than girls (10.3 vs. 7.9/1000AE; RR=1.4; 95%CI: 1.1-1.9); findings were retained when restricted to TL injuries (1.9 vs. 1.5/1000AE; RR=1.5; 95%CI: 1.0-2.3). Most injuries were to the lower extremity (boys: 48.9%; girls: 44.1%) and diagnosed as contusions (boys: 52.3%; girls: 40.7%) and sprains (boys: 12.9%; girls: 16.9%). Most injuries were due to contact with equipment, particularly stick contact (boys: 36.1%; girls: 22.0%) and ball contact (boys: 14.5%; girls: 23.7%). Player contact was also common in boys (18.3%). Checking comprised a low proportion

of injuries in boys (5.8%) and girls (0.0%). In total, 15 concussions were reported; however, all but one occurred in boys. Of the 14 concussions in boys, 6 (42.9%) were due to player contact and 5 (35.7%) stick contact.
CONCLUSIONS: Data provide injury incidence estimates from the largest known sample of youth lacrosse players. As seen in previous research, rates were higher in boys than girls, highlighting the need for sex-specific prevention strategies, particularly related to concussion and player contact. The high incidence of stick- and ball-related injuries also reiterate the need for rule changes to better protect players. Supported by the National Operating Committee on Standards for Athletic Equipment (NOCSAE).

1509 Board #184 June 1 8:00 AM - 9:30 AM
Shoulder Impingement in Soldiers: Descriptive Epidemiology and Common Surgical Procedures
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(No relationships reported)

PURPOSE: Subacromial impingement syndrome (SIS) is one of the most common shoulder diagnoses in people with significant upper extremity demands, and this diagnosis may include multiple underlying factors. The purpose of this study is to examine the incidence of SIS in U.S. Army Soldiers, risk factors for SIS, and identify the most common surgical procedures in operative cases. **METHODS:** Medical encounter data for all U.S. Army Soldiers was examined from 2002-2011. Cases of SIS were identified using International Classification of Diseases 9th Revision (ICD-9) codes 726.10 and 726.2. A 10-year incidence rate (IR) was calculated. A Cox Regression Model was used to calculate Hazard Ratios (HR) and 95% confidence intervals (CI) for factors associated with SIS using the variables of age, race, education level, sex, length of military service, and occupational physical demands rating. Surgical cases were identified using Current Procedural Terminology (CPT) codes, and the most common surgical codes were reported. **RESULTS:** 67,341 cases of SIS were identified in 1,261,297 Soldiers, for a 10-year IR of 15.73 per 1,000 person years. Risk increased with age in years (<20 reference; 20-25 HR=1.36, 95% CI [1.29, 1.43]; 26-30 HR=2.07, 95% CI [1.95, 2.19]; 31-35 HR=2.83 95% CI [2.67, 3.00]; 36-40 HR=4.32, 95% CI [4.08, 4.59]; >40 HR=6.31, 95% CI [5.95, 6.71]) and years of military service (<1 as reference; 3-5 years HR=1.13, 95% CI [1.09, 1.18]; >5 years HR=1.06, 95% CI [1.02, 1.10]). Of the SIS cases, 3686 were identified as surgical cases with the most common procedures being claviclelectomy (85%), biceps tenodesis (40%), chronic rotator cuff tear repair (37%), acromioplasty (28%), capsulorrhaphy with labral repair (22%), and coracoclavicular ligament release (20%). **CONCLUSIONS:** Increasing risk for SIS with increasing age and longer occupational exposure are consistent with previously identified factors related to SIS. This study shows that the most common shoulder surgical procedures in Soldiers with a diagnosis of SIS were associated with anatomy thought to contribute to compression of subacromial structures, while surgical management of instability may also be a factor for some cases. The views expressed are those of the authors and do not reflect the policy of the Department of Army, Department of Defense, or the U.S. Government.

1510 Board #185 June 1 8:00 AM - 9:30 AM
Characterizing Injuries and Participation in High Intensity Functional Training
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Limited epidemiological data related to injury and high-intensity functional training (HIFT) suggest relatively low injury risk compared to other exercises (e.g., running). **PURPOSE:** This qualitative study characterized injury related experiences for HIFT participants. **METHODS:** 60-min key informant interviews (KI) with six HIFT coaches (67% male, age = 39 ± 8y, 4 ± 3y experience), six 90-min focus groups (FG) with 48 HIFT exercisers (56% male, age = 34 ± 9y, 40% > 1y experience), and 15-min interviews (IN) with 10 HIFT exercisers (50% male, age = 43 ± 15y, 50% > 1y experience) were used. Only FG were asked “What injuries have you experienced as a result of participating in HIFT?” Data were audio recorded and transcribed verbatim. Member checking was used for interviews. Data were thematically analyzed to identify statements related to injuries, hurt, pain, soreness, or safety for all participants. Data were open-coded and discussed for consensus by two researchers. **RESULTS:** Key themes included participants reporting mostly minor “HIFT injuries” (KI = 33%, FG = 100%, IN = 20%). Participants also reported having “injuries from other types of exercises/sports” (KI = 33%, FG = 67%, IN = 10%) “High intensity workouts” influenced when participants pushed too hard and became injured or lessened intensity to avoid injury (KI = 50%, FG = 67%, IN = 20%). Accordingly, participants reported feeling pain and soreness “during workouts” (KI = 33%, FG = 83%, IN = 20%), although some liked this. Some “started HIFT because of injury”

(KI = 33%, FG = 67%, IN = 10%) and utilized HIFT for “therapy/prevention of other health problems” (KI = 17%, FG = 50%, IN = 67%) while others “stopped HIFT due to injury” (KI = 33%, FG = 50%). Even though “perceived injury risk” was a participation barrier (FG = 67%, IN = 10%), “scaling or modifying” workouts helped avoid injuries or continue HIFT when injured (KI = 50%, FG = 17%, IN = 10%). “Good coaching” (KI = 50%, FG = 50%), “improved fitness” (KI = 17%, FG = 33%, IN = 30%), and “knowledge, technique, and goals” (KI = 33%, FG = 83%, IN = 10%) were injury prevention tools. **CONCLUSIONS:** Data illuminate the range of participants’ experiences with HIFT regarding injury, including how to modify workouts, prevent/recover from injuries, and improve health. Prospective studies should be designed to prevent and/or better track HIFT injuries.

1511 Board #186 June 1 8:00 AM - 9:30 AM
The Experience Of Low Back Pain In Pre-professional And Professional Dancers: A Longitudinal Study
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PURPOSE: Low back pain (LBP) is often cited as one of the most common musculoskeletal conditions experienced by pre-professional and professional dancers, although there is a dearth of evidence to support this. The purpose of this study was: i) to determine the prevalence of LBP in dancers, as well as the impact on practice and management strategies used by dancers; and ii) to identify any demographic or physical factors associated with LBP in dancers. **METHODS:** This was a prospective cohort study of 110 (n=19 male) pre-professional and professional classical ballet and contemporary dancers (mean (SD) age 17.8 (2.9) years). Data were collected using an online questionnaire repeated monthly for 9 months. Univariate and multivariate analyses were conducted to determine demographic and physical factors related to LBP prevalence. **RESULTS:** 74% of dancers reported a history of LBP. Preliminary analysis revealed a monthly and point prevalence between 40 to 60% and 16 to 25% respectively. Each month, between 35 to 63% of all episodes of LBP resulted in some form of activity modification or time away from dance, 16 to 27% of dancers with back pain consulted a health professional and 15 to 30% used medication for their back pain. Multivariate analysis found no association with individual or demographic factors and history of LBP. **CONCLUSIONS:** Pre-professional and professional dancers have an increased vulnerability to LBP. The development of LBP within this population is complex and may not be associated with individual factors measured in this study.

1512 Board #187 June 1 8:00 AM - 9:30 AM
Injuries Reported During a Pre-participation Examination in Division 1 Collegiate Athletes: A Prospective Cohort Study
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Introduction
 Understanding the influence of sport and gender on prior injury is important for providing rehabilitation and prevent future injury. The purpose of this study was to examine injury prevalence in Division 1 collegiate athletes prior to participation and report injury risk.
Methods
 856 pre-participation questionnaires were collected between 2012 and 2016 in 32 varsity sports. Data reviewed was gender, sport, and injury in: neck, shoulder, elbow, hand, spine, hip, knee, lower leg, and foot. Top 5 sports were identified by percent total injuries and injuries per team. Odds of injury were reported by gender and matched sport.
Results
 Football was 12% of the cohort. Injuries were highest in hand (26.6%), knee (24.5%), and lower leg (22.9%). Top 5 sports by number of injuries and total of team are summarized in table 1. Overall, males have a 1.8 times greater odds of shoulder injury compare to females (p<0.01). No difference in injury was found between genders in any other area (p>0.05).
 In sports with corresponding male and female teams, gymnastics had 3.0 and ice hockey 2.8 times greater odds of shoulder injury (p=0.03 & 0.04). Gymnastics had 2.5 times greater odds and track & field 3.8 times lesser odds of elbow injury (p=0.05 & 0.03). Golf had 4.9 times greater odds of spine injury (p=0.03). Gymnastics had 7.1, golf 4.6, and track & field 4.3 times greater odds of foot injury (p<0.01, p=0.05, & 0.01). Gender was not a confounder (p>0.05).

Soccer had 4.6, track & field 4.0, gymnastics 4.0, and females 1.9 greater odds of hip injury (p=0.01, 0.02, 0.03, & 0.01). Basketball had 2.8, gymnastics 2.7, and females 1.7 times greater odds of knee injury (p=0.05, 0.03, & 0.01).

Conclusion

Football accounted for the largest gross number of injuries but not when averaged by number of participants. Gymnastics had a significant risk for having reported injury at the time of pre-participation examination. Females had a significant risk of hip and knee injuries compared to male athletes.

Table 1. Top 8 sports for each area by percent total number of injuries and percent total of team

Sport	First		Second		Third		Fourth		Fifth	
	% Total	% Team	% Total	% Team	% Total	% Team	% Total	% Team	% Total	% Team
Neck	M Swim/Dive	16.7	W Ice Hockey	11.1	M Lacrosse	11.1	M Lacrosse	9.9	M Lacrosse	5.6
Shoulder	Football	21.2	M Gymnastics	9.8	M Ice Hockey	9.1	W Swim/Dive	8.1	W Wrestling	5.3
Elbow	W Gymnastics	6.3	Wrestling	3.3	Baseball	2.2	W Gymnastics	2.2	M Swim/Dive	1.2
Hand	Football	14.5	M Gymnastics	3.7	M Ice Hockey	3.7	M Lacrosse	3.3	Wrestling	4.3
Spine	Football	12.7	Wrestling	3.9	Rowing	2.8	M Swim/Dive	2.8	W Gymnastics	2.3
Hip	Football	15.6	W Track & Field	11.0	W Gymnastics	7.3	M Soccer	7.3	W Track & Field	5.5
Knee	Football	15.2	Wrestling	3.8	W Soccer	3.2	W Gymnastics	4.4	W Basketball & W Gymnastics	4.3
Lower leg	Football	15.8	W Soccer	5.1	W Track & Field	6.1	M Lacrosse	5.6	M Gymnastics	5.1
Foot	Football	16.2	M Gymnastics	7.7	W Track & Field	7.7	Chemistry	5.6	M Lacrosse & W Lacrosse	4.9

Sport	% team		% team		% team		% team		% team	
	Sport	% team	Sport	% team	Sport	% team	Sport	% team	Sport	% team
Neck	W Ice Hockey	5.5	M Basketball	7.7	M Swim/Dive	6.4	W Gymnastics	5.0	M Lacrosse	4.5
Shoulder	M Gymnastics	46.1	W Ice Hockey	42.9	M Volleyball	33.3	W Swim/Dive	32.4	W Volleyball	26.7
Elbow	W Gymnastics	46.0	M Gymnastics	33.3	W Tennis	27.3	Field Hockey	25.0	Baseball	25.0
Hand	M Volleyball	53.3	M Gymnastics	49.1	M Ice Hockey	46.4	W Soccer	43.5	W Golf	42.9
Spine	M Golf	37.5	W Gymnastics	30.0	W Golf	26.5	W Tennis	27.3	Rowing	26.7
Hip	W Gymnastics	49.1	W Tennis	32.4	W Track & Field	31.8	M Soccer	27.6	W Soccer	26.1
Knee	W Basketball	40.0	M Volleyball	33.3	W Gymnastics	30.0	Wrestling	30.0	W Soccer	47.9
Lower leg	W Soccer	29.2	W Fencing	49.7	M Volleyball	40.0	M Gymnastics	37.0	W Gymnastics	35.0
Foot	M Gymnastics	40.7	W Gymnastics	30.0	W Track & Field	28.0	W Golf	25.6	W Basketball & W Volleyball	26.7

1513 Board #188 June 1 8:00 AM - 9:30 AM

Risk Factors For The Development Of Osteoarthritis In Patients With ACL Reconstruction.

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(No relationships reported)

Patients with anterior cruciate ligament reconstructed (ACLR) knees are at high risk for early development of tibiofemoral osteoarthritis(OA). Since there is no cure for osteoarthritis, it is important to understand factors that influence OA development with the goal of identification of patients at risk to prevent the young patient with an old knee. **Methods:** We searched a commercially available healthcare database (Pearlriver) including ICD-9 and CPT codes from a single insurance provider (Humana). We searched for Arthroscopic ACL reconstruction (CPT 29888) between 2007-2015 and identified new diagnoses of OA identified by ICD-9. The desired outcome was a new diagnosis of OA after ACLR with up to 5 years follow-up. We calculated proportions to describe incidence of OA after ACLR and performed logistic regression to describe the odds ratios(OR) for developing OA based on age, sex, BMI, meniscus involvement, osteochondral graft use and tobacco use. We controlled for multiple co-morbidities and other diagnoses that would potentially confound the development of OA after ACLR. Odds ratios were considered statistically significant if the associated P-value was 0.05 or less. **Results:** We identified 10,565 patients with ACLR who did not have an existing diagnosis of OA, 517 of which had a documented new diagnosis of knee OA after ACL reconstruction. When stratified by follow up time point, 12.3% of patients with 5 year follow up data had new diagnoses of OA, 10.4% OA diagnosis for those with 4year follow up, 8.4%OA in patients with 3 years follow up, 6.2%OA after 2 year follow up, 4.1% OA after 1 year and 2.3% after 6 months. Risk factors for new OA diagnoses were: Age > 35 years (OR 2.44, P < 0.0001), Female sex (OR 1.2, P = 0.002), Obesity (BMI 30-40, OR 1.4, P = 0.0004), Morbid Obesity (BMI>40, OR 1.5, P = 0.006), Tobacco Use (OR 1.3, P = 0.001), Partial Meniscectomy (OR 1.2, P = 0.005), Meniscus Repair (OR 1.3, P = 0.0004), Osteochondral Graft: not significant, P>0.05). **Conclusion:** We have reported current data regarding the development of incident OA in the early to mid-phase of recovery from ACLR in patients with no pre-existing OA diagnoses. Odds ratios can inform treating clinicians to best develop risk profiles in patients with the common goal to achieve optimal long term outcomes after ACL reconstruction.

1514 Board #189 June 1 8:00 AM - 9:30 AM

Number of Previous Knee or Ankle Injuries Is Associated With Poor Physical but not Mental Health

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(No relationships reported)

The knee and ankle are among the most commonly injured joints in the body. Long-term strength and neuromuscular control deficits are common following these injuries, yielding lifelong disability and poor quality of life. However, it is unknown if quality of life worsens as the number of ankle and knee injuries sustained increases. **PURPOSE:** Determine the association between the number of ankle or knee injuries sustained and physical and mental quality of life. **METHODS:** A total of 806 ankle-injured (age:45.2±15.3yrs; body mass index[BMI]:28.6±7.4kg/m²), 658 knee-injured

(age:49.3±16.1yrs; BMI:28.4±7.4kg/m²), and 1066 uninjured (age:45.8±16.3yrs; BMI:27.5±7.0kg/m²) adults completed the SF-8 survey to determine the physical (PCS) and mental (MCS) contributions to quality of life. Respondents were categorized by injury history (ankle, knee, none) and number of injuries (0, 1, 2, 3+) to the same joint. Backward elimination linear regression analysis determined the association between quality of life, age, and injury history separately for SF-8 PCS and MCS and ankle versus knee injury. **RESULTS:** For ankle injury, reporting 1, 2, or 3+ injuries and age explained 7.3% of the variance in SF-8 PCS (P<0.001). Further, 1 or 2 ankle injuries (P<0.001) and age (P<0.001) explained 5.5% of the variance in SF-8 MCS. Reporting 1, 2, or 3+ knee injuries and age significantly predicted PCS (P<0.001) explaining 7.6% of the variance in PCS. Age, but not knee injury, significantly predicted SF-8 MCS (P<0.001), explaining only 7.2% of the variance in SF-8 scores. **CONCLUSIONS:** Only current age influenced mental quality of life. Current age and history of sustaining at least one injury negatively impact physical quality of life following either a knee or ankle injury. However, neither number of injuries nor age explained much of the variance in SF-8 scores. More research is needed to determine what other factors contribute to quality of life so that it can be improved following injury.

1515 Board #190 June 1 8:00 AM - 9:30 AM

Head Coaches' Return To Play Decision Making After Injuries In Semi-professional Team Sport Athletes

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(No relationships reported)

Head coaches of semi-professional sport teams are most often in charge of the final positive return to play (RTP) decision. **PURPOSE:** To assess how different decision-guiding factors, such as health and performance related actuators, as well as evidence based guidelines, support the head-coaches' process-orientated RTP decision. **METHODS:** A survey consisting of questions on the importance of different decision-guiding factors used when making the RTP decision following injuries was administered to head coaches of semi-professional players' teams. With respect to helpfulness in the RTP decision-making process, the coaches rated both the importance of the opinion of physicians, physiotherapists, strength and condition coaches, the athletes, themselves, and of both general and injury-specific RTP guidelines. **RESULTS:** Our survey revealed that the head coaches refer to physicians and physiotherapists to a large extent, to the athletes and to themselves to a medium extent, and to strength and conditioning coaches and RTP guidelines to a small but still relevant extent. The coaches' effort to seek a shared decision-making process in RTP is, hence, partially evident. **CONCLUSION:** A multitude of actuators intervenes when making the RTP decision. The call for a professionalization of the RTP process in semi-professional sports includes the athlete itself, the head coach, the (external) physician, the (external) physiotherapist and the strength and conditioning coach based on general RTP decision-making models and specific criteria related to injury type, sports type, level and playing position. The development of awareness and implementation strategies of RTP models should be subject to further research.

1516 Board #191 June 1 8:00 AM - 9:30 AM

Reliability of the Head Impact Exposure Estimate in Former Professional Football Athletes

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PURPOSE: The long-term neurological effects of exposure to repetitive subconcussive impacts, such as those occurring in American football, are poorly understood. Recent studies have suggested that greater exposure to subconcussive impacts is associated with worse health outcomes in former high school, collegiate, and professional football players. Helmet accelerometer research has shown the magnitude, location, and frequency of impacts sustained by American football players varies widely and are dependent on many factors, including position, practice structure, playing time, and career duration. Thus, estimating cumulative head impact exposure across a player's career using these factors may prove useful in studying their long-term effects. Previously, our research center developed the head impact exposure estimate (HIEE), a structured interview covering game and practice contact hours over the course of an athlete's playing career. However, the test-retest reliability of the HIEE is unknown. **METHODS:** We examined the test-retest reliability of the HIEE in 11 retired professional football athletes (mean age: 64.7 +/- 3.13y). The HIEE was administered by two raters over two occasions with a mean period of separation of 4.4 +/- 0.42y. Intra-class correlation coefficients, ICC(2,1), were used to quantify agreement between HIEE assessments. We calculated ICC(2,1) values for

the overall HIEE, as well as the two subcomponents of practice- and game-weighted contact hours. P-values were determined for the test of ICC=0 and 95% confidence intervals were calculated. **RESULTS:** The mean HIEE at assessment 1 was 3423.76 +/- 1406.02hrs while at assessment 2, the mean was 2627.68 +/- 819.56hrs ($t_{10}=1.75$, $P=0.11$). The overall ICC(2,1) for the HIEE was 0.124 ($P=0.33$; 95% CI: -0.36, 0.62). The ICC(2,1) for weighted practice contact hours was 0.111 ($P=0.36$; 95% CI: -0.44, 0.63) and for weighted game contact hours was 0.330 ($P=0.01$; 95% CI: -0.11, 0.75). **CONCLUSIONS:** Overall, the head impact exposure estimate had poor reliability. The subcomponent of game contact hours was more reliable than practice contact hours. The reported number of contact practices per week appears to be the major factor reducing reliability. A more explicit definition of a "contact practice" may improve reliability.

1517 Board #192 June 1 8:00 AM - 9:30 AM
Boxing Exposure in a Representative Cohort of Modern Era Professional Boxers
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PURPOSE: To determine the boxing exposure of a representative cohort of retired professional boxers who competed in modern era boxing.
METHODS: Boxing records of a previously studied cohort of 338 professional boxers who were applying for license to box professionally in New York State in the 1980's were reviewed. Boxing exposure was extracted from boxing records provided by BoxRec.
RESULTS: Of the 338 boxers previously studied, boxing records of 282 professional boxers were located and reviewed. The mean age of the boxers at the time of extraction was 51.9 years (range 31-66). All boxers were presumed to be retired. The mean age at the time of first professional bout was 21.6 years (range 16-30). The mean duration of the professional boxing career was 8.1 years (range 1-38). The mean number of total professional bouts 22.1 (range 1-129) with an average of 12 wins (range 0-79) and 9.3 losses (range 0-102). The average number of wins and losses by technical knockout/knockout (TKO/KO) was 7.3 (range 0-84) and 4.5 (range 0-35), respectively. The average number of total rounds boxed was 113 (range 1-735). The mean number of annual bouts and rounds was 3.2 (range 0-27) and 14.5 (range 0-165), respectively.
CONCLUSION: The range of exposure to boxing among a representative sample of retired professional boxers is highly varied. To the best of our knowledge this is the only documentation of professional boxing exposure in modern era (late 20th century) boxing. Follow-up of this cohort may serve as a representative sample of retired professional boxers to study the chronic effects of repetitive brain trauma, such as chronic traumatic encephalopathy (CTE).

1518 Board #193 June 1 8:00 AM - 9:30 AM
Comparison of Online and Onsite Health Education Intervention in Preventing Sports Injury among College Students
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(No relationships reported)

PURPOSE: To determine the effect and the superiority of online and onsite education intervention designed to improve perception and basic knowledge and skills of sports injury prevention among college students.
METHODS: 2,088 college students were recruited from a cluster random sampling of 51 classes to acquire sports injuries epidemiology for the further intervention. 321 collected participations were randomly allocated to the online (n=157) and onsite (n=164) group. 4 educational sessions led by specialists were designed with the same topics in both groups. The components engaged in health awareness, basic knowledge, and enrichment activities targeting skills training. Students received prospective surveys incorporated 12 Likert scale questions. Differences within and between groups were compared using independent and paired T-test, respectively. SPSS18.0 was used for the statistical analyses and a significant level was set at $P \leq 0.05$.
RESULTS: The rate of sports injuries was 15.4% (321/2088 students) on the retrospective survey. There were no differences between groups in awareness (online: 2.40 ± 0.06 vs onsite 2.34 ± 0.06 , $p=0.509$) and knowledge and skills (online: 1.87 ± 0.07 vs onsite 1.86 ± 0.09 , $p=0.891$) on the pre-intervention survey. Pre- and post-intervention data revealed improved awareness (online: pre- 2.40 ± 0.06 vs post- 3.25 ± 0.07 , $p=0.000$; onsite: pre- 2.34 ± 0.06 vs post- 3.45 ± 0.07 , $p=0.000$) and knowledge and skills (online: pre- 1.87 ± 0.07 vs post- 2.37 ± 0.07 , $p=0.000$; onsite: pre- 1.86 ± 0.09 vs post- 3.94 ± 0.06 , $p=0.000$) within both groups. Statistical tests indicated significantly difference between groups in knowledge and skills (online: 2.37 ± 0.07 vs onsite 3.94 ± 0.06 , $p=0.000$), particularly with higher scores in onsite group, while no difference in awareness (online: 3.25 ± 0.07 vs onsite 3.45 ± 0.07 , $p=0.000$).

CONCLUSIONS: limitations of perception and knowledge and skills of injury prevention may compromise the students' ability to prevent sports injuries. Both online and onsite education may be attributed to heightened perception and basic knowledge and skills, while onsite education had priority to online format in improving fundamental knowledge and skills in injury prevention among college students.
 Supported by the Hubei Science Education Project (2014B196 & 2016B155).

C-41 Exercise is Medicine®/Poster - EIM - Physical Activity, Training and Lifestyle
 Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1519 Board #194 June 1 9:00 AM - 10:30 AM
Preliminary Results for Test-Retest Reliability of a New Screening Tool: The Get Active Questionnaire
 Dawn P. Gill¹, Andrea F. Petrella¹, Liza Stathokostas¹, Mary Duggan², Robert J. Petrella, FACSM¹. ¹*Western University, London, ON, Canada.* ²*Canadian Society for Exercise Physiology, Ottawa, ON, Canada.* (Sponsor: Robert Petrella, FACSM)
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PURPOSE: The Get Active Questionnaire (GAQ), developed by the Canadian Society of Exercise Physiology, is a new physical activity (PA) readiness assessment tool that seeks to safely encourage and 'screen-in' as many people as possible to participate in regular PA.
 To evaluate the test-retest reliability of items from the GAQ in a sample of community-dwelling older adults.
METHODS: Older adults (≥ 50 years) were recruited from a research laboratory routinely conducting PA screening for community-based referrals. Study participants [$n=86$; mean age (SD): 75.7 ± 7.7 years; xx% female] completed 2 study visits, one-week apart, where participants self-completed the GAQ that was provided in paper form. The first page of the GAQ includes 9 yes/no questions designed to ensure individuals have a safe PA experience. Questions ask about: specific diagnoses/symptoms in the past 6 months; whether pain/other conditions affect ability to do PA; and whether a provider advised avoidance of PA/take precautions. Test-retest reliability was assessed using kappa statistics (κ) and 95% CIs.
RESULTS: Test-retest reliability could not be examined for 2 of the questions (loss of consciousness/fainting for any reason; concussion) because all participants responded "no" at 1 of the 2 visits. Of the 7 questions evaluated, the question that asked whether other medical conditions affected ability to be physically active showed almost perfect agreement between testing occasions [κ (95% CI): 0.84 (0.63-1.00)]. Most questions (diagnosis of heart disease or stroke or pain/discomfort in chest in daily activities or during PA; diagnosis of high blood pressure (BP) or resting BP $\geq 160/90$ mmHg; pain or swelling in any part of body affecting ability to do PA; provider advised avoidance of PA/take precautions) showed substantial agreement with results ranging from 0.65 (0.28-1.00) to 0.74 (0.39-1.00). The remaining 2 questions showed either moderate agreement [i.e., dizziness during physical activity: 0.58 (0.25-0.91)] or fair agreement [i.e., shortness of breath at rest: 0.32 (-0.16-0.80)].
CONCLUSION: Preliminary results from this study indicate that key GAQ screening questions demonstrate acceptable test-retest reliability over a 1-week period. Future research will further examine reliability, as well as validity of the GAQ.

1520 Board #195 June 1 9:00 AM - 10:30 AM
Development of Trait-Tailored Physical Activity Promotion Messages for Use in Community and Clinic Settings
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Physical inactivity is a risk factor for many chronic disorders. Evidence suggests that health promotion message content interacts with personality to influence message effectiveness, such that certain messages are more effective for certain types of people than they are for others, but this effect has not been tested in the context of physical activity (PA) promotion. **PURPOSE:** To develop a set of physical activity promotion messages designed to target approach (BAS) and avoidance (BIS) motivational traits for potential use in typical community or clinical settings. **METHODS:** A set of 75 messages about physical activity were developed across five message conditions: (1) gain-framed desirable outcome, (2) gain-framed undesirable outcome, (3) neutral, (4) loss-framed desirable outcome, and (5) loss-framed undesirable outcome. Two

samples (n=800 undergrads, and n=400 primary care patients) rated the messages on three semantic differential scales (gain/loss, cost/benefit, positive/negative outcomes), and completed a PA self-report measure. Motivational traits were assessed in the undergrad sample. **RESULTS:** Content ratings conformed to the expected linear pattern according to message condition on all three ratings scales in both samples while controlling for age, race and PA ($F(df)>302.5(4); p<.001$). Bivariate associations supported expectations that BAS trait would be significantly related to ratings of gain-framed messages (r range= .17 to .30; $p<.01$) and that BIS trait would be significantly related to ratings of loss-framed messages (r range= -.09 to -.13; $p<.05$). Further, BAS was significantly related to rating of neutral messages (r range= .18 to .23; $p<.01$). Structural equation modeling supported the influence of BAS on ratings of gain-framed and neutral messages ($\beta(SE)> .26(.05); p<.001$), but the relationships between BIS and loss-framed message ratings were reduced to non-significant values ($\beta(SE)< -.24(.13); p>.06$), while controlling for self-reported PA. **CONCLUSIONS:** Approach motivation may be particularly important in the perception of message content when messages are gain-framed. More work is needed to understand how personality interacts with message content to influence the degree of message processing in the context of physical activity promotion.

1521 Board #196 June 1 9:00 AM - 10:30 AM
Promoting Physical Activity among African Americans through Policy Level Intervention
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Physical inactivity results in nearly \$131 billion of healthcare costs. The American College of Sports Medicine's "Exercise is Medicine Initiative (EIM)" expects healthcare providers (HCPs) to actively promote regular physical activity (PA) to patients in order to prevent many chronic diseases. EIM is especially important for minorities. Disproportionately, African Americans (AAs) are physically inactive. PA is an underused, evidence-based approach to prevent obesity, diabetes, and heart disease. These conditions are extremely frequent among AAs and could be prevented with a program of regular PA. Having policies to encourage PA discussions by HCPs at each clinic visit may actually hold promise because many adults visit their HCPs yearly and patients value PA counseling from their HCPs. The **purpose** of this study is to determine what policies (or lack of policies) are in place to support HCP discussions of PA and whether a policy level intervention can increase the frequency of those discussions in a safety-net clinic in Birmingham, Alabama. **Methods:** A pre-post design has begun at the clinic in three phases: 1) Policy and Baseline Assessments including reviewing all policy manuals for policies that promote PA discussions and interviewing AA patients instantly following their HCP visit for self-reported occurrence of PA discussions, 2) Policy Development and Implementation of a new policy that promotes PA discussions during the HCP visit, and 3) Policy Evaluation including interviewing patients post policy implementation to assess if PA was discussed and obtain HCPs feedback on the policy change. **Preliminary Results** 1) No policies to encourage PA discussions by HCPs were found in policy manuals of the clinic; 2) 39 patients (age range 29-71) were interviewed. Only 5 patients stated that PA was discussed during their clinic visit. We have developed a "PA Discussion" policy to guide PA discussions with patients at each clinic visit. Policy will be implemented in January 2017. We are currently adding EIM assessment questions to the electronic medical record to assess physical inactivity status of patients. Answers to these questions will assist HCP with tailored PA discussions. **Conclusion:** This study will help fill the gap in understanding whether policies to increase PA discussions are needed in this safety net clinic.

1522 Board #197 June 1 9:00 AM - 10:30 AM
Physical Activity Mode and Survival in U.S. Adults
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PURPOSE: Physical activity (PA) is a preventive health behavior that protects against chronic disease as well as premature mortality. Many studies have shown the necessary amounts of PA needed to produce positive health outcomes. However, less is known about the specific modes of PA and health outcomes. Therefore, the purpose of this study was to examine the protective effects of different modes of PA on all-cause mortality in adults. **METHODS:** Data for this research came from the 2001-2002 National Health and Nutrition Examination Survey (NHANES). Participants 18+ years of age who were eligible for mortality linkage were used in the analysis. Different modes of PA were determined from a series of questions asking respondents if they participated in transportation (TPA), home/yard (HPA), moderate recreational (MPA), vigorous recreational (VPA), or muscle strengthening (MSPA) physical activity. Those

respondents answering "yes" to either question were considered participating in that PA mode. Cox proportional hazards regression was used to model the effects of PA mode on mortality while controlling for age, sex, race, and income. **RESULTS:** A total of 5,985 adults were included in this analysis with a mean (median) person-year follow-up of 9.24 (9.83) and 965 deaths. Weighted prevalence estimates for TPA, HPA, VPA, MPA, and MSPA were 24.1% (SE=1.7), 64.0% (1.1), 38.4% (1.5), 52.1% (1.6), and 29.7% (1.7), respectively. Adults were at less risk of mortality if they participated in TPA (Hazard Ratio (HR)=0.72, 95% CI: 0.57, 0.90), HPA (HR=0.43, 95% CI: 0.33-0.55), VPA (HR=0.30, 95% CI: 0.23-0.38), MPA (HR=0.53, 95% CI: 0.45-0.62), and MSPA (HR=0.44, 95% CI: 0.32-0.60). In the unadjusted model, a 37.0% decrease in mortality (HR=0.63, 95% CI: 0.56-0.70) was seen for each additional PA mode adopted. The adjusted model showed a 24.0% decrease in mortality (HR=0.76, 95% CI: 0.67-0.85) for each additional PA mode adopted. **CONCLUSIONS:** Results from this study indicate that various types of PA protect adults from all-cause mortality. Additionally, a dose-response relationship exists between the number of PA modes adopted and risk of mortality.

1523 Board #198 June 1 9:00 AM - 10:30 AM
Physical Activity and Health-Related Quality of Life in Rural U.S. Adults with Chronic Disease
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 (No relationships reported)

PURPOSE: Physical activity (PA) is known to increase health-related quality of life (HRQOL) in adults. However, little is known regarding this association in rural adults suffering from chronic illness. Therefore, the purpose of this study was to examine the relationship between PA and HRQOL in a large-scale population of rural adults with chronic disease. **METHODS:** Data for this study came from the CDC's 2015 Behavioral Risk Factor Surveillance System (BRFSS). A total of N=65,492 rural adults 20+ years of age were included in the analysis. The main outcome variable was HRQOL as assessed by the CDC Healthy Days Index. Adults reporting 13 or fewer unhealthy days were considered to have "good" HRQOL and those reporting 14 or more unhealthy days were considered to have "poor" HRQOL. Adults were categorized as "meeting" PA guidelines if they reported 150+ minutes of moderate-intensity PA per week and "not meeting" PA guidelines if they reported less than 150 minutes. Participants were considered having a chronic disease if they reported ever being told by a health professional that they had diabetes, COPD, cancer, heart disease, a stroke or a heart attack. Multiple logistic regression was used to compute odds ratios (ORs) and 95% confidence intervals (CIs) while adjusting for age, sex, race, and income. SPSS Complex Sampling 24 was used to account for the sampling design. **RESULTS:** Rural adults with at least one chronic disease and meeting recommended levels of PA were significantly more likely to report good HRQOL (72.5%; 70.7-74.3) than their less active counterparts (58.1%; 56.4-59.7, $p<.001$). Those meeting recommended levels of PA had greater odds of good HRQOL regardless of reporting diabetes (OR=1.58; 95% CI: 1.31-1.91), COPD (1.49; 1.20-1.85), cancer (1.79; 1.43-2.22), stroke (1.73; 1.30-2.31), heart disease (1.52; 1.18-1.96), or heart attack (1.68; 1.32-2.15). Additionally, the same increased odds were seen across rural adults reporting 1 (1.59; 1.34-1.88), 2 (1.64; 1.28-2.11), and 3+ (1.52; 1.13-2.05) chronic diseases. **CONCLUSIONS:** Results from this study indicate that meeting recommended levels of PA is strongly associated with optimal levels of HRQOL among rural adults with chronic disease. Health promotion programs should market interventions to rural adults with such diseases to improve HRQOL.

1524 Board #199 June 1 9:00 AM - 10:30 AM
Lifestyle And Socio-Demographic Factors Determining The Coronary-Arterial Disease Risks In Brazilian Free-Living Adults
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PURPOSE: Coronary heart disease (CHD) continues to be a leading cause of morbidity and mortality among adults worldwide. The risk factors include complications of Metabolic Syndrome (MetS) and environmental factors. The Framingham score (FS) is a predictive algorithm developed using categorical variables, allowing the 10-yr prediction of multivariate CHD risk in patients without overt CHD. The purpose is to determine the intrinsic and the involved environmental factors of CHD in free-living adults. **METHODS:** A lifestyle modification program (LSM) involving dietary counseling and regularly supervised physical activity ("Move for Health") has been used here, since 1991 for NCDs primary care. In a cross-sectional study we used the baseline data from 709 subjects (2005-2016), older than 35 yrs. The FS distribution was used as main variable and, as co-variables socio-demographic, behavioral (dietetic and physical fitness) anthropometric and clinical-biochemistry. For

these accomplishments, were used IPAQ(long-version), Healthy Eating Index(through 24h food intake recall), body weight, height and electrical bio-impedance, clinical signs and fasting plasma markers of insulin resistance(HOMA-IR), inflammatory(hs-CRP) and oxidative(MDA and uric acid) states. Statistical comparisons were defined by $p=0.05$. **RESULTS:** The top quartile of FS was found as $\geq 10\%$ for females(F) and $\geq 15\%$ for males(M) and, they differed from the lower quartile ($\leq 3\%$ and $\leq 5\%$, respectively), by presenting 1.81x higher either HOMA-IR, 1.61x hs-CRP and 1.6x MDA values. Prevalence of MetS was 2.6x higher in p75(71.9% F and 73.1%M) than p25(28.1%F and 26.9%M) with p75 being fatter(higher BMI, total body and abdominal fatness) with lower physical activity, lower aerobic capacity, lower either muscle mass and hand grip force. The p75 FS subjects presented also lower schooling and lower income. Their poor diet quality(HEI) was characterized by being more processed foods(higher CHO/fibers and sodium/potassium ratio), higher daily consumption of oils(and PUFAs) and cholesterol and, less amounts of MUFA, fruits and vegetables(and fibers).

CONCLUSIONS: The higher FS(moderate CHD risk) of this community followed markers of the MetS aggravation, having inadequate- dietary quality and physical unfitness as environmental factors.

1525 Board #200 June 1 9:00 AM - 10:30 AM
Is Grip Strength Related to Metabolic Risk Factors and Cardiorespiratory Fitness?

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 (No relationships reported)

PURPOSE: Grip strength is very easy to be measured, and is an index to reflect people's muscle strength. This study aimed at detecting if there are relationships between grip strength and metabolic risk factors and cardiorespiratory fitness.

METHODS: The 1925 people were recruited (men: 1425, female: 490; average age 41.33±9.35 yrs) and finished grip test and 835 of them finished VO_{2max} test. Metabolic risk factors (Total cholesterol (TC), triglyceride (TG), LDC-C, HDL-C, fasting blood glucose) were detected. Grip strength (n=1925) was tested in dominant hand, relative grip strength was calculated (relative grip strength = grip strength(kg)/body weight (kg) × 100), and VO_{2max} (n=835) was measured by YMCA cycle test. The relationship among grip strength, metabolic risk factors and VO_{2max} were analyzed after dividing people into several groups by gender and each age of 10 years (20-29yrs, 30-39yrs, 40-49yrs, 50-59yrs).

RESULTS: 1) Men's grip strength and relative grip strength are larger than women's (grip strength: men: 38.18±7.38kg, women: 22.43±4.68 kg; relative grip strength: men: 54.35±11.55, women: 39.87±8.64), and are negatively related to age (P < 0.01). Men's VO_{2max} is larger than women's (P < 0.01). 2) Relative grip strength of all men is related to TG (P < 0.05), and related to fast blood glucose in men with 30-39yrs and 40-49yrs ($r=-0.129$, P < 0.01; $r=-0.118$, P < 0.01), while grip strength of men is only related to TG in 40-49 yrs ($r=-0.129$, P < 0.05). No relationships in women. 3) In men, VO_{2max} is related to TC and LDC-C ($r=-0.211$, P < 0.05; $r=-0.287$, P < 0.01) in 20-29yrs, and related to TG in 30-39yrs ($r=-0.296$, P < 0.01); in women, VO_{2max} is related to fast blood glucose in 30-39yrs ($r=-0.435$, P < 0.05) and related to TG in 40-49yrs ($r=-0.468$, P < 0.05). 4) There is relationship between men's relative grip strength and VO_{2max} except 40-49yrs group (P < 0.05); no relationship is found in women.

CONCLUSIONS: 1) Grip strength decreased with age, and men's is larger than women's. 2) Relative grip strength may be a predicted factor of metabolic risk and cardiorespiratory fitness (VO_{2max}) for men. 3) VO_{2max} may be a predicted factor of metabolic risk for adults. Supported by Chinese Health Promotion Foundation (CHPF2014-FITEX)

1526 Board #201 June 1 9:00 AM - 10:30 AM
Sedentary Time Adversely Influences the Mental Health of Adolescent Males Residing in a Treatment Facility

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PURPOSE: Emerging research indicates a negative relationship between sedentary behaviors or sitting time and mental health in youth; however, most research designs were cross-sectional, reported small associations, and may or may not have accounted for PA. The purpose of our study was to explore whether increased access to physical activity (PA) opportunities altered PA and sedentary time along with mental health outcomes in adolescent males residing in a treatment facility for sexual health behavior problems. **METHODS:** The sample consisted of nine adolescent males (15

± 1 years; BMI of 25.5 ± 7.2 kg/m²). Accelerometers were used to measure PA levels and sedentary time. The Beck Youth Inventory was used to measure mental health. **RESULTS:** There was a significantly positive correlation between the change in sedentary time and the BDBI-Y (Disruptive Behavior). Recreational therapy free time allotted in the warmer months (16.4 ± 2.6hr-wk⁻¹) was higher than the cooler months (8.2 ± 2.8 hr-wk⁻¹) ($t=52.7$, $p<0.01$); however most participants chose to be sedentary. There was a significant inverse correlation ($r=-0.71$, $p<0.01$) between the change in recreational therapy time and BSCI-Y (Self-Concept). In comparison to norms using the same cut-points, the present study's participants fall within the 10th percentile of total counts per day (TAC: d⁻¹) when matched for sex and average age. Moreover, participants were in the 5th percentile when matched for sex and average age for light physical activity. **CONCLUSION:** The present study supports the importance of structured PA programs and a need to reduce sedentary time and increase light PA for adolescent males living in a treatment facility for sexual health behaviors. **Keywords:** adolescent, physical activity, psychology, special needs populations, health behavior

1527 Board #202 June 1 9:00 AM - 10:30 AM

Effect of High Intensity Intermittent Games-Based Activity on Adolescent Cardio-Metabolic Health

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In adults emerging evidence suggests that games-based activity acutely stimulates anti-inflammatory and inhibits pro-inflammatory cytokine production, proposed to induce cardio-metabolic health benefits. The acute effects of high-intensity intermittent games on adolescent cardio-metabolic health remain unexplored. **PURPOSE:** To examine the effects of an acute bout of games-based activity on adolescent cardio-metabolic health. **METHODS:** Following ethical approval 18 adolescents (12.5±0.6 y) completed an exercise (E) and resting (R) trial in a counter-balanced, randomised crossover design. Following a standardised breakfast (1.5 g·kg⁻¹ bm carbohydrate), participants completed 1 h games-based activity (basketball). Capillary blood samples were taken at baseline, immediately and 1 h post-exercise. A standardised lunch was consumed (1.5 g·kg⁻¹ bm carbohydrate) and capillary blood samples were taken 30, 60 and 120 min post-lunch. A final blood sample was taken the following morning. Capillary blood samples were analysed for blood glucose, plasma insulin and cytokine (IL-6, IL-10, IL-1ra, IL-1β, IL-8 and TNF-α) concentrations. Data were analysed using repeated measures ANOVA and paired sample t-tests in SPSS. **RESULTS:** The blood glucose response to lunch was attenuated following exercise (trial*time interaction, $p=0.008$), with a tendency for a lower peak blood glucose concentration on the exercise trial (E: 5.6±0.7 mmol·L⁻¹, R: 6.3±1.4 mmol·L⁻¹, $p=0.070$). Similarly, the plasma insulin response was attenuated (trial*time interaction, $p=0.002$), with a lower peak plasma insulin concentration on the exercise trial (E: 217.2±29.2 pmol·L⁻¹, R: 366.1±45.3 pmol·L⁻¹, $p<0.001$). IL-6 concentration was higher (E: 4.22±0.80 pg·mL⁻¹, R: 3.46±0.69 pg·mL⁻¹, $p=0.005$) and there was a tendency for TNF-α to be attenuated (E: 1.24±0.22 pg·mL⁻¹, R: 1.34±0.23 pg·mL⁻¹, $p=0.081$) on the exercise trial. Exercise had no effect on the remaining cytokines. **CONCLUSION:** High-intensity intermittent games-based activity attenuated postprandial blood glucose and plasma insulin concentrations, whilst demonstrating an increase in IL-6 concentration, potentially mediating the reduced TNF-α concentrations. Thus high-intensity games-based physical activity elicits cardio-metabolic health benefits in adolescents.

1528 Board #203 June 1 9:00 AM - 10:30 AM

Associations of Aerobic and Strength Exercise with Clinical Laboratory Test Values

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PURPOSE: Physical exercise is known to affect levels of blood-based biomarkers. However, exercise status is generally not considered in the interpretation of common laboratory results. This study examines the associations of habitual aerobic and strength exercise participation with laboratory test results.

METHODS: The effects of self-reported days per week of aerobic and strength exercise participation on laboratory test results for 26 biomarkers in adults aged 18 to 34 years (n = 80,111) were evaluated using percentile distribution analyses and multivariate regression. **RESULTS:** Days per week of self-reported exercise participation was associated with significant shifts in results for most biomarkers evaluated. In both men and women, more days per week of either aerobic or strength exercise were significantly associated with lower levels of glucose, hemoglobin A1c, LDL cholesterol, total cholesterol, triglycerides, estimated glomerular filtration rate,

globulin, and C-reactive protein, and significantly higher levels of HDL cholesterol, creatinine, iron, and percent saturation (all $p < .05$). Exercise frequency had no significant effect on thyroid stimulating hormone levels in men or women. Type of exercise or gender influenced the observed relationships with exercise frequency for total cholesterol, aspartate aminotransferase, gamma-glutamyl transferase, alkaline phosphatase uric acid, bilirubin, and iron binding capacity. **CONCLUSIONS:** Physical exercise participation is associated with levels of many common biomarkers. Both forms of exercise shifted the distribution of results into the direction suggestive of better health, yet the majority of results still tended to fall within reference intervals. Reported relationships may help clinicians and patients to better understand and interpret laboratory results in athletic populations and possibly re-evaluate interpretation of reference intervals for physically active populations.

1529 Board #204 June 1 9:00 AM - 10:30 AM
The Effect Of Acute Muscular Exercise and Training Status On Hepatorenal Functions
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Introduction: Decreased blood flow to vital organs such as liver and kidney during muscular exercise could alter the hepatorenal function. **Purpose:** To investigate the effect of an acute bout of exercise on the hepatorenal function of the athletic and non-athletic adult males and to observe if they respond differently to the same exercise intensity. **Methods:** 20 Male footballers and 19 non-athletes were recruited for this observational study following the inclusion and exclusion criteria. Blood samples were taken pre- and post- 90 minute football matches, from all subjects. The students-t-tests were used to compare values within and between the two groups. **Results:** The baseline serum urea (2.90 ± 0.1 vs 3.77 ± 0.2), and creatinine (70.05 ± 2.3 vs 81.90 ± 3.0) significantly ($P < 0.05$) increase with a significant decrease ($P < 0.05$) in potassium (5.07 ± 0.2 vs 4.26 ± 0.1) and AST activity (26.85 ± 2.1 vs 18.85 ± 1.5) post- exercise in the athletic group. significant ($P < 0.05$) decrease in the baseline serum ALT activity (38.78 ± 3.1 vs 31.84 ± 2.0) post-exercise was observed in the non-athletic group. The post- exercise, serum albumin (49.85 ± 1.0 vs 40.89 ± 1.8), total protein (82.70 ± 1.1 vs 73.26 ± 3.7), urea (3.77 ± 0.2 vs 2.56 ± 0.1), and creatinine (81.90 ± 3.0 vs 55.63 ± 4.8), were significantly higher ($p < 0.05$) in the athletic group compared to the non-athletic. While the ALT activity (22.40 ± 1.2 vs 31.84 ± 2.0) and sodium (137.15 ± 3.0 vs 141.78 ± 0.7) was significantly lower ($p < 0.05$) in the athletic compared to the non-athletic group. However, the post-acute muscular exercise serum ALP, TBIL, CBIL, and bicarbonate showed no significant ($p > 0.05$) difference within and between the groups. **Conclusions:** Acute muscular exercise of same intensity altered hepatorenal function indices of athletes differently from the non-athletes and adaptive response seems to explain this finding.

Key words: Acute muscular exercise - athletic - hepatorenal function

REFERENCES

1. Rahnama, N., Younesian, A., Mohammadion, M., and Bambaiechi, E. (2009). A 90 minute soccer match decreases triglyceride and low density lipoprotein but not high-density lipoprotein and cholesterol levels. *Journal of Research in Medical Sciences.* Nov-Dec; 14(6): 335-341.

1530 Board #205 June 1 9:00 AM - 10:30 AM
Effect Of Exercise On Patients With Concussion
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PURPOSE: To examine the effect of exercise prescription on days from injury to symptom resolution and on days from first clinic visit to symptom resolution among youth with sports-related concussions presenting to a concussion clinic. **METHODS:** Data were retrospectively analyzed using electronic health records from seven concussion clinics at a pediatric hospital in the Midwest. Patients aged 10-17 years with a sports-related concussion (SRC) who presented to the clinics within 30 days post-injury, from May 2015 to May 2016 were included in the study. Youth in the exercise prescription group were prescribed non-contact exercise before symptom resolution while youth in the comparison group were prescribed exercise at or after symptom resolution. Unadjusted and adjusted generalized linear regression models were used to model the effect of active exercise prescription on days to symptom resolution, adjusting for age, sex, history of previous concussion, days from injury to initial visit, and symptom score at time of injury. **RESULTS:** Of 357 (male=229, female=128) concussed youth included, 204 (57.1%) were in the exercise prescription group and 153 (42.9%) were in the comparison group. The median symptom score (SS) at injury was 37 [interquartile range (IQR): 29.5] for the exercise prescription group and 36 (IQR: 32.0) for the comparison group. No statistically significant differences were observed in SS at injury ($p=0.4719$), SS at

initial clinic visit ($p=0.4146$), or days from injury to initial clinic visit between the two groups ($p=0.3725$). The median of symptom resolution for youth in the exercise prescription group was 16 days, which was statistically significantly longer than youth in the comparison group (median=12 days, $p=0.0192$) after adjusting for other covariates. However, no statistically significant difference was found in days from first clinic visit to symptom resolution between the two groups ($p=0.1118$). **CONCLUSIONS:** Prescription of exercise during recovery from concussion did not shorten the duration of symptoms from time of injury, however it did not lengthen the time to recover from concussion when measured from the first physician visit. Further research with prospective design is warranted to evaluate the effect of non-contact exercise prescription on concussion recovery among youth.

1531 Board #206 June 1 9:00 AM - 10:30 AM
Mechanisms for Balance Improvement in Tai Chi Intervention Trials: A Systematic Review
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The literature on the mechanisms by which Tai Chi interventions improve balance is limited and divergent. **PURPOSE:** To systematically review the literature on Tai Chi trials aimed at improving balance to gain insight into the mechanisms that mediate the reported balance improvements. **METHODS:** Database searches identified 26 randomized control Tai Chi trials with the purpose of improving balance that proposed and/or measured mechanism(s) among older adults (≥ 60 yr). **RESULTS:** Qualifying Tai Chi trials ($n=26$) proposed and/or measured 10 different mechanisms and used 19 different balance assessments. Nearly three quarters (71.3%) of the trials reported significant improvements in balance. Sensory function was the most commonly reported mechanism to improve balance ($n=14$, 53.8%). However, the majority ($n=11$, 78.6%) of these did not measure sensory function. The three trials (21.4%) that measured sensory function (i.e., proprioception) with peripheral mechanoreceptor acuity assessments chose balance measurements not designed to challenge sensory function. Furthermore, none of these three trials observed significant improvements in balance and sensory function simultaneously. Neuromuscular function was the second most commonly reported mechanism to improve balance ($n=11$, 42.3%). The majority ($n=10$, 90.9%) of these did not measure neuromuscular function. The one trial that measured neuromuscular function (i.e., muscle reaction time) with electromyography, selected balance measurements designed to challenge neuromuscular function (i.e., the Timed Up and Go Test). This trial also found significant improvements in both balance and neuromuscular function. **CONCLUSION:** The mechanisms by which Tai Chi interventions improve balance remain elusive because: 1) most trials (61.5%) do not measure the mechanism proposed to be the mechanism for balance improvement; and (2) when the proposed mechanism was measured, trials rarely chose balance measurements that matched the proposed mechanism. Future Tai Chi trials aimed at improving balance are needed that align the proposed mechanism with the appropriate balance measurement so that the mechanisms by which Tai Chi improves balance can be identified.

1532 Board #207 June 1 9:00 AM - 10:30 AM
Short-term Effectiveness Of Home Based Exercise To Change Lifestyle In Not Communicable Disease
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PURPOSE Supervised exercise has shown remarkable effectiveness, but is associated to poor compliance at long term. In this study, we aimed to verify whether a home-based exercise program is effective in physical fitness related to health parameters management of a cohort of breast cancer survivors. **METHODS** Experimental cohort observational study. We enrolled 13 women (age 49.1 ± 5.5 , height 163 ± 7.3 cm) survivors to a breast cancer. At baseline were assessed the lifestyle in term of physical activity with accelerometer (Sensewear Bodymedia) and physical fitness related to health in term of aerobic capacity by 6 Minutes Walking Test (6MWT), flexibility (Sit & Reach), grip and lower limbs strength (Hand Grip and 30" Chair Test) and body composition (anthropometrics parameters, skinfold thickness and bio impedance). Home based exercise was prescribe for 40 days with two target: - Fast walking activity in terms of weekly session, minutes per session and intensity with heart rate, rate of perceived exertion (CR10) and steps per minute; - Individually daily steps target Parameters of physical fitness related to health before and after 40 days of unsupervised exercise were compared (t-test for paired data). **RESULTS** At baseline (T0), patients displayed a moderate level of physical activity (PAL=1.5±0.1, daily steps=8569.3±2107.1) and were overweight (BMI=26.5±3.6 kg/m²). After 40 days of

unsupervised exercise (T1), we observed improvement of all analyzed parameters with statistical significance in waist circumference (T0=92.4±8.5 cm, T1=89.5±7.9 cm; $p<0.01$), distance walked in 6 MWT (T0=445.4±168.1 m, T1=534.6±151.5 m; $p<0.05$), 30'' Chair test (T0=14.8±5.6 rep, T1=16.3±4.9 rep; $p<0.05$). **CONCLUSION** Home-based unsupervised exercise in breast cancer survivors yielded short-term efficacy in all analyzed parameters. To change the lifestyle in terms of physical activity it is necessary to create a model that allows long-term therapeutic efficacy. Unsupervised approach, in comparison with supervised one, allow a reduction of the cost related to the treatment of not communicable disease with exercise therapy. Efficacy at long-term and a possible effect in reducing the risk of tumor relapse remain to be elucidated in larger cohorts with longer and multidisciplinary follow up.

1533 Board #208 June 1 9:00 AM - 10:30 AM
Implementation of a Veteran Group-Based Aquatic Program Using an Individualized Varied Intensity Protocol

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 (No relationships reported)

Aquatic exercise has been proven to be an effective modality for improving health, physical fitness, daily living, and quality of life. The aquatic environment is particularly beneficial for individuals finding weight bearing difficult due to joint pathology, increased fall risk, or other conditions restricting or limiting weight based exercise. **PURPOSE:** To validate a group based aquatic exercise program used by Veterans at Canandaigua's VA Medical Center. **METHODS:** 7 Male Veterans (age = 68.71±10.75) medically cleared and referred for supervised exercise by their primary care provider and who volunteered or were recommended by Exercise Physiology staff participated in the aquatic exercise program. All participants were taught how to progress, regress, or modify exercises based on their individual need. This individualized strategy, coupled with a cardio-respiratory stage training protocol, facilitated a safe and effective exercise program in a group setting. Baseline and annual testing to measure physical abilities and improvements were done via the 10-meter walk, 30-second chair stand, and the 8-foot up and go. Health based testing consisted of Pre/Post weight, abdominal circumference, and blood pressure. Additionally, health surveys regarding falls and participant satisfaction were administered during each Pre/Post test. **RESULTS:** Participants had a mean weight reduction of 22.93 lbs ($p=0.10549$), 1.79 inch decrease in abdominal circumference ($p=0.2823$), 15% reduction in systolic blood pressure ($p=0.0411$), 12% reduction in diastolic blood pressure ($p=0.08556$), 2.047 sec. improvement on gait speed via 10 meter walk ($p=0.00239$), 6.72 rep improvement for 30 sec. chair stand ($p=0.1899$), 1.698 sec. improvement on 8-foot up and go ($p=0.00396$), 28.6% improvement in reported falls from baseline, and a program satisfaction rating of 96%. **CONCLUSION:** Significant improvements in both health and fitness-based testing results were observed. These outcomes are known to prevent, reduce, or treat a vast array of chronic diseases and disabilities, improve functional capacity, and reduce all-cause mortality rates. Our results support previous research and demonstrate the effectiveness of an individualized and progressive group-based aquatic exercise program for the Veteran population.

C-42 Exercise is Medicine®/Poster -
EIM - Psychological Aspects, Bone, Muscle and Cartilage

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1534 Board #209 June 1 9:00 AM - 10:30 AM
Strength Training In Patients With Schizophrenia: Effects On Muscle Force Generating Capacity

Mona Nygård¹, Mathias F. Brobakken¹, Ismail Cüneyt Güzey¹, Gunnar Morken¹, Einar Vedul-Kjelsås¹, Eivind Wang¹, Jørn Heggelund². ¹The Norwegian University of Science and Technology, Trondheim, Norway. ²St. Olav's University Hospital, Trondheim, Norway.
 (No relationships reported)

Patients with schizophrenia are inactive, have impaired physical function and slowed performance in motor tasks. As a countermeasure, maximal strength training (MST) with high load and few repetitions improves muscle force generating capacity and physical function during daily activities. **PURPOSE:** Investigate the effect and feasibility of MST as a part of standard clinical treatment of patients with

schizophrenia. **METHODS:** 11 male and 6 female outpatients (37±10(SD) yrs, ICD-10 schizophrenia, schizotypal or delusional disorders (F20-F29)) were randomized to either a training group (TG), performing leg press MST (4 repetitions, 4 sets, at ~90% of one repetition maximum (1RM)) twice a week for 12 weeks at the hospital exercise training clinic, or a control group (CG) following traditional guidelines for physical activity. **RESULTS:** 5/9 patients in the TG completed >85% of the training and were included in the statistical analysis. After MST, 1RM and muscle rapid force development (work/time with a load ~70% of 1RM) increased 43% (233±35 to 333±50 kg, $p<0.05$) and 36% (408±108 to 555±137 Nm·s⁻¹, $p<0.05$), respectively. These improvements in muscle force generating capacity were ~twofold larger ($p<0.05$) compared to the CG which had improvements of 23% in 1RM (188±66 kg to 232±89 kg, $p<0.05$) and 16% in rapid force development (391±223 to 454±227 Nm·s⁻¹, $p<0.05$). **CONCLUSIONS:** MST yielded larger improvements in functionally relevant muscle force generating capacity compared with conventional treatment, and suggest that MST should be implemented as a part of standard clinical practice for optimal exercise rehabilitation benefits.

Supported by grants from the Norwegian ExtraFoundation for Health and Rehabilitation, The Liaison Committee between the Central Norway Regional Health Authority and the Norwegian University of Science and Technology, and The Norwegian Directorate of Health.

1535 Board #210 June 1 9:00 AM - 10:30 AM
Exercise As An Augmentation To Antidepressant Treatment For Depression: Results From A 12-week Pilot Intervention Study

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 (No relationships reported)

PURPOSE: To examine the efficacy of aerobic exercise to augment anti-depressant effects of a 12-week Venlafaxine trial to treat Major Depression in older (60-79 yrs.) and younger (20-39 yrs.) adults.

METHODS: Participants included adults with Major Depression. All participants were sedentary (<20 minutes exercise 3 times per week), had no contraindications for aerobic exercise, were cognitively unimpaired, and were eligible to undergo an MRI. Participants were randomized to a 12-week trial of Venlafaxine only or Venlafaxine + Aerobic Exercise. All participants met with a clinician biweekly for medication management. The exercise group additionally received 1 hour of supervised aerobic exercise 3 times per week for 12-weeks. All participants completed cardiorespiratory fitness testing ($VO_{2\text{submax}}$) and the Montgomery-Asberg Depression Rating Scale (MADRS) at baseline and follow-up.

RESULTS: Twelve participants were randomized, but two dropped out (one from each group). The resulting sample included 10 adults (mean age = 38.7, 40% male, 90% Caucasian). At baseline, participants had a mean MADRS score of 26.10 (5.04) and a mean estimated $VO_{2\text{submax}}$ of 29.61(6.01). Across both groups, there was a decrease in depressive symptoms over 12-weeks ($t=6.60$, $p<0.001$). The Venlafaxine only group (N=5) showed a mean decrease of 16 points on the MADRS and the exercise group (N=5) showed a mean decrease of 19.8 points. The exercise group showed a mean increase of 4.74% (SD =12.11%) in fitness, while the Venlafaxine only group showed a mean decrease of 8.71% (SD = 17.05%) ($p=0.20$). There was a negative association between change in fitness level and change in depressive symptoms ($r=-0.71$, $p=0.03$). The trajectories of change in depressive symptoms across the treatment groups did not differ (MADRS x Treatment $F=0.112$ $p=0.75$). The exercise and no-exercise group showed the same trajectory of changes in depressive symptoms over the first 4 weeks, but the exercise group showed more consistent decline than the Venlafaxine only group for the last 2 months.

CONCLUSIONS: Participants showed improvement in depression symptoms across both treatment groups. Change in fitness was negatively associated with change in depressive symptoms, suggesting a dose-response effect of exercise on depressive symptoms.

Supported by NIH Grant: P30 MH90333

1536 Board #211 June 1 9:00 AM - 10:30 AM

Cardiovascular Disease Risk Profile in Patients with Schizophrenia

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Poor physical health is a growing concern in patients with schizophrenia. Peak oxygen uptake ($\dot{V}O_{2peak}$) is recognized as a strong predictor of cardiovascular mortality, but cardiovascular risk profiles including $\dot{V}O_{2peak}$ are scarce in this population.

PURPOSE: To assess a risk profile from several key variables for development of cardiovascular disease and premature death.

METHODS: We investigated the physical health in 22 patients, 14 men (37±9 (SD) years) and 8 women (37±10 years), diagnosed with schizophrenia (ICD-10, schizotypal or delusional disorders; F20-F-29). Measurements included included state of the art direct assessment of peak oxygen uptake on a treadmill, physical activity assessment from accelerometers, BMI, waist circumference, blood pressure, as well as lipid profiles obtained from blood samples.

RESULTS: $\dot{V}O_{2peak}$ was 35.3±9.5 mL·kg⁻¹·min⁻¹ (men) and 24.9±7.5 mL·kg⁻¹·min⁻¹ (women), and this was 19% and 35% lower, compared with reference data for healthy men and women, respectively. BMI (27.4±6.5) and waist circumference (111.8±17.4) revealed that the patients were classified as overweight. Additionally, BMI ($r=-0.863$; $p<0.001$) and waist circumference ($r=-0.868$; $p<0.001$) correlated negatively with $\dot{V}O_{2peak}$. Steps per day (6124±3845), counts per minute (477.0±203.4), LDL/HDL-ratio (2.67±1.41) and systolic/diastolic blood pressure (127.5±10.7/82.7±10.9 mmHg) were not associated with $\dot{V}O_{2peak}$.

CONCLUSION: Taken together, our data show that patients with schizophrenia are high at risk for developing cardiovascular disease, and are strengthened by utilization of direct assessment of $\dot{V}O_{2peak}$ in the risk profile determination.

Supported by grants from the Norwegian ExtraFoundation for Health and Rehabilitation, The Norwegian Directorate of Health, The Liaison Committee between the Central Norway Regional Health Authority and the Norwegian University of Science and Technology.

1537 Board #212 June 1 9:00 AM - 10:30 AM

Moderators Of Exercise Training Effects On Depressive Symptoms In Multiple Sclerosis: A Meta-regression Analysis

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Depressive symptoms are prevalent and debilitating among people with MS (PwMS). Though exercise training has demonstrated small-to-moderate antidepressant effects among PwMS, less is known about factors which influence the positive effects of exercise.

Purpose: To examine the extent patient and trial characteristics moderate the antidepressant effects of exercise among PwMS.

Methods: Twenty-four effects were derived from 14 articles published before August 2016 located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 624 PwMS and included randomization to exercise training or a control condition that lacked exercise and measurement of depressive symptoms at baseline and at mid- and/or post-intervention. Hedges' *d* effect sizes were computed, study quality was assessed, and random effects models were used for all analyses. Meta-regression quantified the extent to which patient and trial characteristics moderated the estimated population effect.

Results: Twenty-one effects (87.5%) were larger than zero. PEDRO scores ranged from 4-7 with a mean of 5.79±0.80. Exercise training significantly reduced depressive symptoms by a heterogeneous mean effect delta (Δ) of 0.55 (95%CI: 0.31-0.78; $p<0.001$). The effect was moderately consistent across studies ($I^2=59.9\%$, 95%CI: 49.6%-68.1%). Significant improvement in fatigue moderated the overall mean effect ($\beta=0.37$; $p<0.03$). Significantly larger antidepressant effects resulted from trials in which exercise significantly improved fatigue ($\Delta=1.04$, 0.53-1.55; $k=8$) compared to trials in which fatigue was not significantly improved ($\Delta=0.41$, 0.21-0.60; $k=14$; $z=2.91$, $p<0.004$). Age ($\beta=0.32$), disease severity ($\beta=0.05$), exercise program length ($\beta=0.26$), and exercise session duration ($\beta=0.13$) were not significantly related to effect size (all $p>0.15$).

Conclusions: Exercise significantly improves depressive symptoms among PwMS. Exercise-induced improvements in fatigue significantly moderated exercise effects on depression. Future trials may benefit from focusing on using exercise to concurrently improve depression and fatigue as a symptom cluster.

1538 Board #213 June 1 9:00 AM - 10:30 AM

Effect Of 24-weeks Low Vs High Intensity On Anxiety, Depression And Self-esteem In Obese Adolescents

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Purpose: To compare the effects of low vs. high intensity training on symptoms of anxiety and depression as well as on self-esteem in obese adolescents. **Methods:** Sixty-two obese adolescents (age=15.03±1.48; BMI=34.87±4.22 kg/m²) were randomized into high intensity training (HIT, n = 31) or low intensity (LIT, n = 31) groups for 24 weeks. All participants also received the same nutritional, psychological and clinical counseling. Pre- and post-intervention symptoms of depression, anxiety and self-esteem were assessed by questionnaires and body composition by DXA. Statistical analysis was conducted using mixed models for repeated measures and effect size (Cohen's *d*). **Results:** Depressive symptoms were reduced in both groups ($p = 0.006$) with higher effect size to HIT ($d = 1.16$) compared to LIT ($d = 0.45$). Trait anxiety were reduced in HIT ($p = 0.002$; $d = 0.81$) and LIT ($p = 0.002$; $d = 0.31$). No changes were observed for self-esteem and anxiety state.

Table 1. Effect of low vs high intensity training on self-esteem, depressive and anxiety symptoms in obese adolescents.

	Baseline (n=28)	24 weeks (n=28)	P values		
			G	T	GXT
BDI					
HIT	19.86±7.75	12.29±5.69*	0.77	<0.01	0.40
LIT	18.86±8.44	14.85±10.14*			
RSES					
HIT	19.79±6.25	21.69±4.33	0.82	0.11	0.60
LIT	20.71±5.05	21.46±4.54			
STAI-State					
HIT	41.07±11.26	38.00±13.26	0.85	0.21	0.81
LIT	39.79±10.48	38.54±13.16			
STAI-Trait					
HIT	45.71±9.49	37.43±11.37*	0.92	<0.01	0.21
LIT	43.86±8.34	40.92±11.12*			

BDI: Beck Depression Inventory; STAI: Spielberger State-Trait Anxiety Inventory; RSES: Rosenberg Self-Esteem Scale; HIT: High Intensity Training group; LIT: Low Intensity Training group; *vs baseline ($p<0.05$); G: group; T: time.

Conclusion: The results from the present study suggested that in obese adolescents the positive changes in psychological outcomes are independent of the intensity of exercise training. Supported by CNPq (grant 477955/2009-6) and FACEPE (grant 0928-4.9/08)

1539 Board #214 June 1 9:00 AM - 10:30 AM

Social And Environmental Determinants Of Physical Activity And Dietary Choices In Adolescents With Intellectual Disabilities.

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Purpose: The prevalence of obesity is higher in those with intellectual disabilities than the general population. The aim of the study was to understand the determinants of physical activity and dietary patterns in this population during their final year of school.

Methods: Participants were recruited from four additional support needs (ASN) schools in the Greater Glasgow and South Lanarkshire area of Scotland. Qualitative data were generated from 10 interviews with adolescents with mild-moderate intellectual disabilities. A phenomenological approach was utilised to explore their perceptions of factors influencing their lifestyle behaviours. Transcripts were analysed

for recurrent themes relating to PA and diet using a deductive thematic analysis, employing Self-Determination Theory (SDT) as a theoretical framework. Themes were identified based on the explicit meanings of the data, until the point of saturation.

Results: Three major themes, each with two respective sub-themes, were identified as influencing participants' engagement with PA and dietary choices. These were: 1) situatedness (sub themes: school culture and family/home culture); 2) motivation (sub themes: self-efficacy and social connectedness); and 3) wider environmental influences (sub themes: weather and availability and price). Overall, the school and home environments were found to have the strongest influence on participants' lifestyle behaviours, but in very distinct and often conflicting ways. School structure, high self-efficacy, and social connectedness facilitate increased physical activity and healthier diet in adolescents with intellectual disabilities, whereas home life, low self-efficacy and a lack of social connectedness can serve as a barrier to PA and a healthy diet.

Conclusions: Adolescents' environment and social interactions play a pivotal role in influencing physical activity and dietary patterns. These findings suggest that influences on the young people in this population's PA and dietary patterns are multifaceted and complex in nature.

The study was funded by the Baily Thomas charitable fund.

1540 Board #215 June 1 9:00 AM - 10:30 AM
Does Adipose Tissue Mass Positively Or Negatively Influence BMD In An Overweight Or Obese Population? A Systematic Review And Meta-Analysis

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(No relationships reported)

PURPOSE: To quantify the relationship between adipose mass (absolute and relative) and bone mineral density (BMD) in over-weight and obese populations.

METHODS: The protocol for this review was designed in accordance with PRISMA guidelines. An electronic search of the literature was undertaken using three databases (Medline, Embase and Science Direct) and supplemented through screening the reference lists of retrieved and review articles. Outcome measures included a measure of adipose mass (kg or %BM) and BMD (g cm⁻²) of the total body, lumbar spine, total femur or femoral neck from overweight and obese individuals. A multi-level meta-regression model was used to obtain pooled estimates of the magnitude and direction of reported correlations, whilst investigating the effect of potential moderators (sex, age and BMI class). The protocol was prospectively registered in PROSPERO (CRD42015024313).

RESULTS: Sixteen studies, including 2587 participants and 75 correlation coefficients were included. Opposing relationships between BMD and adiposity, expressed as an absolute or relative quantity, were reported. Absolute adiposity was positively correlated and relative adiposity was negatively correlated with BMD. Sex and age were the primary moderators of these relationships, as a significant negative correlation between relative adipose mass and BMD was shown in men (R=-0.37; 95%CI: -0.57, -0.12) and in those aged <25 years (R=-0.28; 95%CI: -0.45, -0.08).

CONCLUSIONS: Increasing levels of adipose mass exert a negative influence on BMD, but only when considered relative to total body mass. These results highlight the importance of optimising body composition over weight loss *per se*, which is particularly relevant in men and younger individuals. In order to protect bone mass in overweight and obese populations, exercise and nutrition based interventions that focus on a controlled reduction of adipose mass with concomitant preservation of lean mass are required.

1541 Board #216 June 1 9:00 AM - 10:30 AM
Influence of Yi-Jin-Jing Training on Sex Hormones and Bone Density among Chinese Older Women

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(No relationships reported)

PURPOSE: Yi-Jin-Jing, one common mind-body Chinese tradition exercises, is not or very little studied for being potentially utilized to treatment of bone-related disorders. The primary purpose of this randomized clinical study was to assess the effectiveness of Yi-Jin-Jing training on changes of the sex hormones and bone mineral density in Chinese older women.

METHODS: Twenty-four older women between 60-69 years old were recruited from the urban tertiary of Shanghai, China. After signing the informed consent, subjects were randomly assigned into two groups: non-exercise control group (n=12) and Yi-

Jin-Jing training group (n=12). All exercise groups were trained five days per week, sixty minutes of duration for three months with Yi-Jin-Jing exercise, while control group maintained the regular daily life with no exercise. Height, body weight, BMI, bone mineral density (BMD), and female sex hormones (E2, T, FSH, and LH) were measured and analyzed. SPSS for Windows 18.0 was used for the statistical analyses and a significant level was set at P≤0.05.

RESULTS: No statistically significant differences in age, height, body weight, and BMI were observed between Control and Yi-Jin-Jing groups. After three-month intervention, subjects in Control experienced decreases in BMD of all measured parts and total BMD with a statistically significant decrease in pelvis BMD; while women in Yi-Jin-Jing increased BMD in all measured parts with significant increases in trunk and total body BMD. Compared with Control, Yi-Jin-Jing-trained individuals had high BMD changes of the mean difference in trunk, pelvis, and total body. There were no significant changes of E2, T, FSH, and LH in Control; however, Yi-Jin-Jing-trained subjects had significant E2 increases and significant FSH decreases. There was a significant positive correlation between E2 and BMD (r=0.529, P=0.008) and between T and BMD (r=0.429, P=0.036). FSH showed a significant negative association with BMD (r=-0.576, P=0.003).

CONCLUSIONS: Our study indicated that Yi-Jin-Jing training may delay older women's BMD decline, especially in trunk and pelvis. It may influence positively on the increased E2 and T levels and the decreased FSH level. Further research is needed to confirm if Yi-Jin-Jing provides protective benefits to bone health for older adults.

1542 Board #217 June 1 9:00 AM - 10:30 AM
Copenhagen Sarcopenia Study - Time To Implement Assessment Of Muscle Mass And Muscle Function As A Clinical Target

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(No relationships reported)

Copenhagen Sarcopenia Study - Time to implement muscle mass and muscle function as a clinical target

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Purpose:

Despite the lack of consensus on the diagnostic criteria for sarcopenia, the combination of low muscle mass, muscle strength and function are important risk factors for disability, frailty and mortality in older individuals, as well as a wide range of patients with muscle loss. Consequently, reliable methods are therefore needed to implement routine clinical evaluation tools that allow for effective diagnostics and treatment of sarcopenia.

Methods

Participants from the Copenhagen City Heart Study were included to establish a Danish reference material (Copenhagen Sarcopenia Study) on muscle mass characteristics (Appendicular Skeletal Muscle (ASM), iDXA, GE Lunar), muscle strength, (hand grip strength, Jamar dynamometer and Leg extension power, Nottingham Power Rig) and functional ability (30 sec Chair Rise Test (CRT) and 10 m maximal walking speed).

Results

1305 subjects, (732 women and 573 men) 20-89 years were included. Compared to women, men had larger ASM (26,5 kg vs 18,2 kg; p< 0.05), BMI (26,9 kg/m² vs 24,8 kg/m²; p< 0.05), ASM/BMI (1,02 vs 0,75; p< 0.05), muscle power (3393 w vs 2535 w; p< 0.05) and HGS (46,8 kg vs 29,5 kg p< 0.05). In contrast there was no difference in CRT (21,2 vs 20,4; p< 0.05) and WS (4,5 s vs 5,0 s; p< 0.05). With increasing age, ASM (r=-0.306 and r=-0.432; p< 0.05), leg extension power (r=-0.186 and r=-0.423; p< 0.05) and CRT (r=-0.405 and r=-0.414p< 0.05) declined in both women and men, respectively.

Conclusions

Adequate reference materials are needed to identify individuals with low muscle mass, reduced muscle strength and impaired functional capacity, in line with the current assessment of bone mineral density. Effective diagnosis of low muscle mass and parallel impairments in muscle function will enable early targeted treatments to be initiated guided by relevant diagnostic tools.

1543 Board #218 June 1 9:00 AM - 10:30 AM
Effects of Well-Rounded Exercise Training on Cartilage Metabolism in Females without Radiologically Knee Osteoarthritis

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PURPOSE: The population with osteoarthritis (OA) is increasing due to the aging society. Maintenance of healthy cartilage is essential for prevention of OA. Physical exercise is highly recommended for OA patients because of clear evidence that it reduces pain and enhances physical function of joints with OA. For older adults, exercise prescription ideally includes aerobic, muscle strengthening, and flexibility exercises. However, effects of the exercise intervention on preosteoarthritic cartilage remain unclear. This study was aimed to evaluate the effects of well-rounded exercise training on cartilage metabolism using systemic biomarkers in females without radiologically knee OA.

METHODS: A combination of aerobic, resistance (mainly for quadriceps and hamstrings), flexibility, and balance exercise trainings was assigned to 23 female subjects [mean age 57.9 (49 to 68), mean BMI 21.8 (18.6 to 24.7)] without radiologically knee OA (Kellgren-Lawrence grade \leq 1) for 90 minutes once a week during 12 weeks under supervision. The subjects were followed up during the subsequent 12 weeks. Blood and urine samples were collected at 0, 1, 2, 4, 8, 12, 16, 20, and 24 weeks from the initiation of intervention. Whereas type II collagen carboxy-propeptide (CPII) and cartilage oligomeric matrix protein (COMP) were measured using serum by enzyme-linked immunosorbent assay (ELISA), collagenase-generated neopeptide of type II collagen (C2C) and carboxy-telopeptide of type II collagen (CTX-II) were evaluated using urine by ELISA.

RESULTS: One week after the initiation of the training, type II collagen degradation evaluated by CTX-II dropped down to lower levels, and thereafter maintained the levels by the final follow-up. Compared with the baseline, a significant decrease in CTX-II levels was found at 1, 2, 4, 8, and 24 weeks. Similarly, type II collagen cleavage evaluated by C2C reduced immediately after the exercise intervention, and reached the significantly low levels at 12, 20, and 24 weeks. Type II collagen synthesis evaluated by CPII and a cartilage degradation marker COMP had no appreciable changes during the whole period of intervention and the subsequent follow-up.

CONCLUSIONS: Well-rounded exercise training could decrease type II collagen degradation in females without radiologically knee OA.

C-43 Free Communication/Poster - Fat Metabolism and Exercise

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1544 Board #219 June 1 8:00 AM - 9:30 AM
Fat Oxidation and Aerobic Fitness in Postmenopausal Women: Comparing an Exercise Intervention to Long-Term Exercise

Andrew W. Froehle¹, Margaret J. Schoeninger², Susan R. Hopkins³. ¹Wright State University, Dayton, OH. ²University of California, San Diego, San Diego, CA. ³University of California, San Diego, School of Medicine, San Diego, CA. (Sponsor: Drew Pringle, FACSM)

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Menopause is related to reduced fat oxidation capacity, limiting energy for submaximal activity, contributing to earlier fatigue, reducing aerobic performance and making physical activity more difficult. Exercise interventions can increase fat oxidation in sedentary postmenopausal women, but the degree to which this enhances aerobic performance is unknown. It is also unclear if postmenopausal interventions generate fat oxidation and fitness levels similar to women who are physically active before, during, and after menopause. **PURPOSE:** To evaluate the effects of exercise on fat oxidation and aerobic fitness in postmenopausal women by comparing a short-term intervention in sedentary women to long-term exercisers. **METHODS:** Two cohorts were studied for 16 weeks: 1) Active cohort (N = 13), exercised > 5 hr/wk for \geq 10 years; 2) Training cohort (N = 14), sedentary, completed 16-week, 1000 MET-min-week⁻¹ intervention. Gas exchange was measured at rest and during cycle ergometer maximal exercise

tests. Fat oxidation was calculated from RER at rest and during warmup and exercise phases of the cycle test. Fitness variables were workloads and oxygen consumption at ventilatory threshold (workload_{VT}, VO_{2VT}) and maximal exertion (workload_{MAX}, VO_{2MAX}). Body composition was measured with DXA to normalize O₂. **RESULTS:** At baseline, compared to the Active cohort, the Training cohort had less fat-free mass (P = 0.04), used 15.7% less fat energy at rest (P = 0.02) and 9.7% less fat energy during warmup (P = 0.02), had a 46 W lower workload_{MAX} (P < 0.01), 3.6 ml O₂·kg_{FPM}⁻¹·min⁻¹ lower VO_{2VT} (P < 0.01), and 8.2 ml O₂·kg_{FPM}⁻¹·min⁻¹ lower VO_{2MAX} (P < 0.01). At 16-weeks the Active cohort's values did not change, but the Training cohort increased fat energy during warmup (+12%; P = 0.02), workload_{VT} (+9 W; P < 0.01), workload_{MAX} (+16 W; P < 0.01), and VO_{2MAX} (+2.6 ml O₂·kg_{FPM}⁻¹·min⁻¹; P < 0.01). At 16 weeks the cohorts differed for fitness, but did not differ for fat energy during warmup (P = 0.25). Change in fat oxidation was not correlated with change in aerobic fitness. **CONCLUSION:** Exercise interventions improve fat oxidation and aerobic fitness in sedentary postmenopausal women. Increased fat oxidation approaches the level of long-term postmenopausal exercisers, but fitness gains are not as marked and are not explained by increased fat oxidation.

1545 Board #220 June 1 8:00 AM - 9:30 AM
Change in Maximal Fat Oxidation in Individuals in Response to Different Regimes of High Intensity Interval Training (HIIT)

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(No relationships reported)

INTRODUCTION: Increased capacity for fat oxidation (FatOx) is widely reported (Talanian et al. 2007; Burgomaster et al. 2008) in response to high intensity interval training (HIIT). However, most of these data was obtained in studies in which a non-exercising control group (CON) was not used. Based on the widespread variability in FatOx reported (Crocini et al. 2014), it is unknown if these previously-reported increases in FatOx are real or a product of day-to-day variability in the measure.

OBJECTIVE: To examine changes in FatOx and maximal fat oxidation (MFO) in response to 20 sessions of HIIT varying in structure in active men and women.

METHODS: Thirty-nine active men and women (age and VO_{2max} = 22.5 ± 4.4 yr and 40.0 ± 5.6 mL/kg/min) completed progressive HIIT, and 34 men and women matched for body fat and VO_{2max} served as a non-exercising control group (CON). Ten sessions of low volume HIIT (8 – 10 1 min bouts at 90 – 110 % peak power output separated by 75 s recovery) were performed on a cycle ergometer after which subjects were randomly assigned to complete 10 additional HIIT sessions consisting of sprint interval training (SIT), high-volume HIIT, or periodized HIIT. After an overnight fast and 24 h dietary standardization, individuals underwent progressive cycling to exhaustion before, midway, and post-training to assess MFO, FatOx and carbohydrate oxidation (CHOOx).

RESULTS: Results showed no effect of training on MFO (p = 0.11) although small increases in FatOx equal to an additional 4.3 g of fat were evident (p = 0.03). Individual responses in MFO occurred as 33 % of participants revealed meaningful increases in MFO from pre- to post-HIIT, and there was a significant inverse association between baseline MFO and the training-induced change, r = -0.46, p = 0.004. There was no time X training interaction for CHOOx (p = 0.31) suggesting a similar response of CHOOx to HIIT versus CON.

CONCLUSIONS: Data refute previously-reported increases in MFO in response to HIIT (Astorino et al. 2013), although participants with low initial MFO tended to show meaningful increases in MFO with training. We recommend that scientists use a non-exercising control group to certify that the frequently-reported increase in FatOx attributed to HIIT is indeed a result of training and not due to marked variability in the measure.

1546 Board #221 June 1 8:00 AM - 9:30 AM
Effects of Exercise on FGF-21 Pathway Functions in Hepatic Lipid Metabolism

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(No relationships reported)

Fibroblast growth factor 21 (FGF-21) is recently known as an important factor controlling lipid metabolism in liver. Regular exercise is helpful to fat loss in obese individuals, however, whether exercise can promote fat oxidation by activating FGF-21 pathway functions has not been clearly explained.

PURPOSE: To investigate the effects of aerobic and resistant exercise on blood lipid profiles and the functions of hepatic FGF-21 pathway in obese mouse.

METHODS: Thirty male obese mice were randomly assigned into control group (CON, n=10), aerobic exercise group (AE, n=10), and resistant exercise group (RE, n=10). AE group ran on a treadmill for 8 weeks, 5 days/week, the running speed was started at 15 m/min in week 1 and increased by 1.5 m/min per week until 25 m/min in week 8. The exercise time was increased from 20 to 60 min accordingly. RE group completed an 8-week resistant exercise program by climbing on a ladder. The mice were trained once in every two days, and the load was adjusted according to their exercise capacity in each time. Blood samples and liver tissues (right lobe) were collected after the last training session for 24 hours.

RESULTS: The body mass of CON (765.7±41.8 g) was greater than that of AE (651.4±42.1 g) and RE (687.6±39.8 g) after exercise intervention ($p < 0.01$), the levels of total cholesterol, triglyceride, and low density lipoprotein cholesterol were also higher in CON ($p < 0.05$). The mRNA expression of PPAR α was higher in RE than the other two groups ($p < 0.01$), but no difference in protein expression was observed. Greater mRNA expression of FGF-21 was observed in CON (CON vs. AE and RE: 1.00±0.06 vs. 0.76±0.21 and 0.83±0.10, $p < 0.01$), however, FGF-21 protein expression was higher in AE and RE than CON (CON vs. AE and RE: 1.00 vs. 1.50±0.32 and 1.59±0.38, $p < 0.05$). Moreover, the PGC-1 α mRNA expression was higher in RE than the other two groups ($p < 0.01$), but the protein expression was found no difference among groups.

CONCLUSIONS: Both aerobic exercise and resistant exercise were helpful to improve blood lipid profiles in obese mice after an 8-week exercise program. In addition, the FGF-21 protein expression was increased after exercise, and the resistant exercise seemed to be more effective in activating FGF-21 pathway functions and promoting hepatic lipid metabolism. (Supported by NSFC 31471139 and CISSFRF 16-18)

1547 Board #222 June 1 8:00 AM - 9:30 AM
Effects of Isoflavone and Exercise on Regulation of Energy Homeostasis in Ovariectomized Female Rats
 Wenya Zheng. *German Sport University Cologne, Cologne, Germany.*
 (No relationships reported)

Postmenopausal women tend to have higher risk of developing metabolic syndrome due to lose control of energy balance. Isoflavone (ISO) supplementation and exercise have shown some beneficial effects on regulating metabolic parameters. **PURPOSE:** To investigate the effects of ISO intake, exercise training and the combination on parameters related with energy homeostasis in an ovariectomized (OVX) rat model. **METHODS:** Female Wistar rats were assigned to six groups: (1) Sham; (2) Sham with exercise training (Sham+T); (3) OVX; (4) OVX+T; (5) OVX+ISO; (6) OVX+ISO+T. Rats in the exercise groups were trained 10 min/time, twice/day, a rest day every four days on a treadmill with an incline of 25° for 61 days and a gradually increasing velocity from 12 to 20 m/min. Adipocyte size was determined by HE staining. Leptin levels in serum were measured by Elisa. Gene and protein expression in adipose tissue was investigated by RT-PCR and Western blot. **RESULTS:** Visceral fat mass, adipocyte size and serum leptin level were about 20%, 38% and 87% increased by OVX compared with Sham ($p < 0.05$). Training significantly decreased all three parameters both in Sham (28%, 30% and 40%) and in OVX (31%, 26% and 55%) groups ($p < 0.05$). ISO supplementation showed only significant reduction effect on leptin level (35%, $p < 0.05$). OVX significantly reduced PPAR δ and FAS gene expressions in adipose tissue, whereas the effects were antagonized by training. Training also increased SREBP-1c expression. In contrast ISO significantly reduced SREBP-1c expression in OVX rats. No similar effect was observed with PPAR δ and FAS gene expressions. The effect shown in OVX+ISO+T group was similar as in OVX+T group of all these parameters, except for FAS gene expression. ISO antagonized FAS expression when in combination with training. In addition, the result of FAS gene expression was proved by its protein expression. **CONCLUSION:** Estrogen deficiency resulted in metabolic syndrome related risk such as increasing visceral fat mass, adipocyte size, leptin. The designed exercise antagonized all these effects. Furthermore, the exercise enhanced gene expressions which are responsible for fatty acid oxidation (PPAR δ) and lipogenesis (SREBP-1c and FAS). ISO diet showed effects only on reducing leptin level and SREBP-1c gene expression. Supported by DFG Di 716/12-1

1548 Board #223 June 1 8:00 AM - 9:30 AM
Effects of Endurance Exercise and Rapamycin on Hepatic Energy Metabolism Gene Expression in Rats Fed a High-Fat Diet
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 (No relationships reported)

Objective The mammalian target of rapamycin(mTOR) pathway is a critical signaling component in the development of obesity-related insulin resistance, but the precise mechanisms linking exercise-induced improvement of the insulin resistance

and the mitochondria oxidative metabolism in high-fat diet(HFD) rats remain unclear. Our aim was to investigate the role of the rapamycin (inhibitor of mTOR) on exercise-induced improvement of hepatic gene involved in energy metabolism in HFD rats.

METHODS: 24 male SPF rats were fed with HFD for 6 weeks. After one week exercise adaptation, the rats were randomized to 4 groups(n=6):HFD+sedentary group(H group),HFD+exercise group(HE group),HFD+rapamycin (HR group), HFD+exercise+rapamycin(HER group).The rats in HE group and HER group were performed the exercise training for 4 weeks from the 8th week on and those in HR group and HER group received the intraperitoneal injection of rapamycin with the dose of 2 mg/kg/day for 2 weeks from the 10th week on. At the 11th week, the rats were sacrificed after 12-16 hour fast. The liver was harvested for analysis of activity of mitochondria oxidative enzyme and gene expression involved in energy metabolism, oil-red satining was used to determine the hepatic triglyceride(TG)content.

Result Oil-red staining indicated that the exercises reduced hepatic TG content, but rapamycin had no effect on hepatic TG content in HFD rats. Further analysis indicated that the rapamycin significantly improved the activities of succinodehydrogenase(SDH), but reduced the activity of cytochrome C oxidase (COX) in liver of HFD rats. The exercise significantly up-regulated the gene expression level of PGC-1 β mRNAs, but Rapamycin had no effects on the gene mRNAs expression level of PGC-1 α , PGC-1 β , PPAR α , PPAR β , CPT1 α and PDK4.

Conclusion Chronic rapamycin administration does not affect exercise-induced reduction of hepatic TG content and mitochondrial metabolic gene in HFD rats.

1549 Board #224 June 1 8:00 AM - 9:30 AM
Effects of Hypoxic Living and Exercise Training on the miR-27/PPAR γ Pathway in Obese Rat Liver
 yingli lu, lei zhu, Lianshi Feng. *China Institute of Sport Science, Beijing, China.*
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 (No relationships reported)

PURPOSE: To examine the effects of hypoxic living and exercise training on the miR-27/PPAR γ pathway in the liver of obese rats.

METHODS: Forty 13-week-old male diet-induced obesity rats were randomly divided into four groups (n=10 each): normoxic group(N), exercise group(E), hypoxia group(L), hypoxia and exercise group(LE). Rats in the hypoxia groups were exposed to an oxygen concentration of 13.6%, for 24h/day. Rats in the exercise groups were exercised on a treadmill at a speed of 25m/min, 1 hour/day, 5 days/week for a total of 4 weeks. MicroRNA-27(miR-27) expression level in the liver were determined by real-time PCR. Protein and mRNA expression levels of PPAR γ , ABCA1, CYP7A1, CD36, ATGL, LPL, L-FABP, SREBP1 were tested in the obesity rat liver.

RESULTS: After the 4-week intervention period, adipose tissue around the kidney weight was significantly lower in the E(2.18±0.26g), L(2.30±0.29g), and LE(1.49±0.36g) than in the N(2.80±0.83g)($p < 0.05$), and epididymal adipose tissue weight was significantly lower in the E(6.84±1.11g), L(7.13±0.86g), and LE(6.13±1.60g) than in the N(8.44±1.63g)($p < 0.05$). Liver miR-27 levels were significantly lower in the LE(0.16±0.09) than in the N(0.26±0.09) ($p < 0.05$). N(1.11±0.26) rats' PPAR γ mRNA level is lower than E(1.81±0.28), L(1.45±0.29) and LE(1.52±0.44) ($p < 0.05$), and N(0.61±0.12) rats' protein expression level of PPAR γ is lower than E(0.80±0.16), L(0.78±0.14) and LE(0.84±0.14) ($p < 0.05$). N(1.08±0.60) rats' CYP7A1 mRNA level is lower than L(2.51±1.13) and LE(3.48±2.36) ($p < 0.05$), and N(0.46±0.13) rats' protein expression level of CYP7A1 is lower than L(0.66±0.12) and LE(0.65±0.12) ($p < 0.05$). N(0.80±0.25) rats' CD36 mRNA level is lower than E(1.45±0.80) ($p < 0.05$), and N(0.49±0.17) rats' protein expression level of CD36 is lower than E(0.73±0.13) and LE(0.18±0.06) ($p < 0.05$). N(1.03±0.23) rats' SREBP1 mRNA level is lower than L(1.37±0.41) ($p < 0.05$). Rats' mRNA and protein expression level of ABCA1, ATGL, LPL, L-FABP is no significant difference each other.

CONCLUSIONS: Hypoxic exercise may decrease the miR-27 level in the liver of obese rats, and negatively regulate the expression of PPAR γ , and affects the dynamic balance of fat metabolism in the obese rats' liver, then leads to the decrease of visceral fat of obese rats.

Project 31471139 supported by NSFC.

1550 Board #225 June 1 8:00 AM - 9:30 AM
"It Takes Two To Tango"; Exercise Modifies Skeletal Muscle Mitochondria And Lipid Droplets Closeness
 Sonia Conde Alonso, Nicholas T. Broskey, Francesca Amati, FACSM. *University of Lausanne, Lausanne, Switzerland.*
 (No relationships reported)

PURPOSE: Intramyocellular lipids (IMCL), stored in lipid droplets (LD), are known to be a hallmark of skeletal muscle insulin resistance. Chronic exercise (training) increases IMCL while also increasing insulin sensitivity (IS), a paradigm known as the athlete's paradox. Mitochondria (M), the powerhouse of the cells, are responsible to transform LD content into energy. The closeness of these 2 organelles in the different subcellular compartments (intramyofibrillar (IMF) and subsarcolemmal (SSL)) and

how they change with training are not yet known. The purpose of this study was to examine exercise induced changes in LD and M closeness in insulin resistant non-diabetic subjects.

METHODS: In a nested case-control study, 12 cases (6F/6M) underwent a 4-months supervised endurance exercise intervention. 12 insulin sensitive subjects matched by age and gender served as controls (C). LD, M and the surface in contact with each other, were assessed in muscle biopsies with electron microscopy. IS was measured by hyperinsulinemic euglycemic clamp. VO_{2peak} was measured by GXT and body composition by DEXA.

RESULTS: Although training improved IS by $45\pm 8\%$ ($P<0.05$), increased VO_{2peak} by $13.2\pm 4.4\%$ ($P<0.05$), reduced body fat by $3.9\pm 1.2\%$ ($P<0.05$), cases remained significantly different from C. M increased in IMF and SSL ($54.7\pm 15.1\%$ and $78.2\pm 20.5\%$ respectively, $P<0.05$). LD increased in IMF ($51.8\pm 18.1\%$) and decreased in (SSL $20.7\pm 8.3\%$, both $P<0.05$). Contact between M and LD increased significantly only in IMF ($65.1\pm 26.3\%$, $P<0.05$). While SSL LD were negatively correlated with IS at baseline, changes in overall LD with intervention were related with improvements in IS. SSL LD correlated with body adiposity, but not IMF LD.

CONCLUSIONS: With endurance training, the closeness of M and LD increased only in the contractile region, i.e. the IMF compartment. At the same time, the amount of M and LD increased in this compartment. This observation confirms what is observed in healthy and athletic individuals, which suggests that IMCL are used for fuel. At the contrary, LD decreased in the SSL region while M increased in this compartment. Our observations are of interest, as IMCL are known to be involved in the mechanisms leading to insulin resistance in sedentary muscle, possibly explaining the observation in the SSL region.

1551 Board #226 June 1 8:00 AM - 9:30 AM

Metabolic Flexibility In Lean Children: Effect Of Parental BMI

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(No relationships reported)

Metabolic flexibility is defined as the ability of the body to switch fuel preferences after some form of stimulation. Metabolic inflexibility is associated with metabolic disorders, including obesity and diabetes. Because obesity has been determined to be the result of an interaction between environmental and genetic factors, it is possible that the influence of parental weight status may influence the child's metabolic tendencies, even in lean children. **PURPOSE:** This study examined the effect of parental weight status on the child's metabolic flexibility, expressed via fat oxidation. **METHODS:** Subjects were separated into groups based on parental BMI: those with two lean parents (LL, n=5, 10.5±1.3 years old, 31.5±4.6 kg, BMI of 16.9±1.0, 17.9±3.1 % body fat) and those with at least one overweight or obese parent (LO, n=7, 10.2±1.6 years old, 35.6±6.7 kg, 16.9±1.7, 17.6±4.3 % body fat). The experimental visit occurred in the morning, preceded by a standardized breakfast. The child performed two 20-minute exercise bouts, separated by a 10-minute rest. The first bout consisted of 10 minutes at 50% VO_{2max} and 10 minutes at 75% VO_{2max} . The second bout consisted of 20 minutes at 50% VO_{2max} . A two-way (group x time) ANOVA was used to compare the relative contribution of fat (fat use %) and fat oxidation rate (FOX) between the 10-minute time point of the first bout and the 5-, 10-, 15-, and 20-minute time points of the second bout. Significance was set at $p\leq 0.05$. **RESULTS:** There were no significant differences in age, body mass, BMI, or body fat percentage between groups. VO_{2max} was 43.5 ± 6.8 and 44.0 ± 8.1 ml/kg/min in the LL and LO groups, respectively ($p>0.05$). Fat use % across the five time points ranged from 32.8 ± 20.8 to $48.8\pm 14.9\%$ and from 32.1 ± 7.3 to $40.2\pm 8.4\%$ in the LL and LO groups, respectively. FOX across the five time points ranged from 0.11 ± 0.07 to 0.16 ± 0.06 g/min and from 0.12 ± 0.04 to 0.16 ± 0.05 g/min in the LL and LO groups, respectively. Fat use % and FOX were significantly greater at each time point of the second bout versus the 10-minute time point of the first bout. No significant group or interaction effects were noted. **CONCLUSION:** This study suggests that parental weight status may not have an effect on the metabolic flexibility in fat metabolism of lean children in the early stages of puberty.

1552 Board #227 June 1 8:00 AM - 9:30 AM

Postprandial Triglyceride Responses in Younger versus Older Active Adults

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(No relationships reported)

BACKGROUND: A large post-meal triglyceride (TG) response (postprandial lipemia) is linked to increased cardiovascular disease risk. Exercise lowers postprandial lipemia, although this has been primarily shown in young adults. Studies have reported an

age-related increase in postprandial lipemia, but it is unknown whether this is a direct result of aging or an outcome of reduced physical activity, as postprandial lipemia has scarcely been assessed in older adults.

PURPOSE: The purpose of this study was to compare active older adults to active younger adults with regard to postprandial lipemia. We hypothesized that the younger active (YA) adults would display a lesser postprandial TG response compared to the older active (OA) adults.

METHODS: Sixteen adults (8 OA adults, 67 ± 5 yr; 8 YA adults, 25 ± 5 yr; each group: 4M/4W) reported to the lab following a 10-hour overnight fast and having abstained from exercise for two days. An indwelling catheter was inserted into a forearm vein and a baseline blood sample was taken to assess fasting TG. Next, participants consumed a high-fat meal (60% fat, 37% CHO) that was relative to their body mass (12 kcal/kg; 921 ± 164 kcal). Blood draws were then performed hourly for 6 hours to characterize the postprandial TG response.

RESULTS: There was no difference ($p = 0.20$) in fasting TG between groups (OA: 52.3 ± 9.0 mg/dL; YA: 47.4 ± 4.6 mg/dL). Total area under the curve (AUC) TG response was significantly greater ($p = 0.003$) in the OA group (625.6 ± 169.0 mg/dL x 6 hr) compared to the YA group (407.9 ± 115.1 mg/dL x 6 hr). The OA participants also elicited a greater ($p = 0.007$) incremental AUC TG response (312.1 ± 123.3 mg/dL x 6 hr) versus the YA participants (123.6 ± 119.6 mg/dL x 6 hr). There was no difference ($p = 0.32$) in the time to peak TG response between groups (OA: 3.1 ± 1.0 hr; YA: 3.8 ± 1.0 hr), but the peak TG value was significantly higher ($p = 0.007$) in the OA adults (144.0 ± 42.2 mg/dL) compared to the YA adults (90.5 ± 27.0 mg/dL).

CONCLUSION: Despite being chronically active, OA adults displayed a higher TG response than YA adults, agreeing with previous findings of an age-related increase in postprandial lipemia. Future research should test whether OA adults differ from older inactive adults, as it would be valuable to identify the contributions of aging versus physical activity in postprandial TG modification.

1553 Board #228 June 1 8:00 AM - 9:30 AM

Effect Of 2-week Cold-water Swimming On White Adipose Tissue Browning In Mice

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Brown adipose tissue (BAT) is an important thermogenic organ and is generally induced by exercise or cold exposure via a white adipose tissue browning pathway. However, the synergic effects of exercise and cold exposure on this pathway remain unclear. Cold-water swimming, such as winter swimming which is a traditional sport in northern China and Russia, may be a potential therapeutic form of exercise in the treatment of obesity and diabetes. **PURPOSE:** To investigate the synergic effects of exercise and cold exposure on white adipose tissue browning in mice. **METHODS:** 8-week-old male ICR (Institute of Cancer Research) mice were randomly divided into 3 groups: a control group (N=6), a warm-swimming group (N=6) and a cold-swimming group (N=6). Mice in the warm-swimming and cold-swimming groups trained twice a day for 2 weeks and the duration of the exercise session was gradually increased (from 10 min to 60 min). The temperature of water was $35\pm 2^\circ\text{C}$ in the warm-swimming group and $22\pm 2^\circ\text{C}$ in the cold-swimming group. Body weight of mice in each group was recorded daily before the exercise sessions. Biomarkers of white adipose tissue browning were examined by hematoxylin and eosin (H&E) stain, western blotting and immunohistochemistry. **RESULTS:** After 2-weeks of swimming training, body weight was significantly lower in the cold-swimming group compared to the warm-swimming and control groups (34.4 ± 1.0 vs. 35.3 ± 1.4 & 37.2 ± 1.1 g, both $p<0.05$). And the relative cell size of white adipose tissue in the cold-swimming and warm-swimming groups decreased in compared with the control group (142 ± 41 & 168 ± 68 vs. $328\pm 59\%$, both $p<0.05$). The expression of uncoupling protein-1 (UCP-1) in white adipose tissue in the cold-swimming group was higher significantly than in the warm-swimming and control groups (147 ± 8 vs. 112 ± 6 & $123\pm 2\%$, both $p<0.01$), while peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1-alpha) in the warm-swimming group was higher than the control group (193 ± 48 vs. $124\pm 28\%$, $p<0.05$). Moreover, serum zinc finger protein-516 (ZNF-516) increased in the cold-swimming group compared to the control group (323 ± 44 vs. $179\pm 43\%$, $p<0.05$). **CONCLUSIONS:** Cold-water swimming induces white adipose tissue browning and weight loss and may be an effective form of exercise in the treatment of cardiometabolic diseases.

1554 Board #229 June 1 8:00 AM - 9:30 AM
High Intensity Versus Low Volume Resistance Exercise On Postprandial Triglycerides In Healthy College Students

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Elevated postprandial triglycerides (TGs) contribute to the development of cardiovascular disease. Prior exercise is a well-established method to lower postprandial TGs; however, most exercise protocols involve prolonged aerobic or resistance training (RT) of sixty to ninety minute which is not realistically attainable by the general population. **PURPOSE:** The present study investigates the effect of high intensity interval training (HIIT) of twenty minutes and RT of thirty minutes on postprandial TGs. **METHODS:** Approval for this study was obtained from the Institutional Review Board of the College of Saint Benedict and Saint John's University and signed informed consents were provided by all participants. Thirty healthy college-age students (5 males, 25 females) were recruited from nutrition and exercise science courses. All subjects completed the control, HIIT, and resistance protocols one week apart. Subjects performed the exercise protocols 12-16 hours prior to an oral fat tolerance test (milkshake, 1 g of fat per kg of body weight). Subjects were instructed to consume similar diets during the 24 hours prior to the milk shake. Each exercise session was supervised; HIIT consisted of four 30 second sprints with 4 minutes of walking recovery and the low-volume RT consisted of six machine-based lifts, 2 sets of 8 repetitions at 75% of one repetition maximum. Postprandial TGs were measured at baseline and three hours following consumption of the milkshake using the CardioChek PA blood analyzer (PTS Diagnostics, Indianapolis, IN). Data was analyzed using a three way repeated measures ANOVA statistical test. **RESULTS:** The triglyceride levels at baseline were on average less than 150 mg/dL (desirable value); however, 20% were above. The means are as follows for each treatment and time point (baseline, and postprandial respectively): Control 107 +/- 49, 140 +/- 73 mg/dL; HIIT 93 +/- 34, 122 +/- 59 mg/dL; and Resistance 108 +/- 47, 144 +/- 64 mg/dL. While there appears to be a trend that HIIT lowered both fasting and postprandial TG's the decrease was not statistically significant (p=0.699). **CONCLUSION:** Twenty minutes of HIIT or thirty minutes of low-volume RT did not significantly lower postprandial triglyceride response to a high fat milkshake in a healthy, college-age population.

1555 Board #230 June 1 8:00 AM - 9:30 AM
The Effects of Isointensive Endurance Exercise on Postprandial Lipemia

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 (No relationships reported)

The ability to alter postprandial metabolism in favor of elevated fat metabolism could help attenuate the plasma lipid excursion, leading to decreased CVD risk. **PURPOSE:** We compared two isoenergetic exercise modalities (run, walk) on subsequent postprandial lipemia in males. **METHODS:** Active, college-aged males (n=7; weight = 72.5 ± 3.9 kg; BP% = 17.9 ± 1.2; VO_{2max} = 51.5 ± 1.36 mL/kg/min) participated in a crossover-designed study, and studied on each of 3 occasions: Walk, Run, and Control. Subjects completed a body composition and VO_{2max} test. (Run) was 60-min on a treadmill at 0% grade and speed equal to 60% VO_{2max} (694.4 ± 26.1 kcal). (Walk) was 60-min at 3.3mph and a steep incline equal to 60% VO_{2max} (677.9 ± 20.9 kcal). A post-exercise meal of 11.5 kcal/kg FFM (CHO-48%, Fat-36%, Protein-16%; 672.7 ± 31.6 kcal) was given 30-min post-exercise. Pulmonary gas exchange and plasma TG was assessed at baseline (0), post-exercise (60) then at 90, 120, 180, 240, and 300 min to assess TG, metabolic rate, FATox, and CHOox. RM ANOVAs were used for statistical analysis. Values were calculated as either time weighted average over the 300 min or incremental AUC. **RESULTS:** There was no significant difference in TG tm wtd avg (Run, 77.9 ± 2.6; Walk, 86.7 ± 15.4; Con, 89.3 ± 15.2 mg/dL, P>0.05) or incremental AUC (Run, 7157 ± 695; Walk, 7954 ± 3120; Con, 6559 ± 1010 mg/dL) between the three groups. In comparison to Con, both Run and Walk led to increased incremental AUC for FATox (Run, 110.9 ± 29.4; Walk, 87.5 ± 24.5; Con, 9.8 ± 29.4 kcal, P<0.05) with no significant difference between Run and Walk. There was no significant difference in CHOox, TEE, or RER between any conditions (P>0.05). **CONCLUSION:** Running and walking at 60% VO_{2max} for 60-min enhances the rate of fat oxidation in the postprandial period in active males, when compared to a time-matched sedentary control, without a significant attenuation in the postprandial plasma TG excursion. These results indicate the effects of 60% VO_{2max} may not be potent enough in this population to elicit an attenuation in the postprandial plasma TG concentration, especially when consuming a post-exercise meal equivalent to the caloric expenditure of the exercise bout. So, greater intensity or duration may be needed to provide a beneficial effect within this population.

1556 Board #231 June 1 8:00 AM - 9:30 AM
Effect Of Acute Exercise Without Energy Replacement On Fat Oxidation And Hormone Profiles During Sleep

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Purpose: Performing exercise without energy replacement increases 24-h fat oxidation, primarily by increasing fat oxidation during sleep. This study investigated potential mechanisms to explain how daytime exercise without energy replacement increases nocturnal fat oxidation. **Methods:** Twelve healthy adults (7F/5M; age= 27±5 y; BMI=23±3 kg/m²) completed a randomized crossover study that included sedentary-energy balanced (BAL) and exercise-energy deficit (DEF) visits. 24-h energy expenditure (EE) and substrate oxidation were measured using whole room indirect calorimetry. During BAL, subjects consumed an energy-balanced diet and remained primarily sedentary. During DEF, subjects performed 2 bouts of treadmill exercise (~60% VO_{2max}) in the morning and afternoon. Total exercise EE was ~20% of daily energy requirements, which was not replaced in the diet. Room calorimeter data were divided into (1) 24-h, (2) wake (0800h-2200h), and (3) sleep (2200h-0700h) segments for analysis. Metabolites [glucose, free fatty acids (FFA), and triglycerides] and hormones (insulin, growth hormone, norepinephrine, and cortisol) thought to influence diurnal changes in fat oxidation were measured every 90-min during sleep. **Results:** 24-h EE (2483±458 vs. 1995±401 kcal, mean±SD) and waking EE (2173±428 vs. 1580±361 kcal) were higher during DEF than BAL, respectively (p<0.001), but there was no difference in sleep EE (495±83 vs. 504±76 kcal, p=0.35). Sleeping fat oxidation trended towards being higher during DEF (7.1±13.0% higher, p=0.09). DEF decreased nocturnal plasma glucose (p=0.008) and insulin (p=0.02) concentrations and increased FFA (p=0.001), but had no effect on nocturnal growth hormone (p=0.50), norepinephrine (p=0.26), or cortisol (p=0.92). Sleeping fat oxidation during DEF was associated with greater nocturnal FFA availability (R²=0.33, p=0.06), and was modestly related to lower insulin concentrations (R²=0.21, p=0.15). **Conclusion:** Daytime exercise without energy replacement increased nocturnal fat oxidation. This appeared to be driven by lower insulin concentrations, which may have facilitated a higher rate of free fatty acid release (lipolysis) during sleeping hours compared to a sedentary, energy balanced state.

1557 Board #232 June 1 8:00 AM - 9:30 AM
A High-Fat Diet Rich In Polyunsaturated Fatty Acids Downregulates Glut4, But Not Skeletal Muscle Glycogen.

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High fat diets (HFD) are linked to the development of obesity and type 2 diabetes (T2D), characterized by defects in glycogen storage and increased lipid accumulation in skeletal muscle. Replacement of saturated fatty acids in high fat diets, with unsaturated (mono- and poly-unsaturated) fatty acids has been shown to reduce risks for insulin resistance, obesity and T2D. **PURPOSE:** The purpose of this study was to determine the effects of HFD differing in fatty acid composition, on skeletal muscle glycogen, mitochondrial, GLUT4, and lipid contents. **METHODS:** Male Sprague Dawley rats were fed a Western-style (21% fat by weight; 41% total energy) HFD for 9 weeks to induce obesity and then were divided into one of three HFD groups for an additional 6 weeks; a control chow group followed a 15-week low fat diet. Animals consumed either a) low fat Chow diet (CD) (4.8 % fat; 0.74% saturated; 2% mono; 1.77% poly; n=6), b) mixed fat Western diet (WD) (21% fat; 9.76% saturated; 7.68% mono; 3.48% poly; n=6), c) HFD rich in monounsaturated fatty acids (MUFA) (21% fat; 2.82% saturated; 16.01% mono; 2.18% poly; n=6), d) HFD rich in polyunsaturated fatty acids (PUFA) (21% fat; 2% fat; 2.97% mono; 16% poly; n=7). After 15 weeks, glycogen (periodic acid-schiff staining) mitochondria, GLUT4, and lipid content were measured in extensor digitorum longus muscle using immunohistochemical staining techniques and quantified with imageJ software. **RESULTS:** Following the 6-week treatment period, body weight (g) in the WD group was significantly greater compared to MUFA (p=0.0006), PUFA (p=0.02), and CD (p<0.0001). Glycogen content was significantly greater (p=0.04) in animals fed a WD compared to CD. (AU±SEM; CD: 4.41±0.04; WD: 4.74±0.13; MUFA: 4.54±0.08; PUFA: 4.54±0.11; one-way ANOVA p=0.11). A HFD rich in PUFA resulted in

impaired GLUT4 content ($p=0.02$) compared to a CD ($AU\pm SEM$; CD: 77.38 ± 2.22 ; WD: 63.46 ± 3.80 ; MUFA: 61.49 ± 8.46 ; PUFA: 52.84 ± 5.13 ; one-way ANOVA $p=0.03$). There were no significant effects on mitochondrial or lipid content.

CONCLUSION: A high fat diet rich in polyunsaturated fatty acids results in significantly lower GLUT4 content without negatively impacting skeletal muscle glycogen storage in high fat diet induced obese rats. A high fat diet rich in saturated fat resulted in greater muscle glycogen content compared to low fat fed rats.

1558 Board #233 June 1 8:00 AM - 9:30 AM
Effects Of Short-term Ketogenic Dieting Or Ketone Salt Supplementation Lipogenic Gene Expression Adipose Tissue

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PURPOSE: We sought to examine if one week of ketogenic diet (KD) or ketone salt supplementation (KS) feeding versus standard chow (SC) feeding affected the mRNA signature related to *de novo* lipogenesis in subcutaneous and visceral (mesenteric) adipose tissue.

METHODS: Male Fisher rats (4 mo old) were provided isocaloric amounts of KD (5.2 kcal/g, 23.1% protein, 9.6% carbohydrate, and 65.3% fat, $n=10$) or SC (3.1 kcal/g, 24% protein, 58% carbohydrate, 18% fat; $n=30$) for 7 days. The SC rats were split into sub-groups whereby one group was provided a moderate amount of KS in their drinking water (SC+MKS ~1.2g/day, $n=10$), one group was provided a high amount of KS in their drinking water (SC+HKS ~2.4g/day, $n=10$), and one group was un-supplemented (SC, $n=10$).

RESULTS: The KD group lost the greatest mass ($p<0.01$). Feed efficiency revealed a group effect ($p<0.01$) with the lowest values observed in KD. A group effect was also observed for mesenteric (MES) fat ($p=0.05$). Subcutaneous (SQ) fat mass was not different between groups ($p=0.07$). In the MES fat pad FASN mRNA was down regulated in KD and both KS groups ($p=0.001$). HSL and CEBP α mRNAs were not differentially expressed ($p=0.16$ and $p=0.51$, respectively). ACC α was down-regulated in KD and KS groups ($p=0.001$). Regarding the SQ fat pad, only FASN mRNA was found to be differentially expressed (down-regulated in the KD and KS groups; $p=0.01$).

CONCLUSIONS: The KD appears to offer an acute benefit to body mass loss, predominantly acting on visceral fat depots.

1559 Board #234 June 1 8:00 AM - 9:30 AM
Introduction Of A High-fat/sucrose Diet Modulates Voluntary Wheel Running Activity In Adult Female Rats

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Food intake and spontaneous physical activity have been attributed to a common hypothalamic pathway although the specific mechanisms involved in this relationship, and how it is influenced, have yet to be elucidated. **PURPOSE:** To determine how alternating low- and high-fat/sucrose diets affect voluntary wheel running in rats and its relationship with food/energy consumption. **METHODS:** An interrupted time series model was used to examine voluntary running and *ad libitum* food consumption characteristics over a 9-week period in adult female (~40 days old; ~120-140 g) Sprague Dawley rats ($n=8$ /group). Low- (L; 4%) or high- (H; 25%) fat/sucrose diets were provided in 3-week intervals: LLL and HHH control groups received only low- or high-fat/sucrose diets, respectively, whereas alternating diet groups (HLH and LHL) were switched every 3 weeks. Resistance-free running wheels recorded distances automatically and food consumption was measured manually daily; body mass was recorded every two weeks. **RESULTS:** Each diet group increased mean running distance (meters/day) that peaked at Week 3 followed by a gradual decrease in activity through Week 9. Compared to other groups, LLL rats maintained a higher percentage of peak activity between Weeks 4-8. Daily distances were highly variable (range: 633 – 40,079 m/day) depending on the specific rat and day. Although daily food consumption ranged from 42-69 kcal / day, no relationship existed between daily running distances and absolute (grams) or relative (kcal) food consumption for the LHL, HLH, or HHH groups (R^2 range: 0.0006 – 0.15); a significant correlation existed between these variables in LLL rats (R^2 : 0.58; $p<0.05$). Body mass increased from 61-80% from

starting values and final body masses were similar in all groups (range: 225-240 g; $P>0.05$). **CONCLUSION:** Adult female rats demonstrate a high propensity for voluntary physical activity in the first three weeks of wheel access followed by a natural tapering in activity, perhaps associated with age. Consumption of a diet high in fat and sucrose, regardless of when it was introduced during the 9-week protocol, blunted activity from peak values compared to rats that consumed a low fat-only diet (LLL), suggesting that diet composition, rather than intake alone, impacts spontaneous physical activity.

1560 Board #235 June 1 8:00 AM - 9:30 AM
Effects of High-Fat Diet and Exercise on Endoplasmic Reticulum Stress Mediated Apoptosis in Rat Liver

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(No relationships reported)

PURPOSE: To examine the effects of 16 weeks of high-fat diet feeding and swimming exercise on liver steatosis and endoplasmic reticulum stress mediated apoptosis in rats. **METHODS:** Male Sprague-Dawley Rats were randomly divided into 3 groups (each $n=10$): a control group (C), a high-fat diet group (D) and a high-fat diet plus exercise group (DE). Rats in the C group were fed with standard diet, and those in the D and DE groups were fed with high-fat diet for 16 weeks. Rats in the DE group were exercised in a swimming pool for 60 min/day, 6 days/week for 16 weeks. Liver pathological changes were determined by hematoxylin and eosin staining. Hepatocyte apoptosis was measured by terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling assays. Western blots were used to measure expression levels of proteins related to endoplasmic reticulum stress mediated apoptosis, including the CCAAT enhancer-binding protein homologous protein (CHOP), the c-Jun N-terminal kinase (JNK) and the caspase-12 gene. The ABC Immunohistochemical staining was used to detect the positive expression rates of CHOP, JNK, caspase-12. One-way ANOVAs were used for data analysis. **RESULTS:** all rats in the D group obtained NAFLD (C group: 0% vs. D group: 100%). the DE group had a lower incidence of NAFLD (DE group: 20% vs D group: 100%). Compared to the C group, the D group had a higher number of liver lipid droplets (0.483 ± 0.068 vs 0.185 ± 0.041 , $P<0.01$) and a higher liver cell apoptosis index (1.110 ± 0.250 vs 0.350 ± 0.160 , $P<0.05$) and significantly higher expression levels of chop (2.465 ± 0.312 vs 0.858 ± 0.079 , $P<0.01$), caspase12 (1.430 ± 0.136 vs 0.372 ± 0.064 , $P<0.01$), and JNK (1.361 ± 0.114 vs 0.358 ± 0.048 , $P<0.01$) in liver cell. Compared to the D group, the DE group had a lower number of liver lipid droplets (0.306 ± 0.059 , $P<0.01$) and a significantly lower liver cell apoptosis index (0.860 ± 0.270 , $P<0.05$) and significantly lower expression levels of chop (1.110 ± 0.116 , $P<0.01$), caspase12 (0.609 ± 0.052 , $P<0.01$), and JNK (0.645 ± 0.087 , $P<0.01$) in liver cell. **CONCLUSIONS:** Sixteen weeks of high-fat diet feeding caused NAFLD in all rats. Exercise training could improve symptoms related to NAFLD, possibly by lowering the protein expression levels of CHOP, JNK and Caspase12, and reducing liver cell apoptosis.

C-44 Free Communication/Poster - Functional Strength and Fitness

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1561 Board #236 June 1 8:00 AM - 9:30 AM
Core Strength as a Predictor of Performance During Three Functional Movement Screens

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Current measures of core stability utilized by clinicians and researchers suffer from a number of shortcomings. Three functional movement screens appear, at face-value, to be dependent on the ability to activate and control core musculature. As a whole, these three screens may present a viable alternative to current measures of core stability. **PURPOSE:** To determine the relationship of core strength and muscle activation to performance on these three screens **METHODS:** Thirty-nine subjects completed a deep squat (DS), trunk stability push-up (TSP), and rotary stability (RS) screen. Scores on the three screens were summed to form a composite score (COMP). During the screens, muscle activity was collected to determine the length of time that the bilateral erector spinae, rectus abdominus, external oblique, and gluteus medius muscles were active during the screens. Strength was assessed for core muscles (trunk flexion/extension, trunk rotation, hip abduction/adduction) and accessory muscles (knee flexion/extension, and pectoralis major). Strength variables were eliminated due to multicollinearity and two ordinal logistic regression equations were calculated with COMP as the outcome variable. The first equation included both core strength

variables and accessory strength variables as predictors. To compare the relative amount of variance explained, independent of the accessory strength variables, the second equation only contained core strength variables. **RESULTS:** The first model was significant in predicting COMP ($p=.004$) (Pearson's Chi-Square=149.132, $p=.435$; Nagelkerke's R-Squared=.369). The second model was significant in predicting COMP ($p=.001$) (Pearson's Chi Square=148.837, $p=.488$) and the explained variance was similar to the full model (Nagelkerke's R-Squared=.362). The core muscles were found to be active for the majority of screens, with percentages of 'time active' for each muscle ranging from 54%-86%. **CONCLUSION:** Performance on the three screens is predicted by core strength, even when accounting for other strength variables. Further, it appears the screens elicit wide-ranging activation of core muscles. While more investigation is needed, the DS, TSP, and RS, collectively, appear to be a good assessment of core strength.

Supported by the Freddie Fu, MD Graduate Research Award

1562 Board #237 June 1 8:00 AM - 9:30 AM
Functional Movement Screen Performance on Baseball Players of Different Positions

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The Functional Movement Screen (FMS) assesses movement dysfunctions during seven tests to provide musculoskeletal injury risk and a training program reference in a variety of populations. Except for individual differences of FMS movement dysfunction, sport-specific training may affect the dysfunction. Thus, the investigation of FMS performance for baseball players can provide useful training program references for injury prevention of specific baseball positions

PURPOSE: To investigate the difference between outfielders (OF), infielder (IF), and pitchers(PC) on the Functional Movement Screen performance of 7 tests.

METHODS: 27 Division I athletes from city teams including 13 PC, 6 OF, 8 IF athletes (career yrs: 12.5±5.9, 13.5±4.6, 14.5±3.1) performed the FMS. The tests are deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg rise, trunk stability push-up, rotary stability for scoring a 0 to 3 each. The questionnaires of injury history in 5 year were reported to provide injury category of the shoulder, elbow, wrist, hip, knee, and ankle. A One-way ANOVA test was performed to compare among these groups (α level 0.05).

RESULTS: The total score of seven tests did not show the difference among each group(PC: 15.9±1.4, OF :16.3±2.3, IF :16.4±1.6) and each group total score>14. However, the PC showed lower score than the OF on trunk stability push-up (PC: 2.4±0.5, OF: 3.0±0.0, $p=.022$), but higher than OF on rotary stability (PC: 2.23±0.44, OF: 1.67±0.52, $p=.045$). The injury occurred the most for PC are: 60% elbow, 33 % shoulder, 7% wrist; OF :40% shoulder, 30% elbow, 10%wrist; IF:40% elbow, 30% wrist, 10% shoulder.

CONCLUSIONS: Trunk stability push-up requires more core static than dynamic strength, but rotary stability is require core dynamic strength and reflex to perform. The OF showed better in push-up but worse in rotary stability than PC group. It suggests that the designing training program for core strength need to consider the direction of rotation axis and static/ dynamics for different position. Besides, high shoulder ratio injury cases on both PC and OF may due to high demand than IF in the pitching speed or distance. Thus, the training program should adjust content based on playing specific positions to prevent injury.

Supported by MOST Grant 102-2410-H-179-007.

1563 Board #238 June 1 8:00 AM - 9:30 AM
Functional Movement Characteristics of US Navy Explosive Ordnance Disposal Technicians

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 (No relationships reported)

Explosive Ordnance Disposal (EOD) technicians experience high levels of physical stress due to their job demands, and physical conditioning is essential for operational readiness and mission success. Proper functional movement may help maintain physical health, optimize training and performance, and decrease injury risk.

PURPOSE: To describe functional movement characteristics of U.S. Navy EOD technicians.

METHODS: Forty-nine male U.S. Navy EOD technicians (age: 36.18±6.61 yr; height: 176.38±6.13 cm; weight: 88.29±11.04 kg) participated in this study. Subjects self-reported current and past musculoskeletal injuries (MSKI) and underwent a series of functional movement assessments, including center of pressure total sway (CoP_{TS}), functional movement screen (FMS), Y-Balance Test - Lower Quarter (YBT-

LQ), spatial-temporal gait assessment, and counter movement vertical jump with hands on hips. Sample statistics were compared with healthy, age-matched normative populations when available.

RESULTS: This sample reported 35% current and 80% past MSKI with the following functional movement measures (normative values in parentheses): CoP_{TS}: 23.53±11.44 cm (24); FMS: 15.55±2.01 points (15.6±2.3); YBT-LQ: 98.46±7.52 % leg length (95.2±8.8); walking speed: 1.20±0.13 m/s (1.31±0.16); jump height: 37.23±6.05 cm (N/A).

CONCLUSIONS: This study described the functional movement characteristics of U.S. Navy EOD technicians. Functional movement measures were comparable to healthy individuals, even with the high incidence of current and past MSKI. Further analyses evaluating performance relative to conventional standards and specific differences associated with the EOD community may provide insight on how to achieve optimal performance beyond that of the average healthy individual in order to attain the high level of functioning that the job demands of EOD personnel. With this goal in mind, our future studies will evaluate predictors and correlates of functional movement in EOD technicians with implications for training programs designed to improve functional movement, promote peak physical performance, and decrease injury risk.

1564 Board #239 June 1 8:00 AM - 9:30 AM
Effectiveness of a Functional Strength Training Program on Fitness Performance among Boys Aged 13-14 Years

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 (No relationships reported)

Functional strength training (FST) refers to the exercise program that makes training adaptations more specific and applicable for the whole body function output. With the characteristics of neuromuscular training enriched, movement pattern oriented and little equipment required, FST seems suitable to promote fitness performance for youth effectively. However, the scientific evidence of FST as a fitness promotional intervention for youth is not well documented.**PURPOSE:** To compare the effects of an 12-week intervention of FST with traditional resistant training (TRT) on fitness performance among boys 13-14 yrs old.**METHODS:** Sixty-eight healthy boys from Guanshan middle school were randomly assigned to the FST group and TRT group. FST group (n=34, age 13.59±0.89, height 1.67±0.05, mass 51.20±7.18, BMI 20.19±2.99) underwent 10 fundamental exercises in the first 4 weeks and 10 advanced FST exercises in the following 4 weeks, while TRT group (n=34, age 13.48±0.76, height 1.64±0.06, mass 51.52±8.33, BMI 20.55±2.01) did 10 fundamental and 10 advanced TRT exercises in the same time sequence. The training was 3 times/week and 45 min/session for both groups. The participants were tested at the beginning and the end of the intervention on 50m Sprint, Long Jump, Sit and Reach, 1000m Run and Pull-Ups. Independent and paired t tests were conducted to examine the differences between two groups and within groups, respectively. **RESULTS:** The results indicated that the FST group made significantly greater improvement than TRT did on 50m Sprint (Exp 8.71 (before)±0.31 vs. 7.40 (after) ± 0.30. $p<.01$; Control 8.72 (before)±0.91 vs. 8.03(after) ± 0.34), Long Jump (Exp 1.86 (before)±0.12 vs. 2.20 (after)±0.65. $p<.05$; Control 1.85 (before)±0.17 vs. 1.87 (after)±0.29), Sit and Reach (Exp 5.71 (before)±3.51 vs. 11.05 (after)±2.24. $p<.01$; Control 5.76 (before)±3.17 vs. 5.93 (after)±2.86), 1000m Run (Exp 4.59 (before)±0.52 vs. 4.02 (after)±0.55. $p<.01$; Control 4.51 (before)±0.63 vs. 4.27 (after)±0.64 $p<.05$), Pull-Ups (Exp 4.00 (before)±1.32 vs. 10.66 (after)±1.22. $p<.01$; Control 4.04 (before)±1.13 vs. 7.10 (after)±1.77 $p<.05$), respectively after the intervention.**CONCLUSION:** Functional strength training is more effective than traditional resistance training to improve fitness performance among boys aged 13-14 yrs.

1565 Board #240 June 1 8:00 AM - 9:30 AM
Assessing the Relationship Between Vertical Jump Performance and FMS in Young Adult Males

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Functional Movement Screening (FMS) is an assessment test used to determine an athlete's risk of injury based on the scores of seven tests that utilize commonly used movement patterns during exercise. Each test is scored based on whether or not biomechanical deficiencies are present when performing each test. Prior research has predominantly evaluated the relationship between FMS and susceptibility to injury. Yet, there appears to be limited research with FMS and anaerobic performance.

Specifically, the relationship between FMS and vertical jump performance has not yet been addressed. **PURPOSE:** To determine the correlation between Functional Movement Screening scores and maximum vertical jump height in young adult males. **METHODS:** Thirty averagely fit males (Age = 23.13 ± 3.02 yrs, HT = 178.74 ± 8.00 cm, WT = 82.14 ± 13.46 kg, BF% = 14.32 ± 4.60) voluntarily participated in this study. Each subject performed FMS and were scored according to the grading criteria provided by the developers of FMS. Then a dynamic warm-up utilizing a cycle ergometer for 8 min was performed followed by a 4 min passive recovery period. Next, subjects performed four maximum effort vertical jumps, which served as their vertical jump familiarization trials. All jumps were separated by 30 seconds except the last jump of the familiarization trial and the first jump of the performance trials which were separated by 4 min of passive recovery. The highest of the four performance jump trials, excluding the first jump, was utilized for data analysis. Pearson Correlations were utilized to assess the relationship maximum vertical jump height and total FMS score, squat FMS score, and inline lunge FMS score. **RESULTS:** There was a slight positive correlation when comparing maximum vertical jump (69.51 ± 9.68 cm) to total FMS score ($r = .264$) and FMS squat score ($r = .170$), but there was a moderate positive relationship with FMS inline lunge score ($r = .421$), which was significantly higher ($p = .01$) than both FMS total and FMS squat scores. **CONCLUSION:** The results of the current study seem to suggest that total FMS score is not a significant predictor for maximum vertical jump height. However, future studies should seek to determine the potential impact that improvements in the FMS inline lunge, squat, and total score may have on vertical jump performance.

1566 Board #241 June 1 8:00 AM - 9:30 AM

A Functional Resistance Training Design Elicits Greater Exercise and Excess Post-Exercise Oxygen Consumption Energy Expenditure Compared to a Traditional Resistance Training Design.

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(No relationships reported)

PURPOSE: To compare the differences in session energy expenditure and excess post-exercise oxygen consumption (EPOC) between traditional (TRAD) and functional (FUNCT) resistance training protocols. **METHODS:** Twenty-four recreationally trained men ($n=12$, 22.3 ± 1.8 yrs) and women ($n=12$, 20.2 ± 0.6 yrs) completed four separate resistance training exercise bouts in a randomized order, consisting of two TRAD and two FUNCT sessions. Training load was determined by familiarization session where each participant selected a load that elicited a RPE 6-7 ('hard' to 'very hard') for each exercise. Traditional (11 exercises) and functional (10 exercises) programs were matched for exercise time, major movements, and muscle groups. Each exercise session consisted of two sets of 10 repetitions with 90-sec rest between sets. EPOC was measured immediately following each exercise bout for a duration of 30 min. Oxygen consumption was measured continuously throughout the exercise session and energy expenditure (EE) was calculated via portable indirect calorimetry (K4b2, COSMED). Differences in session, EPOC, and total EE between TRAD and FUNCT protocols were analyzed as group means by using paired samples t-tests (SPSS v19; $p < .05$). **RESULTS:** All participants completed all exercise protocols and EPOC trials. Group means ± SD for exercise EE during TRAD and FUNC were 204.0 ± 74.2 kcal and 269.1 ± 87.2 kcal, respectively. Group means ± SD for EPOC EE during TRAD and FUNC were 44.3 ± 24.2 kcal and 51.4 ± 24.8 kcal, respectively. Group means ± SD for total EE during TRAD and FUNC session were 245.5 ± 96.0 kcal and 325.9 ± 113.8 kcal, respectively. Compared to the TRAD, the FUNC bout was significantly higher for exercise EE (95%CI: 51.4-79.0 kcal, $p < .05$), EPOC (95%CI: 1.2-13.0 kcal, $p < .05$), and total session EE (95%CI: 65.0-95.7 kcal, $p < .05$). **CONCLUSION:** These results highlight the effectiveness of a functional resistance training design to elicit greater energy expenditure during exercise and 30-min post-exercise compared to a traditional resistance training design. Electing to implement a functional over a traditional resistance training design may be more beneficial for the purposes of increasing exercise and post-exercise energy expenditure.

1567 Board #242 June 1 8:00 AM - 9:30 AM

Relationship Between Anthropometrics, Body Composition, and Functional Movement Quality

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(No relationships reported)

Previous research suggests an inverse relationship between functional movement quality and body mass index (BMI). Specifically, what aspects of BMI are correlated with the ability to move well? **PURPOSE:** This study investigated the relationship between functional movement quality and various anthropometric variables, including BMI, arm length (AL), and leg length (LL), as well as percent body fat (%BF). **METHODS:** Fifty-two college students (26 male; 26 female) free of

injury participated in this study. Functional movement quality was assessed by a commercially available, 7-test movement screen (FMS); testing was performed and scored by certified screeners per published testing procedures. Height was measured with a stadiometer; AL and LL were measured per published procedures. Weight and %BF were determined with a commercially available, multifrequency bioelectrical impedance system. Linear regression analysis was used to statistically determine the relationship between FMS scores (dependent variable), anthropometric and %BF data (independent variables). **RESULTS:** There was a significant relationship between FMS scores and %BF, LL, AL, and BMI collectively ($R = .531$; adjusted $R^2 = .220$; $p = .003$). Specifically, %BF had the strongest relationship [standardized beta coefficient (β) = -.502; $p = .008$] followed by LL ($\beta = -.278$; $p = .045$). However, AL ($\beta = -.028$; $p = .847$) and BMI ($\beta = .016$; $p = .927$) were not significant variables in the regression model. **CONCLUSION:** These results suggest that %BF is strongly related to functional movement quality and that any noted relationship between FMS scores and BMI is largely due to the influence of %BF on BMI values. Higher %BF may simply be an indicator of lack of fitness and/or physical activity, which, in turn, may be related to poor movement quality. This should be further investigated to determine the exact relationships that do exist between these variables. Additionally, LL is a variable that may influence FMS scores. As many of the tests involve movements of the lower extremity, it is also worth investigating how LL may influence movement quality and if this is a biasing factor in movement screening.

1568 Board #243 June 1 8:00 AM - 9:30 AM

The Impact of Past Athletic Experience on Functional Movement Screen (FMS) Scores in University Students

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(No relationships reported)

PURPOSE: The Functional Movement Screen (FMS) is a screening tool used to evaluate mobility and stability in assessing an individual's potential risk for injury. The purpose of this study was to determine if an individual's past high school athletic experience had an impact on their FMS scores as university students. The secondary objective was to investigate which high school sports had a significant impact on FMS scores. **METHODS:** Physically active university students (53 females, 47 males), ages 18 to 26 years with no recent (<6 weeks) history of musculoskeletal or head injury were recruited from introductory wellness classes. Participants indicated which sport(s) and for how many seasons they participated in each sport(s) during high school. Each participant performed the FMS, which consists of seven tests (deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability). Each test was scored on a scale of 0 to 3. A score of 0 indicates the lowest score possible, while a score of 3 is the highest. The combination of the tests provides an overall maximum score of 21. Research has shown FMS scores ≤14 have a statistically greater chance of injury than scores ≥15. A series of Chi-Square tests were performed comparing scores ≥15 and ≤14 on the FMS to identify which high school sports have the greatest impact on FMS performance. All FMS tests were scored by the same researcher to ensure intra-rater reliability. **RESULTS:** A positive correlation was found between individual FMS scores and number of sport seasons played in high school ($r = .32$, $p < 0.05$). This identifies a statistically significant impact on a university student's FMS score related to the number of seasons they played sports in high school. Participation in basketball, football, or track increased the likelihood of university wellness students scoring ≥15 on the FMS test. **CONCLUSION:** University students who participated in high school basketball, football, or track are more likely to score ≥15 on the FMS which could reduce their risk of musculoskeletal injury.

1569 Board #244 June 1 8:00 AM - 9:30 AM

Efficacy of a Task-Specific Periodized Resistance Training Program on Functional Movement Screening in ROTC Cadets

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(No relationships reported)

PURPOSE: Functional Movement Screening (FMS) is a testing procedure that examines the "quality" of movement patterns to identify individuals that have specific limitations or asymmetries. Low FMS scores have been linked with a higher risk of injury among tactical athletes. Since FMS is becoming a popular screening tool it is important to find methods or training programs that could improve FMS scores in military populations. **Purpose:** This pilot study examined the effects of a 7-week periodized resistance training program on FMS scores of ROTC Cadets. **METHODS:** Subjects consisted of 23 Army and Air Force ROTC cadets (male=18, female=6), Age (yrs) = 2.26±5.96, Height (cm)=172±8.68, Weight(kg)=72.98±12.91. The intervention group (IG n=14) trained for 1 hour/day, 4 days/week and the control

group (CG n=9) participated in traditional military training protocol for 1 hour/day, 3 days/week. A 2x2 mixed factorial ANOVA was used to compare mean change values of total FMS scores for experimental and control groups.

RESULTS: No significant ($p > .05$) differences in mean change values for FMS scores were observed between groups. A significant main effect ($p = 0.02$) was observed for FMS scores. Both groups had an increase in FMS scores after 7-weeks of training.

CONCLUSIONS: Although this study did not find differences in FMS scores between a specific periodized strength training program and a traditional military training program among ROTC cadets it is necessary that future studies address certain limitations that this study encountered (sample size and length of training period). FMS scores are being used more frequently as screening tools for risk of injury and as a result it is important to study methods that will improve FMS scores in diverse athlete's populations.

1570 Board #245 June 1 8:00 AM - 9:30 AM
Validation of a Modified Functional Movement Screen Test for Division III Male Soccer Players
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 (No relationships reported)

The Functional Movement Screen (FMS) is a battery of 7 tests to assess movement patterns. These tests include the deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability test. It is not known whether a shorter version could yield the same results, while allowing for more efficient screening in athletic settings. The modified version includes the deep squat, hurdle step, active straight leg raise, and an added test: a single leg squat.

Purpose

To validate a modified version of the Functional Movement Screen in Division III male soccer players.

Methods

The soccer group was scored once for original (21 points) and modified FMS (10 points), while the control group was scored twice by an FMS certified athletic trainer. The single leg squat was scored as 1 (no knee valgus) or 0 (knee valgus). Reliability was calculated as Pearson Product Moment and concurrent validity was calculated between modified FMS and original FMS scores, using R Statistical Software.

Results

Mean age for the soccer group was 19.6 ± 0.73 years, with mean FMS score of 15.6 ± 1.5 and mean modified FMS score of 7.3 ± 1.63 . Mean age for the control group was 20.5 ± 1.19 years, with a mean FMS score of 14.8 ± 1.64 for trial 1 and 15.3 ± 1.5 for trial 2. There was a strong correlation ($r = 0.74$) between trials for both the original and modified FMS scores and a strong correlation of ($r = 0.73$) between the original FMS and the modified FMS. Trial 2 scores were approximately 3% higher for both original and modified FMS, suggesting a possible practice effect. The addition of a third trial could possibly have attenuated this.

Conclusion

The modified version of the FMS is valid for division III male soccer players. Athletic trainers and coaches may use this modified version for more efficient screening.

1571 Board #246 June 1 8:00 AM - 9:30 AM
The Effects of Brief High Intensity Intermittent Functional Training on Body Composition and Anaerobic Fitness
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 (No relationships reported)

High-intensity intermittent training (HIIT) refers to a group of short intense exercise bouts separated by short rest periods. Standardized protocols have not been established to determine the most efficient intensity, exercise mode, exercise volume, and recovery duration of the HIIT exercises.

PURPOSE: The purpose of this study was to determine the effects of short-term HIIT in recreationally active college students. **METHODS:** The HIIT protocol consisted of 6 cycles of 6 different exercise at a 10 s: 5 s work-to-rest ratio, and a 1-minute recovery between each cycle. The exercise protocol was performed 5 days per week for 2 weeks, for a total of 10 sessions. Fifteen participants completed the brief-HIIT protocol, while another fifteen participants who were randomized in the control group, did not change their normal exercise routine. Before and after the 2 weeks, all participants underwent testing for anaerobic capacity and body fat percentage.

RESULTS: Both groups significantly decreased ($p < 0.05$) body fat percentage and fat mass (HIIT group: BFP = $31.1\% \pm 8.6$ to $30.3\% \pm 8.3$; FM = $26.5 \text{ kg} \pm 14$ to $25.8 \text{ kg} \pm 13.6$, control group: BFP = $26.3\% \pm 10.2$ to $25.6\% \pm 9.6$; FM = $19.34 \text{ kg} \pm 12.6$ to $18.6 \text{ kg} \pm 11.5$), as well as increased ($p < 0.05$) maximum power and fatigue index in the post-testing (HIIT group: MP = 1212.2 ± 491 to 1227.8 ± 486.8 ; FI = 31.9 ± 13.98 to 32.53 ± 14.77 , control group: MP = 966.7 ± 280.2 to 1014.6 ± 295 ; FI =

23.74 ± 7.80 to 26.06 ± 7.91). However, there were no significant changes ($p < 0.05$) in body fat percentage and anaerobic capacity between the two groups after the post-testing. **CONCLUSION:** Results from our study show no significant improvement in body composition or anaerobic capacity after 2 weeks of the brief HIIT protocol. Since no blood or muscle tissues were collected from the HIIT participants, we are not able to say if this protocol induced any molecular and/or cellular changes that might precede whole body and performance improvements. Thus, further research is needed to determine the physiological adaptation of the ultra-short HIIT in conjunction with functional training.

1572 Board #247 June 1 8:00 AM - 9:30 AM
Modified Functional Movement Screen as a Predictor of Knee Valgus in Male Soccer Players
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 (No relationships reported)

INTRODUCTION:

The Functional Movement Screen (FMS) is a battery of seven tests to observe key movement patterns and is scored in a twenty-one point scale (Cook 2010). Studies have suggested that individuals with scores of 14 or less had significantly higher risks of injury (Bushman et al., 2015; Chorba et al., 2010). A modified FMS, scored in a ten-point scale, has been used by a Division III college athletic training staff. It includes three original FMS tests (deep squat, hurdle step, shoulder mobility) and a single-leg squat (scored as 0 for knee valgus, and 1 for no valgus). It is not known whether the new battery can predict knee valgus in Division III male soccer players.

PURPOSE:

To determine whether the modified FMS can predict knee valgus when landing from drop jumps.

METHODS:

Seventeen Division III male soccer players and twenty healthy male non-athletes (ages 18-24) were recruited for the study. Subjects performed all modified FMS exercises and were scored by one FMS certified athletic trainer. Reflective markers were placed on subject's tibial tuberosity and distal tibia to define the tibia and knee valgus angles were measured with respect to the vertical line from video via goniometry at the lowest point of during landing from a drop jump from a 31cm box.

RESULTS:

For the soccer group, the mean for modified FMS score was 7.33 ± 1.63 , mean left knee valgus was -1.73 ± 1.62 degrees and mean right knee valgus was -0.73 ± 1.87 degrees. The controls' mean modified FMS score was 6.85 ± 1.50 , mean left knee valgus was -2.6 ± 2.80 degrees, and mean right knee valgus was -1.35 ± 3.23 degrees. The modified FMS was not a significant predictor of right knee valgus ($p=0.65$) or left knee valgus ($p=0.22$).

CONCLUSION:

The Modified Functional Movement Screen is not a significant predictor of knee valgus in DIII male soccer players. More sensitive scoring could have improved the modified FMS's ability to detect knee valgus. Post hoc power analysis results suggest that the non-dominant side may be more relevant for assessment.

1573 Board #248 June 1 8:00 AM - 9:30 AM
Functional Movement and Personal Fitness Training in a Community College Setting
 Tinker D. Murray, FACSM¹, Gene Power², Lisa Roslanova³, James Eldridge⁴.
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Movement screening (MS) for functional patterns has been advocated as an effective method to evaluate high performance populations such as American football players, firefighters, and military personnel. Corrective strategies are also often implemented in training to improve movement competency and theoretically reduce future injury rates. **PURPOSE:** The purpose of this study was to examine if basic anthropometric/functionality measures and modified simple movement assessments can be significantly influenced (Pre/Post) in young adults (a non-high performance population) with personal fitness training in a Community College setting. **METHODS:** All subjects (N = 142; Males = 57, Females = 85; mean age = 21.29 years) enrolled in a personal fitness course and completed basic anthropometric measures (waist and hip girths, shoulder mobility etc.) and a modified simplified MS (scored as yes/no for success with no pain). Subjects then completed the personal fitness course which emphasized an initial 15-20 minutes of developmental/corrective exercise and then 30 minutes of general resistance training per each class session. Data were analyzed with interval (Repeated Measures ANOVA) and ordinal (Chi

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Square) statistical techniques, and evaluated at the $p < 0.05$ level. **RESULTS:** Subjects reduced their waist and hip girths significantly; mean = 34.94 to 34.24 inches and 40.41 to 39.88 inches, respectively. Left bicep girths and grip strength also increased significantly (left bicep mean = 12.34 to 12.48 inches; left grip strength mean = 61.0 to 64.7 lbs; and, right grip strength mean = 65.27 to 69.7 lbs.). Mean left and right shoulder mobility (scratch test) improved significantly from 6.35 to 5.72 inches left and 5.64 to 4.96 inches right. Four screens (rotary stability- RS, pushups - PU, ankle mobility - AM, and toe touch - TT) out of six simplified MS measures (yes/no responses) increased significantly as well, (RS = 62.7 % to 72.2%; PU = 52.8 and 64.8%; AM = 83.1 to 90.8 %; TT = 81 to 90.7 %). **CONCLUSIONS:** A personal fitness course that focused on developmental/corrective exercise and general resistance training significantly improved basic anthropometric/functionality measures and modified MS assessments. Our results may provide an intervention for other young adults to improve their movement competency and fitness levels.

C-45 Free Communication/Poster - Heat Exposure/ Hydration

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1574 Board #249 June 1 9:00 AM - 10:30 AM Effectiveness of a Mobile Cooling Unit on Perceptual Responses During Preseason Collegiate Female Soccer Practices

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Body cooling between bouts of exercise has been examined in various athletic settings. The lack of breaks in soccer makes it challenging to effectively utilize cooling strategies to decrease heat strain during exercise in the heat.

PURPOSE: To determine the effectiveness of a mobile cooling unit in decreasing perceptions of heat strain in collegiate female soccer players.
METHODS: Perceptual measures of thirst (TST), thermal sensations (THM), ratings of perceived exertion (RPE), and environmental symptoms (ESQ) were measured during 4 preseason collegiate female soccer practices in a warm environment ($31.3 \pm 2.1^\circ\text{C}$). Soccer players (19.5 ± 1.1 y; 66.9 ± 5.3 kg; 168.6 ± 7.0 cm) were randomly assigned to either a cooling condition (POD; $n=16$) or a control condition (CON; $n=18$). POD players entered a mobile cooling unit ($9.5 \pm 1.6^\circ\text{C}$) during a practice break halfway through each practice while CON players rested on the sideline. ESQ was given before and after each practice, and TST, THM and RPE were measured before and after breaks. Perceptual measures were compared to gastrointestinal temperature (TGI) and heart rate (HR). Comparisons between conditions were analyzed using a repeated measures ANOVA (α set at $P < 0.05$). Pearson correlations were used to compare physiological and perceptual measures.

RESULTS: Pre-break TST for POD (6 ± 1) and CON (5 ± 1) were similar ($P=0.18$), while post-break TST was significantly lower in POD (3 ± 1) compared to CON (4 ± 1 ; $P=0.01$). Cooling via a mobile cooling unit resulted in significantly decreased post-break THM in POD (2 ± 1) compared to CON (5 ± 1 ; $P=0.00$). Δ RPE from pre- to post-break was significantly different between conditions ($P=0.00$). There was a strong, positive relationship between cooling rate and Δ THM in POD ($r=.752$, $P=0.005$) but not CON ($r=-.135$, $P=0.62$). ESQ increased pre- to post-practice but there was no difference between conditions ($P>0.05$). There were no differences in TGI and HR between conditions ($P>0.05$).

CONCLUSION: Players had significant changes in their perceived THM and TST sensations when cooled during practice breaks compared to control. The strong relationship between cooling rate and THM in only the cooling condition should be further investigated. In conclusion, players did feel better when cooled between bouts of exercise despite a lack of physiological effects.

1575 Board #250 June 1 9:00 AM - 10:30 AM Novel Cooling Device Enhances Autonomic Nervous System Responses Following Live Fire Training

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Firefighting results in high levels of cardiac strain, due to muscular work, dehydration, and heat stress. Cardiac strain has traditionally been investigated via heart rate responses. However, measures of autonomic nervous system balance in recovery

may provide greater insight into physiological disruption and cardiac risk. Further, because heat stress impairs performance and adds to cardiac strain, firefighters would benefit from portable, effective cooling technology. **PURPOSE:** To investigate the role of a wrist cooling band (dhamaSPORT) on heart rate variability (HRV) during recovery from live fire training. **METHODS:** 10 volunteer firefighters wore a Zephyr Heart Rate monitor during live fire training. Participants performed two evolutions of live-fire training drills and reported to a "rehab station" for rest and recovery. This pattern of 2 drills and rehab was repeated 3 times. When in rehab, the cooling band was placed on the wrist and was turned ON (cooling) for one rehab, then OFF (control) for the next. The on/off cycles continued throughout the 3 cycles with the position of on or off at the first rehab randomly determined. The cooling band instantly reaches a temperature of 44° when turned on. Perceptual measures of thermal comfort and strain were also collected. Participants remained in rehab for 15 minutes before returning to live-fire drills. **RESULTS:** There was no significant difference in HR between conditions (ON vs. OFF) at any time-point during rehab ($p>0.05$). Likewise, there was no significant difference in thermal sensation ($p>0.05$) and thermal comfort ($p>0.05$) between each condition during rehab ($p>0.05$). In contrast, RMSSD (parasympathetic modulation) was significantly reduced from rest to both rehab conditions (ON, $p < 0.05$; OFF, $p < 0.05$). The reduction in parasympathetic modulation was -21% in the ON condition vs. -40% in the OFF condition ($p=0.01$). **CONCLUSION:** There was no difference in HR between conditions but the cooling band blunted the shift in cardiac autonomic balance and helped maintain parasympathetic tone during recovery from live firefighting activity. This study found that the DhamaSPORT cooling band was easy to use during incident rehab and facilitated recovery, suggesting that it may be a useful tool during firefighting training and operations.

1576 Board #251 June 1 9:00 AM - 10:30 AM Hydration Provides No Thermo-Physiological or Cognitive Motor Skill Improvement during Passive Hyperthermia and Subsequent Cooling

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Maintaining hydration is understood to minimize deleterious effects of exercise-induced hyperthermia. Stimulation of arteriovenous anastomoses (AVAs) to induce cooling following hyperthermia is associated with positive changes in cooling time, thermo-physiological and cognitive function, and perception of thermal strain. However, the impact of hydration on these responses is unclear. **PURPOSE:** To determine the impact of hydration during passive hyperthermia and subsequent AVA-stimulated cooling on thermo-physiological function and cognitive motor skill. **METHODS:** Eight participants (23 ± 6 yrs; 172 ± 10 cm; 69.3 ± 10.8 kg) reported either dehydrated (USG > 1.020) or hydrated (USG < 1.010). Waking hydration status was assessed using a hand-held pen refractometer. Hyperthermia ($T_{re} 39.5^\circ\text{C}$) was induced whilst seated in circulated warm water (42°C) to the level of the clavicle. Post-hyperthermia cooling was performed by immersing one hand and forearm in circulated cold water (10°C) until $T_{re} \leq 38.0^\circ\text{C}$. Heart rate (HR) was monitored continuously during hyperthermia and cooling. A battery of cognitive motor skill tests (Stroop Word Color [SWC] and Trail-Making Task [TMT]), quadriceps maximal voluntary contraction (MVC), and perceived thermal sensation (TS) were assessed at baseline, upon reaching hyperthermia, and when $T_{re} \leq 38.0^\circ\text{C}$. Hydration status and cooling time, and thermo-physiological and cognitive motor skill comparisons were made using two-way and three-way ANOVA with repeated measures, respectively. **RESULTS:** Time to cool improved with AVA stimulation (24 ± 9 min vs. 40 ± 14 min, $p=0.001$), and T_{re} ($p=0.006$), HR ($p=0.004$) and TS ($p=0.004$) showed positive interaction effects (cooling and time). However, hydration had no effect or interaction effect ($p>0.05$) on thermo-physiological function. Trail-making task was negatively impacted by hyperthermia (Baseline 38 ± 12 s vs. Hyperthermia 50 ± 22 s vs. Cooled 41 ± 15 s, $p=0.017$), and performance of SWC ($p=0.077$) trended towards a positive interaction effect (cooling and time). However, hydration had no effect or interaction effect ($p>0.05$) on cognitive motor skill. **CONCLUSION:** Hydration status may have little impact on thermo-physiological function or cognitive motor skill during passive hyperthermia or subsequent cooling.

1577 Board #252 June 1 9:00 AM - 10:30 AM
Importance Of Sample Volume To The Measurement And Interpretation Of Plasma Osmolality
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(No relationships reported)

Small sample volumes may artificially elevate plasma osmolality (Posm) measured by freezing point depression. **PURPOSE:** To compare different sample volumes of measured Posm (mmol/kg) to each other, and to calculated osmolality (mmol/L) in euhydrated (EUH) and dehydrated (DEH) volunteers.

METHODS: Posm was measured using freezing point depression and osmolality calculated from measures of sodium, glucose, and blood urea nitrogen. The influence of sample volume was investigated by comparing 20 μ L and 250 μ L Posm samples (n = 158 pairs). Protinol (240, 280, 320 mmol/kg) and Clinitol (290 mmol/kg) reference solutions were compared similarly (n = 246 pairs). Twenty-one volunteers were tested multiple times while EUH (n = 72) or DEH (n = 7) by - 4.0% body mass.

RESULTS: The 20 μ L samples of Protinol, but not Clinitol, were significantly higher by 3 mmol/kg when compared to 250 μ L samples. The 20 μ L samples of plasma were 7 mmol/kg higher than 250 μ L samples with a nearly constant systematic error across the range tested (slope = 0.917). Calculated osmolality was significantly lower than 20 μ L Posm (- 6.6 mmol) but not different from 250 μ L Posm (< 1.0 mmol). When using common criteria for EUH (< 290 mmol/kg), only 19/72 EUH volunteers were correctly classified using 20 μ L Posm, however, 65/72 were correctly classified using 250 μ L Posm. DEH volunteers met the common > 295 mmol/kg DEH criteria in 7/7 (20 μ L Posm) and 6/7 (250 μ L Posm) cases studied. The average change in Posm from EUH to DEH was similar for 20 μ L (11 mmol/kg) and 250 μ L (10 mmol/kg) samples.

CONCLUSIONS: These results demonstrate that Posm measured by freezing point depression will be ~7 mmol/kg higher when using 20 vs. 250 μ L sample volumes. Approximately half of this effect may be due to plasma proteins. Posm sample volume should be carefully considered when calculating the osmole gap or assessing hydration status.

The opinions or assertions contained herein should not be construed as official or reflecting the views of the Army or the DoD.

1578 Board #253 June 1 9:00 AM - 10:30 AM
Assessment of the Efficacy of Military Training Fluid Intake Guidance in a Variety of Conditions
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Fluid intake during military training is prescribed based on the interactions among environmental conditions, uniform configurations and work rates. The efficacy of this guidance has not been empirically assessed for work bouts lasting >4 hours.

PURPOSE: To determine the acceptability of the fluid intake guidance, sweat losses were measured in a variety of conditions and modern uniform/body armor configurations and were then compared to prescribed fluid intakes for each condition (clothing, environment, workload, duration). **METHODS:** Whole body sweat losses of 141 soldiers were measured over a variety of environmental conditions (White-Black flag), uniform configurations (including Battle Dress Uniform and body armor), exercise intensities (easy, moderate, heavy), and work durations (2, 4, and 8 hr). Using the prescribed fluid intake guidance for each condition, the differences between the prescribed fluid intake and the total observed sweat loss were calculated. Differences were then expressed as a percent loss or gain of body weight using the following equation: [% body water flux = ((drinking volume- sweating volume)/ body weight) x 100]. Values within a threshold of \pm 2% body water flux (BWF) were deemed acceptable. This threshold was considered the starting point for performance and health concerns. To simulate a worst-case scenario, it was assumed no urine was produced throughout testing. **RESULTS:** During short work durations (2 and 4hr), 0 of 75 Soldiers exceeded the +2% BWF. During longer work durations (8hr), 50 of 66 Soldiers exceeded the +2% BWF. In all conditions, 50 of 141 Soldiers (35%) exceeded the +2% BWF. In no condition did a Soldier exceed the -2% BWF. **CONCLUSION:** Current fluid intake guidance appears to be sufficient (no over- or under-drinking \pm 2% BWF) during work durations lasting \leq 4 hours. However, for conditions beyond published guidance (>4hr), recommended drinking rates over-prescribe water needs in worst-case scenarios where no urine was produced. It is recommended that military fluid intake guidance be re-evaluated to include longer work durations of 8 hours. The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

1579 Board #254 June 1 9:00 AM - 10:30 AM
Considerations For Using Spot UsG To Detect Inadequate Between Running Bout Fluid Intake Volume
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PURPOSE: No single measure to detect real time hydration status is without limits; however, the validity of using urine specific gravity (USG) has received considerable scrutiny recently. Data used to draw these conclusions potentially suffers from multiple flaws (e.g. samples collected immediately after exercise or when significant sweat loss has not been incurred) in regards to practical application for runners. This study examined the efficacy of USG to detect inadequate beverage fluid consumption between training bouts in a twice-per-day training scenario.

METHODS: Data was pooled from multiple studies resulting in 143 total samples. USG of male and female runners was measured 10-14 hours after runs of 60-90 min in temperate to hot environments. Two meals and snacks were provided during the recovery period of each study. Multiple type of beverages were consumed, and all beverage fluid consumption was measured with some samples being taken before and after the second meal. Pearson r was examined for percent of sweat loss that was replaced with fluid from beverages and USG. Inadequate fluid intake detection was deemed to have taken place when <100% of sweat losses were replaced and USG was \geq 1.020. Analysis was repeated after removing 80 samples in which participants did not begin their run euhydrated (USG <1.020) and/or lost <3% body mass in sweat.

RESULTS: When all samples were included, moderate correlation between fluid replacement percentage and USG (r = -0.50; p < 0.001) was found. Total false diagnosis was detected in 22.4% (n = 32) of samples with 22% of runners replacing <100% of sweat losses exhibiting a USG < 1.020. After removing samples correlation strength increased (r = -0.69). Total false diagnosis was reduced to 12.7% (n = 8), and most importantly error for runners replacing <100% of sweat losses exhibiting a USG < 1.020 was decreased to 15%.

CONCLUSIONS: Pre-run spot USG assessment can be used as a practical field assessment to determine if intentional increased recovery fluid intake is warranted when training twice per day, particularly if the first running bout is undertaken in a euhydrated state (USG < 1.020) and significant sweat losses are incurred (3% body mass).

1580 Board #255 June 1 9:00 AM - 10:30 AM
Fluid Intake During Exercise in Tropical Climate in Young Athletes with Pre-Exercise Euhydration or Hypohydration
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Many young athletes start exercise in a state of body fluid deficit, which magnifies the risk of an excessive increase in body temperature and may lead to deterioration of skills related to sports performance. It is not clear if when water is readily available their voluntary fluid intake during exercise compensates for the pre-exercise fluid deficit, or if it is not enough and initial hydration status worsens. **Purpose:** To compare the amount of fluid replaced during exercise in the heat between young athletes who arrive to an exercise session in a state of euhydration (EUH) and hypohydration (HYP) and are provided water to drink ad libitum. **Methods:** Young athletes (N = 56, mean age = 15.7 \pm 1.4 yr) completed an exercise sweat test, running or racewalking at an intensity > 70% of age-predicted maximum heart rate, in a hot and humid environment (WBGT = 28.5 \pm 1.9°C). Pre-exercise urine specific gravity (USG) was used to categorize the athletes as EUH (USG \leq 1.020 g/mL, N = 15) and HYP (USG > 1.020 g/mL, N = 41). Water was provided in bottles and they drank ad libitum. Sweat loss was calculated from the change in body weight [BW] (corrected for urine output) plus fluid intake. Dehydration was calculated as % change in BW. Ratings of perception of thirst (N = 35) and hot/overheated (N = 39) were examined with a 0 - 10 scale. **Results:** Pre-exercise USG was higher in HYP (1.025 \pm 0.003 g/mL) compared to EUH (1.013 \pm 0.006 g/mL), P < 0.05. Exercise duration, sweat loss (27.4 \pm 11.2 vs 24.2 \pm 9.3 mL/kg) and urine loss (1.5 \pm 1.6 vs 0.7 \pm 0.4 mL/kg) were similar for EUH and HYP, respectively, P > 0.05. Despite fluid availability, fluid intake was low (EUH = 7.8 \pm 6.3 mL/kg; HYP = 9.2 \pm 7.5 mL/kg) and both groups showed significant reductions in BW (EUH = 2.0 \pm 1.0%; HYP = 1.6 \pm 0.8%), P > 0.05. Thirst increased during the session in both groups and was moderately high at the end (EUH pre = 2.2, post = 5.9; HYP pre = 1.9, post = 6.7). Mean perception of hot/overheated was high at the end of exercise (EUH = 6.3; HYP = 7.2). **Conclusion:** Young athletes that start exercise in a state of hypohydration do not drink enough water during exercise to compensate for the pre-exercise fluid deficit and subsequent fluid loss, and their initial hydration status worsens. Thirst may not be a good indicator of the need to drink and the ad libitum intake of water is insufficient even when it is readily available.

Abstracts were prepared by the authors and printed as submitted.

1581 Board #256 June 1 9:00 AM - 10:30 AM
Does Oral Fluid Intake Following Dehydration Influence Subsequent Athletic Performance? A Systematic Review and Meta-Analysis

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PURPOSE: Deleterious effects of dehydration on athletic performance have been well documented. As such, dehydrated individuals are advised to consume fluid in volumes equivalent to 1.25-1.5L·kg⁻¹ body mass (BM) lost to restore body water content. However, individuals undertaking subsequent activity may have limited time to consume fluid. In this context, the impact of fluid intake practices is unclear. This review investigated the effect of fluid consumption following dehydration on subsequent athletic performance. **METHOD:** PubMed (MEDLINE), Web of Science (Thomas Reuters) and Scopus databases were searched to identify studies on athletic performance (categorized as: *continuous*, *intermittent*, *resistance*, *sport-specific* and *balance* exercise) following dehydration of participants under control (no fluid) and intervention (fluid intake) conditions. Studies were excluded if macronutrient intake was not matched across trials. A random effects meta-analysis and multiple meta-regression analyses were performed to determine intervention efficacy for continuous exercise performance (insufficient data existed for meta-analysis with other exercise categories). **RESULTS:** 46 trials (n=404 subjects) derived from 33 publications were reviewed. Dehydration decreased BM by 1.3-4.2% and fluid intake was equivalent to 0.40-1.55L·kg⁻¹ BM lost. Fluid intake significantly improved *continuous exercise* performance (22 trials), Hedges' *g*=0.46, 95% CI: 0.32, 0.61 (I²=80.5). Differences in ambient temperature (*p*<0.001) and exercise duration (*p*=0.050) affected the magnitude of the performance change, with fluid intake demonstrating greater efficacy when exercise was performed in hotter environments and over longer durations (R²=0.95). The volume and timing of fluid consumption did not significantly influence the magnitude of this effect (*p*>0.05). Evidence indicating a benefit of fluid intake on *intermittent* (10 trials), *resistance* (8 trials) and *sport-specific* (6 trials) exercise was less apparent and requires further elucidation. **CONCLUSION:** Fluid consumption following dehydration may improve continuous exercise performance, even when body water deficit is modest and fluid intake is inadequate for complete rehydration. No funding was received for the preparation of this abstract

1582 Board #257 June 1 9:00 AM - 10:30 AM
Hydration Status and Repeated Sprint Performance in Females

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Hydration Status and Repeated Sprint Performance in Females

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Dehydration has been shown to have a negative impact on aerobic exercise performance; however, the effects of dehydration on anaerobic exercise performance are unclear.

PURPOSE: To examine the effects of hydration status on repeated sprint performance in females. **METHODS:** Ten females who were in the luteal phase of the menstrual cycle completed the study [21 ± 2 yrs., O_{2peak} 47.1 ± 3.9 ml·kg⁻¹·min⁻¹, BF 21.3 ± 3.4]. All subjects were utilizing a chemical contraceptive. Subjects completed the study in both a euhydrated and dehydrated state. Dehydration was induced by 12 hr of fluid restriction prior to the start of the sprint protocol. Hydration status was determined by urine specific gravity. A subject was considered to be hydrated with a urine specific gravity <1.020 and dehydrated with a urine specific gravity ≥1.020. Subjects completed twenty four 30 m sprints. The sprints were divided into 3 sets of 8. Subjects rested for 10 s between each sprint, and 2 min between each set of sprints. Core temperature (T_c), heart rate (HR), and rate of perceived exertion (RPE) were measured at baseline, postwarm-up, and after each set of sprints. Blood lactate, hemoglobin (Hb), and hematocrit (HCT) were measured at both baseline and at the end of the third set of sprints. **RESULTS:** No significant difference existed in the average time to complete sprints in a hydrated or dehydrated state. Resting T_c was significantly higher in a dehydrated state when compared to a hydrated state (37.87 °C ± 0.04 vs 37.56 °C ± 0.07, *p* < 0.05). HCT was significantly higher in a dehydrated state when compared to a hydrated state (46.85 ± 0.81 vs 44.95 ± 0.99, *p* < 0.05). HR, blood lactate, and Hb were not affected by hydration status. **DISCUSSION:** The elevation in T_c and HCT in a dehydrated state observed in the current study may be associated with the decrease in circulating blood volume that occurs with dehydration. As blood volume decreases, blood flow to the skin will decrease, leading to an increase in T_c due to a decrease in heat dissipation. Dehydration did not affect the repeated sprint performance of the female subjects.

Funded by Springfield College, College of Health, Physical Education and Recreation

ACSM May 30 – June 3, 2017

1583 Board #258 June 1 9:00 AM - 10:30 AM
Inter-season Dehydration Prevalence In Soccer Players that Rehydrate During Trainings Drinking Ad Libitum

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Drinking *ad libitum* is a very common strategy for rehydration during trainings, however, its application could lead to dehydration and this may differ depending on the year's season and the athlete's age.

PURPOSE: To compare the training dehydration prevalence in two different seasons in major and minor soccer players that drink *ad libitum*.

METHODS: 106 male soccer players were evaluated during a habitual training in summer and autumn. They were divided by age as major (>15 years old, n=47) and minor (11 to 15 years old, n=59), they trained at morning (8:00-10:00) and evening (15:00-17:00), respectively at a 1570 m over sea level height. Dehydration was evaluated as the weight loss percentage calculated and classified as low dehydration (>0% to <1% weight loss) and mild dehydration (≥1% weight loss). Subjects were allowed to drink any fluid *ad libitum* during trainings. These sessions had similar duration and intensity in both evaluations. The results are presented as the total prevalence of dehydration and type and compared for time (summer vs autumn) by one sample t-test and for age (major vs minor) by two samples t-test.

RESULTS: There was a higher dehydration prevalence in autumn than summer in the major group, by an increase in low dehydration prevalence, but without statistical significance (*p*>0.05). In the minor group, the dehydration prevalence was lower in autumn than summer, by a decrease in mild dehydration prevalence (*p*<0.05). There was a lower dehydration prevalence in the minor group than the major group in autumn (*p*<0.05) by a lower prevalence in low dehydration (*p*<0.05).

CONCLUSIONS: These results suggest that drinking *ad libitum* is not enough for maintaining adequate hydration in both major and minor soccer players, neither in summer nor autumn. However, this situation was lower in minor players.

Table 1. Dehydration prevalence in two seasons by age group.

Age type	N	Summer				Autumn			
		General dehydration (%)	Low dehydration (%)	Mild dehydration (%)	Temperature (°C)/ Humidity (%)	General dehydration (%)	Low dehydration (%)	Mild dehydration (%)	Temperature (°C)/ Humidity (%)
Major	47	76.6	51.1	25.5	20/76	91.5	66.0	25.5	19/74
Minor	59	88.1	45.8	42.3	25/49	64.4*	45.8*	18.6 ^b	22/65
Total	106	83.0	48.1	34.9		76.4	54.7	21.7	

* Significant difference vs major group (*p*<0.05); ^b Significant difference vs Summer (*p*<0.05)

1584 Board #259 June 1 9:00 AM - 10:30 AM
Frontal Asymmetry Changes Following Passive Hypohydration

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(No relationships reported)

PURPOSE: Fluid consumption prescriptions among athletic and non-athletic populations continue to elicit both hypo- (HO) and hyper-hydration (HR). Thus, the need to find traits within individuals who may be at a higher risk to experience HO, as well as hyponatremia, is warranted. Therefore, the purpose of this study was to evaluate changes in approach/reward (R) and avoidance/non-reward (NR) via frontal asymmetry (FA) in response to water exposure during eu-hydrated (EU) and HO conditions. **METHODS:** Participants included 14 active college-aged males. Electroencephalogram (EEG) assessed motivational orientations to water exposure in both EU and HO states. A 5 minute nature video was used to stabilize mood, followed by 2 minutes of resting EEG recordings. Then, FA was assessed with the presentation of a glass of ice water, and instruction to observe, but not consume for 3 minutes. FA was re-assessed in the same manner following a dehydration trial (~90 minutes). Dehydration trials were performed in a controlled hot water bath at a mean of 39°C. Participants remained in the bath until 2% body mass loss, with no fluids consumed during the trials. Urine voids were collected

before and after trials to assess specific gravity and color. Body core temperature was monitored throughout the trial, with >38.7°C set as criteria for removal. Participants reported affective measures using Feeling Scale and Felt Arousal Scale throughout the

Denver, Colorado

session to account for unusual affective states. **RESULTS:** EEG recordings were applied to the Frontal Asymmetry Index (FAI). Higher scores on the FAI indicate higher relative left frontal lobe activity, corresponding with an affinity to water (R). Lower scores indicate higher relative right frontal activity, thus less reward motivation (NR). Data revealed that FAI decreased by a mean of 0.05 ± 0.17 from EU to HO states, with EU and HO FAI of 0.06 and 0.01 respectively. In total, 42.9% of participants showed an increased affinity (R) for water from EU to HO states. **CONCLUSIONS:** R/NR motivational orientations changes were less than anticipated following HO trials. However, data revealed that 42.9% of participants exhibited an increased affinity for water thereby, supporting the hypothesis. It is possible that 2% body mass loss is insufficient to create distinct motivational orientation changes.

1585 Board #260 June 1 9:00 AM - 10:30 AM
Are all Heat Loads Created Equal?

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(No relationships reported)

The evaporative requirement for heat balance (E_{req} ; calculated as metabolic heat production minus dry heat loss) is the primary determinant of whole-body sweat rate during exercise in compensable conditions. However, the relative influence of metabolic and environmental heat load on physiological responses at a given E_{req} remains unclear. **PURPOSE:** To assess the thermal and cardiovascular responses during exercise bouts at a similar fixed E_{req} but for different combinations of metabolic and environmental heat loads. **METHODS:** Nine healthy males (46 \pm 8 yrs) performed four experimental trials consisting of 75 min of semi-recumbent cycling wherein dry heat exchange and metabolic heat production were monitored continuously with the latter adjusted to achieve a fixed E_{req} of 400 W. The respective metabolic heat productions and ambient temperatures for each trial were: i) 442 W and 30°C (439W[30°C]), ii) 391 W and 35°C (391W[35°C]), iii) 317 W and 40°C (317W[40°C]) and iv) 258 W and 45°C (258W[45°C]). Whole-body sweat rate was measured via direct calorimetry. Esophageal (T_{es}) and mean skin (T_{sk}) temperatures as well as heart rate (HR) were measured continuously. Mean body temperature (T_{mb}) and physiological strain index (PSI) were calculated from T_{es} and T_{sk} and T_{es} and HR, respectively. **RESULTS:** During exercise whole-body sweat rate was similar between conditions ($P=0.48$), as was T_{mb} ($P=0.65$). In contrast, T_{es} was greater in 439W[30°C] ($37.67 \pm 0.04^\circ\text{C}$) and 391W[35°C] ($37.58 \pm 0.07^\circ\text{C}$) relative to both 317W[40°C] ($37.35 \pm 0.06^\circ\text{C}$) and 258W[45°C] ($37.20 \pm 0.07^\circ\text{C}$; all $P \leq 0.05$). However, T_{sk} was different between all conditions (33.85 ± 0.16 , 34.53 ± 0.08 , 35.67 ± 0.07 and $36.54 \pm 0.08^\circ\text{C}$ for 439W[30°C], 391W[35°C], 317W[40°C] and 258W[45°C], respectively; all $P < 0.01$). HR was greater in 439W[30°C] (107 ± 3 beats \cdot min $^{-1}$) in comparison to both 317W[40°C] (103 ± 4 beats \cdot min $^{-1}$) and 258W[45°C] (89 ± 2 beats \cdot min $^{-1}$; both $P < 0.01$) whereas PSI was elevated in 439W[30°C] and 391W[35°C] compared with 317W[40°C] and 258W[45°C] (all $P \leq 0.04$). **CONCLUSIONS:** While exercise performed at a fixed E_{req} resulted in similar whole-body sweat rates and T_{mb} , physiological responses (i.e. T_{es} , T_{sk} , HR and PSI) varied as a function of the relative contribution of metabolic and environmental heat load. Supported by Ontario Ministry of Labour and NSERC

1586 Board #261 June 1 9:00 AM - 10:30 AM
Postexercise Activation of Muscle Metaboreceptors Modulates Whole-Body Evaporative Heat Loss

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Studies show that heat dissipation following dynamic exercise is suppressed for a prolonged period despite a sustained elevation in body core temperature. More recent work demonstrates that nonthermal factors associated with the activation of metaboreceptors may mediate the postexercise attenuation of local skin blood flow and sweating. However, it is unclear if this may translate into a reduction in whole-body heat dissipation. **PURPOSE:** To evaluate the influence of metaboreceptor activation on the modulation of postexercise whole-body evaporative heat loss (EHL). **METHODS:** On three separate days, 7 young (24 \pm 3 years) physically active males performed 45 min of moderate intensity cycling at a fixed rate of heat production of 400 W, followed by a 60-min recovery period in the heat (35°C). At 15, 30 and 45-min of recovery, participants completed one of three experimental conditions: 1) no isometric handgrip exercise (IHG) or ischemia (forearm occlusion, OCC) (CONTROL), 2) 1 min IHG at 60% of maximal voluntary contraction (MVC) (IHGonly), 3) 1 min

IHG at 60% of MVC followed by 5 min of forearm ischemia (IHG+OCC). Whole-body EHL was measured by direct calorimetry. Mean arterial pressure was measured continuously during the recovery period. **RESULTS:** Relative to pre-IHG levels, EHL increased similarly (~ 110 W, all $P < 0.05$) during IHG exercise at 15, 30 and 45-min of recovery for both the IHGonly and IHG+OCC conditions. As a consequence, EHL was significantly different relative to CONTROL at the end of IHG (all $P < 0.05$). The elevation in EHL was sustained during the 5-min forearm ischemia performed during the IHG+OCC condition, albeit values were slightly reduced from the levels achieved at the end of IHG exercise. Specifically, EHL was elevated by ~ 60 W relative to pre-IHG levels at the end of the period of ischemia (all $P < 0.05$). The increase in EHL however, was not significantly different from IHGonly and CONTROL at the end of ischemia for the 15 and 30-min postexercise measurement periods ($P=0.452$ and $P=0.139$, respectively). Differences were only measured at 45-min of recovery ($P=0.039$). **CONCLUSIONS:** We show that the activation of muscle metaboreceptors can modulate whole-body evaporative heat loss following dynamic exercise in the heat.

Supported by the Natural Sciences and Engineering Research Council of Canada

1587 Board #262 June 1 9:00 AM - 10:30 AM
Aerobic Fitness Modulates Whole-body Heat Loss in Young Adult Females during Exercise in the Heat

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(No relationships reported)

Aerobic fitness is considered a key determinant of the body's ability to lose heat during exercise in the heat. Recent studies show that fitness-related differences in heat loss are dependent upon the exercise-induced heat load. However, it remains unclear if like fitness, an individual's level of physical activity may play an equally important role in modulating whole-body heat loss. **PURPOSE:** To examine at what level of metabolic heat production, and therefore level of heat stress, aerobic fitness as defined by aerobic capacity (indexed by $\dot{V}O_{2peak}$) and physical activity level (indexed volume and intensity) may modulate whole-body heat loss in young females (21 \pm 3 yrs). **METHODS:** Using whole-body direct calorimetry, we compared dry and evaporative heat exchange between endurance ($n=8$, 53.1 mL $O_2 \cdot$ kg $^{-1} \cdot$ min $^{-1}$) and non-endurance trained females ($n=8$; 35.8 mL $O_2 \cdot$ kg $^{-1} \cdot$ min $^{-1}$, $P < 0.01$) with matched physical characteristics (*Study 1*) and between those with low ($n=7$) and high ($n=7$) physical activity levels ($P < 0.01$) but of similar aerobic capacity (~ 35 mL $O_2 \cdot$ kg $^{-1} \cdot$ min $^{-1}$, $P=0.05$) (*Study 2*). Participants performed three successive 30-min bouts of semi-recumbent cycling at increasing rates of metabolic heat production (to ensure a similar thermal drive for sweating) of 250 (Ex1), 325 (Ex2), and 400 W (Ex3) in the heat (40°C), each followed by a 15-min recovery period. **RESULTS: Study 1:** Dry heat gain was greater in the endurance group for Ex2: (80 ± 10 W) and Ex3 (80 ± 12 W) compared to the non-endurance trained females (Ex2: 58 ± 13 W; Ex3: 58 ± 14 W, both $P \leq 0.02$). However, a correspondingly greater evaporative heat loss was measured in the endurance (Ex2: 375 ± 29 W; Ex3: 432 ± 33 W) compared to non-endurance trained females (Ex2: 331 ± 22 W; Ex3: 371 ± 25 W, both $P \leq 0.03$) for these two exercise bouts. As such, body heat storage over the protocol was $\sim 26\%$ greater in the non-endurance compared to the endurance trained group ($P=0.04$). *Study 2:* Dry and evaporative heat exchange did not differ between low and high physical activity groups ($P \geq 0.72$), leading to similar levels of body heat storage ($P \geq 0.47$). **CONCLUSION:** We demonstrate that aerobic capacity, but not physical activity level modulates heat loss in females and that these differences are heat load dependent. Support: Natural Sciences and Engineering Research Council of Canada

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The Effects of Aerobic Fitness on Sweating and Skin Blood Flow in Older Adults

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(No relationships reported)

High aerobic fitness has been shown to prevent age-related decrements in heat dissipation in older adults; however, the mechanisms underlying the influence of this response on sweating and cutaneous vasodilation remain unclear. **PURPOSE:** To determine the role of superoxides and NADPH oxidase on sweating and skin blood flow in older adults during exercise in the heat. **METHODS:** Nineteen older adults (56 \pm 6 years) were separated into two groups based on their aerobic fitness ($\dot{V}O_{2peak}$, mL \cdot kg $^{-1} \cdot$ min $^{-1}$: Low Fit (LF), < 28 ; High Fit (HF), > 32). They performed two 30 min bouts of cycling in the heat (35°C); separated by a 30 min recovery. LF participants exercised at 65% of their $\dot{V}O_{2peak}$. HF participants exercised at the same heat production to that measured for the physically matched LF participants during their first bout (to compare responses for a similar thermal drive) and at 65% of their $\dot{V}O_{2peak}$ for the second bout (to compare responses as a function of relative exercise

intensity). Sweat rate (SR) and cutaneous vascular conductance (CVC) were measured at four intradermal microdialysis forearm skin sites continuously perfused with either: 1) lactated Ringer (Control); 2) 10 mM NG-nitro-L-arginine methyl ester (LNAME) (NOS inhibitor); 3) 100 μ M Apocynin (NADPH Oxidase inhibitor); or, 4) 100 μ M Tempol (superoxide dismutase mimetic). Responses were compared at baseline and 10 minute intervals. **RESULTS:** SR for all sites was not different between groups at end exercise performed at the same rate of heat production (LF: 0.63 vs. HF: 0.83 $\text{mg}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$, $P>0.05$). Conversely, SR for all sites at end exercise matched for relative intensity was significantly greater for HF as compared to LF (1.29 vs. 0.60 $\text{mg}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$, $P<0.05$). Within subjects, SR was not different between skin sites (all $P>0.05$). CVC was reduced at the LNAME site throughout the protocol (~20% reduction in CVC, $P<0.05$), while there were no differences between the other sites. Within the same skin site, no differences in CVC were measured between groups. **CONCLUSION:** Superoxides and NADPH oxidase do not play a role in mediating sweating and skin blood flow in older adults irrespective of their aerobic fitness. In contrast, differences in sweating were influenced by the absolute rather than relative exercise intensity. Supported by Canadian Institutes of Health Research

1589 Board #264 June 1 9:00 AM - 10:30 AM
Blockade Of BKCa Channels Limits Sweat Output In Human Skin
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Purpose: Sudomotor control of sweat gland function results in an increase in cytosolic Ca^{++} due to an IP_3 -mediated Ca^{++} release from intracellular stores and an influx of Ca^{++} from extracellular fluid. While K^+ channels have been implicated in modulating sweat gland function, it is unclear which specific K^+ channels modulate cholinergic sweating. As such, we tested the hypothesis that large conductance Ca^{++} -activated K^+ (BKCa) channels modulate sweat output. **Methods:** To evaluate this hypothesis, we examined the ability of two doses of tetraethylammonium (100 μ M and 50 mM TEA) to blunt axon reflex mediated sweating induced by intradermal electrical stimulation in 5 healthy adults. Local sweat rate (SR) was measured by passing dry gas through a small sweat capsule mounted on the skin. The skin was stimulated at a constant current intensity of 2.5 mA for 30 s at frequencies of 0.2, 1, 2, 4, 8, 16, 32, and 64 Hz using two small stainless steel stimulating electrodes. This procedure produced a sigmoid shape stimulus-response curve when we plotted the area under the SR-time curve versus stimulus frequency. **Results:** In control conditions peak local SR during 64 Hz stimulation averaged $0.511 \pm 0.104 \text{ mg}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$ which was significantly ($p<0.05$) reduced by application of 50 mM TEA to $0.317 \pm 0.060 \text{ mg}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$. 100 μ M TEA did not reduce peak sweat rate ($0.542 \pm 0.153 \text{ mg}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$). The stimulus-response curve during 50 mM TEA was significantly different from Control with a significant reduction in the plateau (0.302 ± 0.026 versus 0.234 ± 0.27 , $p<0.05$) but with a similar EC_{50} values (10.2 ± 1.1 and 6.7 ± 1.3 Hz for Control and 50 mM TEA, respectively). **Conclusion:** Blockade of BKCa channels does attenuate sweat gland function during axon reflex mediated sweating induced by intradermal electrical stimulation. Our data support the hypothesis that BKCa channels on the epithelial cells of the human sweat gland can modulate local sweat rate.

1590 Board #265 June 1 9:00 AM - 10:30 AM
KCA, KATP, And KV Channel Roles In Regulating Cutaneous Vasodilation And Sweating During Dynamic Exercise
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 (No relationships reported)

We recently showed the varying roles of Ca^{2+} -activated (K_{Ca}), ATP-sensitive (K_{ATP}) and voltage-gated (K_{V}) K^+ channels in regulating methacholine-induced cutaneous vasodilation and sweating in normothermic resting humans. However, it is unclear whether these contributions remain intact during dynamic exercise in the heat. **PURPOSE:** To determine the influence of various K^+ channels in regulating cutaneous vasodilation and sweating during exercise in the heat. **METHODS:** Young (23±4 years) habitually active males ($n=11$) completed a 30-min exercise bout at a fixed rate of metabolic heat production of 400 W (to maintain a constant thermal drive), followed by a 40-min recovery period in the heat (35°C). Cutaneous vascular conductance (CVC) and local sweat rate were assessed at four forearm skin sites perfused via intradermal microdialysis with either: 1) lactated Ringer solution (Control), 2) 50 mM tetraethylammonium (a nonspecific K_{Ca} channel blocker), 3) 5 mM glibenclamide (a selective K_{ATP} channel blocker), or 4) 10 mM 4-aminopyridine (a nonspecific K_{V} channel blocker). Responses were compared at baseline and at 10-min intervals during and following exercise. **RESULTS:** K_{Ca} channel inhibition resulted in greater CVC compared to Control at the end of exercise (62 vs. 56 %CVC_{max}, $P<0.05$) and the 10- and 20-min time points of recovery (~63 vs. ~45 %CVC_{max}, both $P<0.01$). K_{ATP}

channel blockade attenuated CVC in comparison to Control during baseline (32 vs. 39 %CVC_{max}, $P<0.05$), exercise (~41 vs. ~51 %CVC_{max}, all $P<0.05$) and at 10-min into recovery (37 vs. 46 %CVC_{max}, $P<0.05$). No differences in CVC from Control were observed with K_{V} channel inhibition during baseline resting (44 %CVC_{max}, $P=0.15$), exercise (~56 %CVC_{max}, all $P\geq 0.06$), or recovery (~49 %CVC_{max}, all $P\geq 0.14$). Local sweat rate did not differ from Control with any K^+ channel blockers (all $P\geq 0.07$), with the exception that sweat rate was augmented with K_{V} channel inhibition during baseline resting in the heat (0.45 vs. $0.37 \text{ mg}\cdot\text{min}^{-1}\cdot\text{cm}^{-2}$, $P=0.05$). **CONCLUSIONS:** We demonstrate that K_{Ca} and K_{ATP} channels contribute to the regulation of cutaneous vasodilation during rest, exercise, and recovery in the heat. In contrast, only the K_{V} channel modulates the sweating response during rest in the heat. Supported by the Natural Sciences and Engineering Research Council of Canada.

1591 Board #266 June 1 9:00 AM - 10:30 AM
Role of Oxidative Stress in Modulating Cutaneous Vasodilation and Sweating During Exercise in Type-2 Diabetics
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Impairments in heat dissipation in individuals with Type 2 Diabetes mellitus (T2D) have been observed during exercise in warm ambient conditions. This decline in heat loss may be related to diminished bioavailability of nitric oxide, an important contributor to the heat loss responses, due to increased oxidative stress. **PURPOSE:** To assess if local administration of ascorbate (ASC, a non-selective anti-oxidant) increases local heat loss responses of cutaneous vasodilation (CVC) and sweating during exercise in the heat in individuals with T2D. **METHODS:** Older adults (62 ± 9 yrs) with ($n=10$, T2D) and without ($n=10$, NoT2D) T2D, matched for age, body surface area and fitness performed 30-min of moderate-to-high intensity cycling (70% of $\text{VO}_{2\text{peak}}$), followed by a 20-min recovery in the heat (35°C). Local CVC and sweat rate were assessed at four skin sites continuously perfused via intradermal microdialysis with either: 1) lactated Ringer (Control), 2) 10 mM ASC, 3) 10 mM N^G-nitro-L-arginine methyl ester (L-NAME, a non-selective NOS inhibitor), or 4) a combination of ASC+ L-NAME. Responses were compared at baseline, end-exercise and end of recovery. **RESULTS:** In both T2D and NoT2D participants, CVC did not differ from Control at the ASC site throughout the protocol (all $P\geq 0.18$). In T2D, CVC at the L-NAME site was attenuated throughout the protocol relative to Control with reductions of 17%, 16% and 16%, during baseline, end-exercise and end of recovery, respectively (all $P\leq 0.05$). In NoT2D, attenuations in CVC at the L-NAME site consisted of 18%, 29% and 23% from Control at the same respective time periods (all $P\leq 0.01$). In T2D, CVC was attenuated at the combination site relative to Control throughout (baseline: 20%, end-exercise: 27% and end of recovery: 23%) (all $P\leq 0.01$). Conversely, in NoT2D the combination of ASC+L-NAME attenuated CVC during baseline (14%, $P=0.01$) and recovery (20%, $P=0.01$) only. No differences in sweat rate were observed between Control and any treatment site in either group (all $P\geq 0.10$). **CONCLUSION:** We show that oxidative stress does not impair CVC or sweating in T2D. Further, reducing oxidative stress in the presence of NOS inhibition in NoT2D alters other mechanisms in the regulation of CVC, however this response is not observed in adults with T2D. Supported by the Canadian Institutes of Health Research

1592 Board #267 June 1 9:00 AM - 10:30 AM
The Influence Of Aerobic Training On Maximum Skin Wettedness And Its Effects During Uncompensable Heat Stress
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 (Sponsor: Dr. Ollie Jay, FACSM)
 (No relationships reported)

PURPOSE: The purpose of the present experiment was to quantify how maximum skin wettedness (ω_{max}) is altered by aerobic training, and compare it to what is achieved following heat acclimation (HA). **METHODS:** Eight sedentary individuals (6 males, 2 females) participated in an 8-week aerobic training regime followed by a 9-day heat acclimation (HA) protocol. Participants completed on separate days, i) a treadmill humidity ramp protocol trial to assess ω_{max} ; and ii) a 60-min treadmill march (450 W of heat production) in an uncompensable environment: 38°C, 60% RH, on three separate occasions: pre-training (PRE-T), post-training (POST-T), and post-heat acclimation (POST-HA); The change in rectal (ΔT_{re}), and mean skin temperature (T_{sk}) were recorded. Whole body sweat loss (WBSL) was calculated as the change in nude body mass and sweating efficiency (S_{eff}) was derived by dividing the sweating

required to achieve ω_{max} (with 100% evaporation) by the actual whole-body sweat rate between the 30th and 60th minute of exercise. **RESULTS:** Aerobic training increased aerobic capacity by ~14% (PRE-T: 45.8±11.8 ml/kg/min; POST-T: 52.0±11.1 ml/kg/min, $P<0.001$). In the humidity ramp trial, ω_{max} was lower PRE-T (0.75±0.07) compared to POST-T (0.87±0.12, $P=0.01$) and POST-HA (1.00±0.00, $P=0.001$), and POST-T was lower than POST-HA ($P=0.04$). In the UC trial, ΔT_{re} was greater PRE-T (1.13±0.16°C) compared to POST-T (0.96±0.13°C, $P<0.001$) and POST-HA (0.96±0.20°C, $P<0.001$). PRE-T T_{sk} was higher after 60-min (38.0±0.4°C) compared to POST-T (37.2±0.9°C, $P<0.001$) and POST-HA (37.1±0.4°C, $P<0.001$). WBSL was significantly greater POST-HA (913±126 g) compared to POST-T (794±78 g; $P=0.002$) and PRE-T (671±83 g, $P<0.001$), however S_{eff} was similar throughout (PRE-T: 67±10%; POST-T: 68±11%; POST-HA: 66±8%). **CONCLUSIONS:** Aerobic training and HA independently increase ω_{max} without altering S_{eff} . A graded reduction in thermal strain during uncompensable heat stress is observed from PRE-T to POST-T, and to POST-HA.

1593 Board #268 June 1 9:00 AM - 10:30 AM
The Effect of a Tattoo on Sweating Function
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The popularity of tattoos has increase tremendously in the last 10-years particularly among college and professional athletes. The tattooing process involves permanently depositing ink under the skin at a similar depth as eccrine sweat glands (3-5 mm). **PURPOSE:** The purpose of this study was to compare the sweat volume and Na⁺ concentration of tattooed and non-tattooed skin. **METHODS:** The participants were 10 healthy males (age = 21-yrs) all with a unilateral tattoo covering a circular area 3-cm in diameter. Sweat was stimulated by iontophoresis using agar gel disks impregnated with 0.5% pilocarpine nitrate. The non-tattooed skin was located contralateral to the position of the tattooed skin. The disks used to collect sweat were composed of Tygon® tubing wound into a spiral so that the sweat was pulled into the tubing by capillary action. The sweat volume was determined by weighing the disk before and after sweat collection. The sweat Na⁺ concentration was determined by flame photometry. **RESULTS:** The average volume of sweat collected from tattooed skin was significantly less than non-tattooed skin (19 ± 15-μL vs. 36 ± 25-μL; $p=0.0001$). All 10 participants generated less sweat from tattooed skin than non-tattooed skin and the effect was -0.77. The average sweat Na⁺ concentration from tattooed skin was significantly higher than non-tattooed skin (69.1 ± 28.9-μEq/L vs. 42.6 ± 15.2-μEq/L; $p=0.01$). Nine of ten participants had higher sweat Na⁺ concentration from tattooed skin than non-tattooed skin and the effect size was 1.01. **CONCLUSION:** Tattooed skin generated less sweat and a higher Na⁺ concentration than non-tattooed skin when stimulated by pilocarpine iontophoresis.

1594 Board #269 June 1 9:00 AM - 10:30 AM
Measurement Of Sweat Sodium Concentration In Exercising Individuals: Inter-instrument Reliability Of The B-722 Laqua Twin
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Optimal replacement of sodium losses during or after prolonged exercise is best achieved when sweat losses and sweat sodium concentration are known. Both can be estimated under field conditions during a controlled test where the changes in body mass from before to after exercise is taken as a representation of sweat losses and sweat sodium samples are collected using the absorbent patches technique. The B-722 Laqua Twin (LaT), a low cost, battery operated, hand-held and easy-to-use sodium analyzer has been shown to have excellent intra- and inter-day reliability and to offer a reasonable degree of validity for the measurement of sweat sodium concentration under field conditions. The inter-instrument reliability of the LaT has never been determined. **PURPOSE:** To assess the inter-instrument reliability of the LaT sodium analyzer. **METHODS:** Seventy sweat samples collected in 14 athletes were analyzed in duplicate with 3 different LaTs. Sweat samples were collected during 40-min cycling or running exercises (~29-30°C and 20-40% relative humidity) from five anatomical sites using 5 x 7 cm absorbent pads covered with highly-adhesive impermeable transparent dressings. Sweat samples were extracted from the pads using centrifugation and then frozen at -20 °C until thawed and analyzed. **RESULTS:** All data were normally distributed and showed no sign of heteroscedasticity. Relative reliability was excellent between LaT 1 and 2, 1 and 3, and 2 and 3 with Pearson correlation coefficients of respectively 0.991, 0.995 and 0.996 and intraclass correlation coefficients of 0.986, 0.993, and 0.996. Mean biases between instruments were low (LaT 1 and 2: -2.6 mmol/L; 1 and 3: -1.8 mmol/L; and 2 and 3: 0.8 mmol/L) but statistically significant. The typical error of measurements as well

as the coefficient of variations were also low between instruments, ranging between 1.8 and 2.6 mmol/L and 2 and 4%, respectively. For comparisons between LaT 1 and 2, 1 and 3, and 2 and 3 the 95% limits of agreement reached ± 7.3, ± 5.3, and ± 4.8 mmol/L, respectively. **CONCLUSION:** The inter-instrument reliability of the LaT is adequate enough such that sports clinicians can confidently interpret exercise sweat sodium concentration values obtained from, and develop sodium replacement strategies for athletes based on, sweat sodium testing realized by different LaTs.

1595 Board #270 June 1 9:00 AM - 10:30 AM
Elevations In Biomarkers Of Acute Kidney Injury During Exercise Heat Stress: Evidence Of A Dose-response
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Purpose: We tested the hypothesis that elevations in biomarkers of acute kidney injury (AKI) are influenced by the magnitude of hyperthermia and dehydration elicited by exercise in the heat. **Methods:** Nineteen healthy males (age: 22 ± 3 y) wearing firefighter protective clothing completed two trials where they walked on a treadmill (4.8 kph, 5% grade) in a 38°C, 50% relative humidity environment. In one trial, subjects completed two 20 min exercise bouts (SHORT), and in the other three 20 min exercise bouts (LONG) were completed. Each exercise bout was separated by 10 min of standing rest. Venous blood samples were obtained before (Pre) and immediately post (Post) exercise, and following 1 h passive recovery in a moderate environment (Rec). Primary dependent variables were intestinal temperature, changes in body weight and plasma volume, plasma osmolality, serum creatinine, serum uric acid, and plasma neutrophil gelatinase associated lipocalin (NGAL), a marker of acute renal tubular injury. Glomerular filtration rate was estimated (eGFR) from creatinine. Data are presented as a change from Pre. **Results:** Changes in intestinal temperature (+2.0 ± 0.8 vs. +1.1 ± 0.3°C, $P<0.01$), body weight (-0.9 ± 0.6 vs. -0.7 ± 0.5%, $P=0.04$) and plasma volume (-12 ± 5 vs. -8 ± 6%, $P=0.03$) during exercise were exacerbated in LONG. Changes in osmolality during exercise did not differ between SHORT (+2 ± 3 mOsm/L) and LONG (+1 ± 4 mOsm/L, $P=0.80$). Increases in creatinine were greater in LONG at Post (0.18 ± 0.16 vs. 0.08 ± 0.06 mg/dL, $P<0.01$) and Rec (0.25 ± 0.19 vs. 0.18 ± 0.08 mg/dL, $P<0.01$). Increases in uric acid did not differ between SHORT (Post: 0.4 ± 0.2, Rec: 0.6 ± 0.4 mg/dL) and LONG (Post: 0.5 ± 0.5, Rec: 0.8 ± 0.6 mg/dL, $P\geq 0.41$). Reductions in eGFR were greater in LONG (Post: -15.5 ± 13.4 vs. -8.5 ± 5.5 ml/min/1.73 m², Rec: -21.0 ± 15.1 vs. -16.1 ± 6.6 ml/min/1.73 m², $P\leq 0.02$). Increases in NGAL were greater in LONG at Post (21.9 ± 21.0 vs. 10.6 ± 9.6 ng/mL, $P=0.01$) and Rec (12.4 ± 9.8 vs. 2.1 ± 9.1 ng/mL, $P=0.02$). **Conclusion:** Elevations in biomarkers of AKI are influenced by the magnitude of hyperthermia and dehydration elicited by exercise in the heat. These changes are not likely mediated by differential hyperosmolality or hyperuricemia. These findings are suggestive of a dose-response relationship between hyperthermia, dehydration and the magnitude of AKI.

1596 Board #271 June 1 9:00 AM - 10:30 AM
Functional Changes in Motor Cortical Brain Regions following Passive and Exertional Heat Stress
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 (No relationships reported)

Endurance performance is impaired when exercising in the heat. Hyperthermia-induced fatigue cannot be entirely explained by alterations in peripheral mechanisms. The central nervous system may have key roles in hyperthermia-induced fatigue and thus warrant further investigations. **PURPOSE:** To evaluate functional changes in the brain following passive or exertional heat stress. **METHODS:** Five moderately-trained athletes (mean ± SD: age 23.6 ± 1.7 years; body fat 9.3±2.0%; VO₂max 58±6 ml kg⁻¹ min⁻¹) underwent a motor task-based blood-oxygen-level dependent (BOLD) fMRI scan while donning a water-perfused thermal suit in a familiarization and four randomized, counterbalanced trials. fMRI scans were conducted after (a) running on a motorized treadmill at 70% VO₂max with ingestion of ambient water (EX) or (b) ice slurry (ICE), (c) passive heating via warm water immersion at 41°C (PAH), or (d) rest (CON). Serum osmolality was evaluated from blood samples collected at the start and end of each trial. Rectal temperature (T_{re}) and heart rate (HR) were assessed using two-way ANOVA with $p < 0.05$ considered as significant.

RESULTS: Participants started all trials euhydrated (mean serum osmolality: 292 ± 1 mOsmol/kg; $p = 0.719$), with similar baseline HR (66 ± 2 beats/min; $p = 0.908$) and T_{re} ($36.9 \pm 0.1^\circ\text{C}$; $p = 0.431$). Post-intervention percent body mass change were similar across trials ($-0.7 \pm 0.2\%$; $p = 0.110$). Post-intervention T_{re} for EX ($39.4 \pm 0.2^\circ\text{C}$) was similar to PAH trial ($39.3 \pm 0.2^\circ\text{C}$; $p = 0.59$) but higher than ICE ($39.0 \pm 0.2^\circ\text{C}$; $p = 0.01$) and CON trials ($36.5 \pm 0.2^\circ\text{C}$; $p < 0.01$). Mean T_{re} achieved during post-intervention fMRI scan were $38.5 \pm 0.1^\circ\text{C}$ for both EX and PAH trials, $37.7 \pm 0.1^\circ\text{C}$ for ICE trial and $36.3 \pm 0.1^\circ\text{C}$ for CON trial. Task-based fMRI detected lower BOLD signals from primary motor cortex in PAH (fold changes from baseline: 0.46 ± 0.35) compared to EX trials (1.03 ± 0.21 , $p = 0.01$). BOLD signals were also lower in primary somatosensory cortex for PAH (0.39 ± 0.23) compared to EX (1.04 ± 0.18 , $p < 0.01$) and CON trials (0.98 ± 0.10 , $p = 0.02$).

CONCLUSION: Preliminary results from task-based BOLD analysis showed that passive heating led to functional suppression in the sensorimotor areas in the brain. Supported by DIRP Grant, PA No. 9015102335.

1597 Board #272 June 1 9:00 AM - 10:30 AM
Outcomes from a Modified Heat Tolerance Test to Track Thermal Strain

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 (No relationships reported)

Heat tolerance testing has been utilized within military settings to assess one's readiness to return to duty after sustaining an exertional heat stroke (EHS). The military protocol (2-h walk at $5\text{ km} \cdot \text{h}^{-1}$ with a 2% grade in 40°C ambient temperature [T_A] and 40% relative humidity [RH]) has also been applied in athletic settings to assist clinicians when returning athletes to play after EHS. However, the efficacy of the military protocol has been questioned for use in athletic settings due to its relatively low intensity compared to the physical demands of most sports.

PURPOSE: To examine the physiological responses from a modified heat tolerance test (mHTT) and identify potential measures to assess individual heat tolerance from mHTT. **METHODS:** Thirty participants completed a $\text{VO}_{2\text{max}}$ test (T_A , $22.9 \pm 1.1^\circ\text{C}$; RH, $39 \pm 3.9\%$) and a mHTT (T_A , 40°C ; RH, 40%) on a motorized treadmill set at 2% incline. mHTT consisted of sustained treadmill running at 60% of the velocity achieved at $\text{VO}_{2\text{max}}$ for up to thirty minutes. Heart rate (HR) and rectal temperature (T_{REC}) were measured throughout the mHTT. Nude body mass (BM) was measured pre and post mHTT. Body surface area (BSA) was calculated using the equation by DuBois (1989). Adjusted physical strain index (PSI_A) was calculated using the formula developed by Moran et al. (1998) with an adjustment based on the maximal HR observed during the $\text{VO}_{2\text{max}}$ test as the upper HR threshold for each participant. **RESULTS:** Average $\text{VO}_{2\text{max}}$ was $42.4 \pm 7.2\text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$. Percent body mass loss from mHTT was $1.3 \pm 0.3\%$, and average end T_{REC} was $38.87 \pm 0.38^\circ\text{C}$. The mean rate of T_{REC} rise in the last 15 minutes of mHTT was $0.05^\circ\text{C} \cdot \text{min}^{-1}$ (range, 0.02 - $0.09^\circ\text{C} \cdot \text{min}^{-1}$). Standard linear regression analysis showed BM (R^2 change, 0.23 ; β , -0.93 ; $p = 0.009$), BSA (R^2 change, 0.12 ; β , 0.56 ; $p = 0.053$), and $\text{VO}_{2\text{max}}$ (R^2 change, 0.12 ; β , 0.46 ; $p = 0.047$) explained 48% of the variance observed in the T_{REC} gain at the end of mHTT ($R^2 = 0.48$, $p = 0.064$). Mean end mHTT PSI_A was 7.89 (range, 5.95 - 9.95 ; Shapiro-Wilk test, df , 31 , $p = 0.629$). There was no correlation between PSI_A and BM, BSA, and $\text{VO}_{2\text{max}}$ ($p > 0.05$). **CONCLUSION:** While T_{REC} response in mHTT was influenced by BM, BSA, and $\text{VO}_{2\text{max}}$, PSI_A was able to track thermal strain independent from these variables and with normal distribution, suggesting further exploration of the utility of PSI_A during the mHTT.

1598 Board #273 June 1 9:00 AM - 10:30 AM
Reduced Cardiorespiratory Fitness Causes Heat Tolerance Test Failures

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 (No relationships reported)

Heat tolerance tests (HTTs) are conducted to determine tolerance to exercise in a hot environment. Current HTT fail criteria state heart rate (HR) cannot exceed 160 bpm and core temperature (T_{rec}) cannot exceed 38.6°C within 120 min. Based on previous observations, some individuals have failed an HTT by exceeding the HR criterion, while T_{rec} remained well below fail criterion. Therefore, it is hypothesized that cardiorespiratory fitness, and not heat intolerance, may be the primary determinant for individuals failing HTTs. By comparing HR responses during exercise in thermoneutral and hot conditions, the impact of exercise load on HR response may be assessed without the confounding variable of increased environmental temperature.

PURPOSE: To compare HR responses during exercise in thermoneutral and hot conditions. **METHODS:** Ten healthy individuals (age: 25.7 ± 2.3 yrs, height: 171.1 ± 7.6 cm, weight: 64.1 ± 9.3 kg) completed one $\text{VO}_{2\text{max}}$ treadmill test and two trials

of treadmill walking at 3.3 mph, 4% grade for up to 120 min. One trial was conducted in thermoneutral conditions (22°C , 40% relative humidity) and one in hot (40°C , 40% relative humidity). HR and T_{rec} were recorded every 5 min during each trial. The trial ended if HR exceeded 160 bpm, T_{rec} exceeded 38.6°C , or 120 min was reached. Data were analyzed to determine heat and exercise tolerance among individual subjects.

RESULTS: Four of the 10 subjects were unable to complete the hot trial. One subject failed by exceeding the criterion for T_{rec} . Three subjects exceeded the criterion for HR, with end of test (EOT) HR responses significantly greater than those who did not exceed HTT criteria (165 ± 4 vs. 130 ± 22 bpm; $p < 0.01$). The same three subjects had higher EOT HR responses in the thermoneutral trial compared with those who never exceeded HTT criteria (131 ± 11 vs. 104 ± 13 bpm; $p = 0.02$). $\text{VO}_{2\text{max}}$ scores were also lower in the three subjects that exceeded the criterion for HR compared with those who did not (44.5 vs. 51.4 ml/kg/min; $p = 0.03$). **CONCLUSIONS:** The presence of elevated HR in both hot and thermoneutral trials, with evidence of lower $\text{VO}_{2\text{max}}$, supports a reduced aerobic capacity among the three individuals exceeding the criterion for HR. Thus, exercise intolerance and reduced aerobic capacity were the likely causes for subjects exceeding the HR criterion in the hot trial.

1599 Board #274 June 1 9:00 AM - 10:30 AM
Thermoneutral Exercise Correlates With End of Trial Heart Rate During Exercise in the Heat

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 (No relationships reported)

Military personnel who have suffered a heat stroke injury may have to undergo a heat tolerance test (HTT). The HTT is usually a "one-test, one-attempt" to assess a heat-injured warfighter's thermoregulatory capacity with implications of discontinued training, reassignment, or separation, if not passed. An HTT is passed if heart rate (HR) and core temperature do not exceed 160 bpm and 38.6°C , respectively, after 120 min has elapsed. It is hypothesized that pre-screening individuals to assess their HR response prior to an HTT could reduce the risk of a failed test. **PURPOSE:** To determine if exercising in a thermoneutral environment, prior to an HTT, can accurately correlate with an end of trial (EOT) HR during exercise in the heat.

METHODS: Ten trained individuals (age: 25.7 ± 2.3 yrs, height: 171.1 ± 7.6 cm, weight: 63.3 ± 9.5 kg) completed 120 min of continuous treadmill walking (3.3 mph, 4% grade) in a thermoneutral (22°C , 40% relative humidity) and hot (40°C , 40% relative humidity) environment to assess HR response. All trials were conducted in the morning and required a urine specific gravity of < 1.018 to start. During each trial, HR was obtained every 5 min until EOT and HR at 30 min was correlated with EOT HR within each trial and between the thermoneutral and hot trials. **RESULTS:** There was a strong correlation (30 min HR versus EOT HR) for each thermoneutral and hot trial, $r = .94$, $r = .91$, respectively. Additionally, there was a strong correlation between thermoneutral 30 min HR and hot EOT HR, $r = .83$. Significance of actual vs. predicted EOT HR for thermoneutral, hot, and thermoneutral-hot comparisons were $p = .99$, $p = .80$, and $p = .92$, respectively. **CONCLUSIONS:** These findings suggest exercise in thermoneutral conditions accurately correlates with EOT HR when performing exercise in the heat. By prescreening warfighters in thermoneutral conditions prior to their HTT, it may be possible to reduce HTT failures due to inadequate aerobic conditioning rather than inadequate thermoregulatory capacity. Future work should seek to identify selection criteria for warfighters that would likely fail an HTT.

1600 Board #275 June 1 9:00 AM - 10:30 AM
Accuracy Of ECTemp Models In Predicting Core Temperature And Circadian Rhythm Indicators From Heart Rate

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 (No relationships reported)

ECTemp is a heart rate (HR) based core temperature (CT) estimation model is being used to monitor and manage heat strain in warfighters and athletes during exercise in the heat. ECTemp may also be valuable for sedentary CT research on circadian rhythm disturbances. A recent modification to better reflect physiology may also improve ECTemp prediction of CT and circadian rhythm indicators (Midline Estimator of Rhythm MESOR, amplitude, and acrophase).

PURPOSE: To compare the accuracy of the original ECTemp model (Quadratic model) and a modified ECTemp model (Sigmoid model) in estimating CT during exercise and rest periods as well as circadian rhythm indicators. **METHODS:** 12 subjects (Age, 23 ± 3 yr; HT, 173.8 ± 7.7 cm; BM, 70.12 ± 8.94 kg) were monitored continuously for CT and HR while enclosed in a calorimeter chamber over two 22.5-hr

trials. Except for a one hour treadmill protocol, participants were required to restrict physical activity to sedentary tasks. Circadian rhythm indicators were extracted from rest periods using mixed effects models. Pearson's correlation coefficients and mean absolute errors (MAE) were determined to evaluate each model's performance during exercise and rest. **RESULTS:** Sigmoid model estimates had slightly stronger correlations with CT during exercise (0.90 vs. 0.89) and rest (0.74 vs. 0.67). Similarly, MAE for the Sigmoid model were lower for the Sigmoid model during exercise ($0.27 \pm 0.23^\circ\text{C}$ vs. $0.28 \pm 0.23^\circ\text{C}$, $p < 0.001$) and rest ($0.22 \pm 0.18^\circ\text{C}$ vs. $0.26 \pm 0.22^\circ\text{C}$, $p < 0.001$). MAE were significantly lower for Sigmoid model estimates of the MESOR ($0.07 \pm 0.06^\circ\text{C}$ vs. $0.16 \pm 0.07^\circ\text{C}$, $p < 0.001$) and acrophase (1.19 ± 0.97 hr vs. 1.57 ± 0.97 hr, $p < 0.001$) but similar for amplitude ($0.08 \pm 0.07^\circ\text{C}$ vs. $0.09 \pm 0.06^\circ\text{C}$, $p = 0.74$). **CONCLUSIONS:** While both models performed well (overall MAE $< 0.28^\circ\text{C}$), the Sigmoid model had more accurate estimates of exercise and rest CT as well as closer estimates of circadian rhythm indicators. Consequently, the modified ECTemp model appears to have potential as a CT estimator in conditions unsuitable for direct CT measurement regardless of activity level. Disclaimer: The views expressed are those of the authors and do not reflect the official policy of the Department of Defense, or the U.S. Government.

1601 Board #276 June 1 9:00 AM - 10:30 AM
Weighted Heat Stress Score as a Predictor of Rectal Temperature in a Warm Weather Race
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Torres et al. (2014) found minor correlations between Heat Stress Score (HSS) and rectal temperature (T_{REC}) in a warm weather race. **PURPOSE:** To examine if the weighted HSS equation (HSS_w) is more effective at predicting T_{REC} in a warm weather race. **METHODS:** Data from twelve participants (males, $n=7$; females, $n=5$) who ran in the 2015 Falmouth Road Race were examined (age, 38 ± 11.5 y; body mass, 66.12 ± 7.91 kg; body fat, $16.70 \pm 4.92\%$). Participants logged their exercise for 28-days leading up to race day using an online questionnaire. Zip codes were used to retrospectively calculate weather data (ambient temperature [T_{AMB}], relative humidity [RH]) using an online weather database. For indoor exercise bouts, the environmental conditions were standardized to $T_{\text{AMB}} = 20^\circ\text{C}$ and $\text{RH} = 30\%$. T_{REC} and finish time (FT) were measured on race day. HSS was calculated for training (HSS_T) and for race day (HSS_R) using the equation $\text{HSS} = (T_{\text{AMB}} [^\circ\text{C}] \text{ duration [min]})$ to determine total heat exposure. Edward's Training Impulse Score ($\text{TRIMP} = \text{exercise duration [min]} \times \text{heart rate weighting factor}$) was used to quantify exercise intensity for training (TRIMP_T) and for race day (TRIMP_R). Values from HSS and TRIMP were then weighted using the updated equation: $\text{HSS}_w = 2 \times (\text{HSS}_T / \text{HSS}_R) + 1 \times (\text{TRIMP}_T / \text{TRIMP}_R)$. Standard linear regression and Pearson product correlation were used to investigate anthropometric and physiological variables that are associated with T_{REC} . Significance was set *a priori* at $p = 0.05$. **RESULTS:** Average HSS_w ($R^2=0.004$, $p=0.841$), difference between finish time (FT) and predicted FT ($R^2=0.139$, $p=0.234$), FT ($R^2=0.104$, $p=0.298$), and body mass ($R^2=0.112$, $p=0.282$) did not predict participant's T_{REC} . Combined, the above variables predicted approximately 43% of the variance in T_{REC} ($r=0.652$, $R^2=0.425$, $p=0.359$). Additionally, average HSS_w ($r=0.125$, $R^2=0.02$, $p=0.671$) and FT ($r=-0.024$, $R^2=0.001$, $p=0.936$) were not correlated with T_{REC} . **CONCLUSION:** HSS_w did not exhibit improved prediction for post-race T_{REC} . Further investigation should examine anthropometric and physiological variables that were not collected in the study to predict T_{REC} response in a warm weather race.

1602 Board #277 June 1 9:00 AM - 10:30 AM
Comparison Of Rectal Temperature Prediction Models Utilizing Machine Learning
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 (No relationships reported)

The only valid methods for assessment of deep body temperature during exercise in the heat are invasive or logistically difficult to implement. Non-invasive prediction of deep body temperature has the potential to provide physiological information to exercising individuals. **PURPOSE:** To examine the use of machine learning models for the prediction and classification of rectal temperature (Trec) derived from non-invasive measurements. **METHODS:** We pooled data from two studies wherein participants, wearing athletic shorts and a tee shirt, walked and ran on a motorized treadmill in an environmental chamber (ambient temperature, $39.8 \pm 1.7^\circ\text{C}$; relative humidity, $33.4 \pm 10.7\%$). Data from twenty-five recreationally active participants were used (mean \pm SD; male, $n=19$; female, $n=6$, age, 24 ± 4 y; height, 177 ± 10 cm; body mass, 75.94 ± 12.45 kg;

body fat, $15.31 \pm 6.55\%$). Heart rate, 7-site skin temperature, speed, incline and T_{REC} were collected throughout exercise. Data were split into a 7:3 partition for model development and evaluation. Skin temperature, heart rate, speed, incline, environmental conditions and anthropometric information were selected as predictors. Multivariate linear regression, recursive partitioning, M5' modeling and multivariate adaptive regression splines (MARS) analyses were performed to develop prediction models. K-nearest neighbor and C5.0 model tree analyses were performed to develop classification models for when individuals became hyperthermic ($T_{\text{REC}} > 39^\circ\text{C}$). **RESULTS:** Standard stepwise linear regression accounted for 61% of the variability in Trec (predictors=17, SEE=0.52). A MARS model accounted for 77.6% of the variance in Trec (predictors=10, RMSE=0.428). A C5.0 decision tree was able to identify cases where an individual was hyperthermic with a sensitivity of 0.625 and a specificity of 0.906 (predictors=13, positive likelihood ratio=6.58). **CONCLUSIONS:** A MARS model improved upon linear regression analyses for the prediction of Trec during exercise. Additionally, a C5.0 decision tree model was able to classify individuals who were hyperthermic with a moderate shift in diagnostic probability. These techniques may be useful for refinement and implementation of future models to predict deep body temperature in an athletic setting.

1603 Board #278 June 1 9:00 AM - 10:30 AM
Dietary Curcumin Supplementation Reduces Gastrointestinal Barrier Permeability During Exertional Heat Stress
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Exertional heat stress increases gastrointestinal barrier permeability and risk of exertional heatstroke (EHS) via a TLR4-mediated inflammatory pathway. Oral curcumin supplementation is known to inhibit both the MyD88 & TRIF-dependent pathways of TLR4 signaling. **PURPOSE:** This work investigated the effect of 3d of 500mg/d dietary curcumin supplementation on gastrointestinal (GI) barrier permeability and systems-physiology responses to exertional heat stress in non-heat acclimated humans. **METHODS:** Eight subjects ran ($65\% \text{VO}_{2\text{max}}$) for 60min in a Darwin[®] chamber ($37^\circ\text{C}/26\% \text{RH}$) two times (CURCUMIN/PLACEBO). Intestinal fatty acid binding protein (I-FABP) and associated pro-inflammatory (MCP-1, TNF α , IL-6) and anti-inflammatory (IL-1ra, IL-10) cytokines were assayed from plasma collected before (PRE), after (POST), 1hr (1-POST), and 4hrs after (4-POST) exercise. Core (Tc), skin (Tsk), and mean body (Tb) temperatures; HR; and physiological strain index (PSI) were measured throughout exercise. Group differences were determined with 2-Way (Condition x Time) RM ANOVAs. **RESULTS:** Intriguingly, the interaction of Condition x Time was significant ($p < 0.05$) for I-FABP and IL-1ra. *Post hoc* analysis indicated the increase in I-FABP from PRE to POST (87%) and 1-POST (33%) in PLACEBO exceeded that in CURCUMIN (58% & 18%; respectively). IL-1ra also increased more from PRE to 1-POST in PLACEBO (153%) than in CURCUMIN (77%). TNF α increased ($p=0.01$) from PRE to POST (19%) and 1-POST (24%) in PLACEBO but not in CURCUMIN. IL-10 increased ($p < 0.01$) from PRE to POST (61%) and 1-POST (42%) in PLACEBO but not in CURCUMIN. The PSI, which indicates EHS risk, was also lower ($p < 0.01$) in CURCUMIN from 40-60min of exercise. **CONCLUSION:** Collectively, these data suggest 3d curcumin supplementation reduces GI permeability and cytokine responses to exertional heat stress.

1604 Board #279 June 1 9:00 AM - 10:30 AM
Curcumin Improves Systemic Responses to Exertional Hyperthermia but Doesn't Alter Protein Expression in Circulating Leukocytes
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 (No relationships reported)

Exertional heat stress increases gastrointestinal barrier permeability and risk of exertional heatstroke (EHS) via a TLR4-mediated inflammatory pathway. Curcumin has been shown to inhibit TLR4 signaling *in vitro* but has not been examined in a human exertional heat stress model. **PURPOSE:** This work investigated the effect of 3d of 500mg/d dietary curcumin supplementation on the cellular and systemic responses to exertional heat stress in non-heat acclimated humans. **METHODS:** Subjects ($N=6$) ran ($65\% \text{VO}_{2\text{max}}$) for 60min inside an environmental chamber ($37^\circ\text{C}/26\% \text{RH}$) two times (CURCUMIN/PLACEBO). Core temperature (Tc), heart rate (HR), and physiological strain index (PSI) were measured throughout exercise. Peripheral blood mononuclear cells (PBMC) were isolated from blood samples that were taken before (PRE), after (POST), 1hr (1-POST), and 4hrs after (4-POST) exercise. The protein content of markers along the TLR4 signaling pathway (TLR4,

MyD88, pNFKB, NFKB) and indicators of cellular energy status (SIRT1 & p-AMPK) were determined with Western Blot. Group differences were determined with 2-Way (Condition x Time) RM ANOVAs. **RESULTS:** Under CURCUMIN, Tc rose less ($0.23 \pm 0.15^\circ\text{C}$; $p < 0.01$) and both HR and PSI were lower from 45-60min of exercise (HR: 9 ± 2 bpm, PSI: $12 \pm 1\%$; $p < 0.05$). In PBMC, the ratio of pNFKB to NFKB at 1-POST was increased by 64% in PLACEBO and 51% in CURCUMIN ($p = 0.05$). Intriguingly, TLR4 was reduced at 1POST in both conditions (PLACEBO: -28%, CURCUMIN: -17%; $p = 0.05$), as were pAMPK (PLACEBO: -62%, CURCUMIN: -57%; $p < 0.01$) and SIRT1 (PLACEBO: -61%, CURCUMIN: -48%; $p = 0.02$). **CONCLUSIONS:** Despite robust improvements in systemic responses to exertional heat stress under CURCUMIN, there was no difference in the protein expression profile of PBMC that were collected under CURCUMIN and PLACEBO conditions. However, in both conditions we did note a significant elevation in pNFKB:NFKB at 1-POST, which (ironically) coincided with a significant reduction in TLR4 (but not MyD88). At present, our working hypothesis is that pAMPK and SIRT1 were downregulated in an effort to maintain the pro-inflammatory capacity of PBMC during this "open window", an effect that has not previously been described in PBMC collected under exertional heat stress conditions.

1605 Board #280 June 1 9:00 AM - 10:30 AM
Impact of Heat Stress and Prolonged Exercise on the Oral Microbiome in Adults

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PURPOSE: To assess the impact of completing a 164-km road cycling event performed in a hot environment (Wichita Falls, Texas in August), on the oral microbiome in men and women.

METHODS: 28 participants completed the ride and had their complete oral microbiome analyzed. Oral microbiome samples were collected in the morning before (PRE) and immediately after (IP) completing the ride. Sample's DNA was isolated and the V4 region of the 16S rRNA was then amplified by PCR. Libraries were sequenced on MiSeq, and reads were aligned and processed through QIIME to generate an OTU table. Microbial diversity was estimated using the following indexes: chao1, observed species, Shannon, PD whole tree and equitability. In addition, Lefse was utilized to identify tax enrichment in different sex, age and BMI groups - using pre/post as a subcategory.

RESULTS: Across all samples, the top 5 phyla accounted for 97% of bacteria present: *Firmicutes* (0.69 ± 0.02) > *Proteobacteria* (0.11 ± 0.01) > *Bacteroidetes* (0.08 ± 0.007) ~ *Actinobacteria* (0.08 ± 0.006) > *Fusobacteria* (0.01 ± 0.002). Microbial diversity was not changed due to the event. However, there was significant increase in the relative abundance of *Firmicutes* ($P = 0.0007$) and decreased abundance of *Bacteroidetes* ($P = 0.01$) after the exercise. There was also a borderline-significant trend for *Proteobacteria* to decrease after exercise ($P = 0.055$). In addition, the ratio of *Firmicutes* to *Bacteroidetes* rose from approximately 10.9 before exercise to 22 post exercise ($P = 0.01$). 14 taxa were associated with males (5 *Fusobacteria*, 4 *Actinobacteria*, 2 *Bacteroidetes*, 2 *Firmicutes*, 1 *Proteobacteria*) and 1 (*Actinobacteria*) with females. With BMI divided into 3 categories (Group 1 <25; Group 2= 25 - 30; Group 3 >30), three taxa (all *Actinobacteria*) were associated with the leanest group, 5 with the intermediate group (all *Bacteroidetes* class *Flavobacteriia*) and 3 (2 *Bacteroidetes* family *Porphyromonadaceae*, 1 *Tenericutes*) with the "obese" group. **CONCLUSIONS:** Completing a 164-km road cycling event in hot conditions resulted in increased ratios of *Firmicutes* to *Bacteroidetes* and *Firmicutes* to *Bacteroidetes* in both men and women. Therefore, the shift of the oral microbiome caused by the stress of the prolonged riding in the heat may lead to some populations more susceptible to immune dysfunction.

1606 Board #281 June 1 9:00 AM - 10:30 AM
Effects Of Lower-body Versus Upper- And Lower-body Resistance Exercise On Lower-body Intramuscular Temperature

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PURPOSE: Intramuscular temperatures above 38.6°C are associated with impaired endurance. However, the effects of resistance exercise on intramuscular temperature has not been studied. Further, some studies have shown that exercise in one muscle group can impair performance in other muscles. Thus, the purpose of this study was to compare the effects of lower-body (LB) only and lower-body with upper-body (UB) resistance exercise on intramuscular temperature of the vastus lateralis.

ACSM May 30 – June 3, 2017

METHODS: Ten subjects (age= 19.9 ± 2.4 y; height= 179.1 ± 8.6 cm; mass= 81.4 ± 7.7 kg) participated in the study. Experimental visits consisted of either a LB or (UB) condition. During UB, participants completed three circuits of 90% one-repetition maximum (1RM) hip sled and 80% 1RM lat pull-down exercises to failure followed by a final 90% 1RM hip sled set to failure. During LB, participants completed four sets of hip sled to failure at 90% of 1RM. The beginning of each hip sled set was separated by 4-minutes. For all sets a thermocouple sampled vastus lateralis temperature. For all statistical analyses, alpha was set at .05.

RESULTS: A 2 (condition) by 4 (set) by 2 [intra-set change (start versus end)] repeated measures ANOVA revealed a significant interaction between set and intra-set change on muscle temperature ($p = .001$; $\eta^2 = .647$); there were no other significant interactions. Collapsed across conditions, intra-set muscle temperature increases were progressively attenuated (highest $p = .006$) from a maximum of $.5^\circ \pm .2$ in set 1 to $.2^\circ \pm .2$ in set 4. There was no significant main effect of condition on muscle temperature ($p = .257$; $\eta^2 = .140$). Two one-sample t-tests showed that muscle temperature at the end of set 4 was significantly less than 38.6° in the LB (CI= $35.6-37.2^\circ$; $p < .001$) and UB (CI= $35.2-36.6^\circ$; $p < .001$) conditions. A 2 (condition) by 4 (set) repeated measures ANOVA yielded no significant main effect of condition on total number of completed hip sled repetitions ($p = .494$; $\eta^2 = .053$; LB CI= $6.5-10.8$ reps; UB CI= $5.7-10.5$).

CONCLUSIONS: During resistance exercise, it is unlikely that muscle temperatures get high enough to enhance the rate of fatigue development. Furthermore, the addition of UB resistance exercise does not appear to significantly increase LB muscle temperature or affect performance under these conditions.

1607 Board #282 June 1 9:00 AM - 10:30 AM

Deep Tissue Heating Increases Mitochondrial Respiratory Capacity of Human Skeletal Muscle

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Environmental factors such as hypoxia and heat stress have been shown to disrupt cell homeostasis, resulting in altered cellular energy status and the activation of signaling pathways associated with mitochondrial biogenesis. In response to heat stress, mitochondrial biogenesis has been confirmed in skeletal muscle using both animal and *in vitro* research models. **Purpose:** To investigate the effect of deep tissue heating on skeletal muscle respiratory capacity in humans. **Methods:** Ten healthy men ($n = 5$) and women ($n = 5$) volunteered for the study (20.3 ± 2.05 yrs, 171 ± 13 cm, 65 ± 14 kg). From each volunteer, a randomly selected leg was chosen to receive daily heat therapy over a 6-day period via short-wave diathermy. Intramuscular temperature was measured with the insertion of a temperature probe to the approximate depth at which muscle tissue would be sampled (≈ 3.5 cm). Muscle biopsies were taken before and after the therapeutic intervention from both the treated and untreated vastus lateralis muscles. Maximal respiratory capacity (OXPHOS) and maximal uncoupled respiration (ETS) were measured according to the standard Substrate-Uncoupler-Inhibition Titration (SUIT) protocol for high-resolution respirometry. **Results:** No differences in OXPHOS ($p = 0.215$) or ETS ($p = 0.4114$) were detected between the treatment and control muscles before heat therapy. Muscle temperature increased significantly in response to diathermy treatment ($3.96 \pm 0.51^\circ\text{C}$, $p < 0.0001$). After 6 days of heat therapy, there was a strong trend for increased maximal OXPHOS (5.55 ± 3.50 pmol $\cdot\text{kg}^{-1}\cdot\text{sec}^{-1}$, $p = 0.055$). Following heat therapy, there was also a significant increase in ETS (9.40 ± 4.17 pmol $\cdot\text{kg}^{-1}\cdot\text{sec}^{-1}$, $p = 0.035$). **Conclusion:** In support of previous animal and *in vitro* research, these data support increases in mitochondrial respiratory capacity in response to heat stress in human skeletal muscle. Such increases in mitochondrial respiratory capacity may have implications for individuals suffering from mitochondrial myopathies, as improved respiratory capacity may promote improvements in skeletal muscle health and function. Additional research involving more practical heating modalities is necessary if these findings are to be extended to clinical populations.

1608 Board #283 June 1 9:00 AM - 10:30 AM
Repeated Thermal Stress Sensitizes C2C12 Myotubes To Subsequent LPS Exposure

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 (No relationships reported)

Purpose: This study investigated the hypothesis that "preconditioning" hyperthermia affords cytoprotection against subsequent LPS stimulation in C2C12 myotubes. **Methods:** C2C12 myotubes were incubated for 2hr/d at 40°C for 6d (HEAT) or maintained at 37°C (CONTROL). After recovering for 24 hours, myotubes were stimulated with LPS (500ng/ml) for 2hr, following which protein markers of the heat shock response (HSR), NFKB activation, and lipid/glycogen storage capacity were examined via Western Blot. **Results:** As expected, the HSR was strongly activated by HEAT [HSP32 (+38%; $p < 0.01$), HSP60 (+32%; $p < 0.01$), HSP70 (+68%; $p < 0.01$)].

Unexpectedly, HEAT exhibited a *heightened* inflammatory response [p-IKk α /b (+81%; p=0.04), p-IKb α (+432%; p<0.01), p-NFKBp65 (+283%; p=0.04)]. Intermediate enzymes of lipid [p-ACCa (-33%; p=0.02)] and glycogen [p-GSK3 α /b (+367%; p=0.03)] biosynthesis were also down regulated, with elevated p-AMPK (+80%; p<0.01) suggesting an energetic deficit. Apoptosis activators Caspase 8 (+53%; p=0.04) and FOXO1 (+74%; p=0.02) were up regulated, as was p-JNK (+41%; p=0.03). Through follow-up analysis we determined these undesirable responses were linked to up-regulation of TLR4 (+24%; p=0.03) and MyD88 (+308%; p<0.01), as well as p-NIK (+199%; p=0.02) but not IRAK-1 (p=0.46). **Conclusion:** Despite a robust activation of the HSR, repeated thermal stress imparts an exaggerated pro-inflammatory and pro-apoptotic response to LPS stimulation in C2C12 myotubes. This may be due to elevated TLR4 signaling capacity. We speculate that reduced glycogen storage in HEAT may have contributed to lower stress tolerance, with the upregulation of apoptosis serving as a negative-feedback mechanism (to reduce myotube number).

1609 Board #284 June 1 9:00 AM - 10:30 AM
Human Skeletal Muscle Myogenic and Proteolytic Response To Environmental Temperature

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 (Sponsor: Dr. Dustin Slivka, FACSM)
 (No relationships reported)

Many human diseases lead to loss of skeletal muscle function and mass. Local and environmental temperature can alter the exercise-stimulated response of several genes involved in skeletal muscle growth and breakdown. However, the impact of environmental temperature, independent of exercise, has not been addressed in a human model. **PURPOSE:** The purpose of this study was to compare the effects of exposure to hot, cold, and room temperature conditions on skeletal muscle gene expression related to myogenesis and proteolysis. **METHODS:** Recreationally trained male subjects (n=11, age 27 \pm 5, height 183 \pm 5 cm, weight 84.1 \pm 13.0 kg) each completed three trials in hot (33 $^{\circ}$ C), cold (7 $^{\circ}$ C), and room temperature (20 $^{\circ}$ C) conditions. Whole body oxygen consumption was monitored during the 3 h exposure. Muscle biopsies were taken from the *vastus lateralis* before and after the 3 h temperature exposure. Muscle samples were analyzed for gene expression using qRT-PCR. **RESULTS:** Temperature had no effect on MSTN (p = 0.987), MYOG (p = 0.444), MYF5 (p = 0.343), MYF6 (p = 0.458), MYOD (p = 0.201), FOXO3 (p = 0.102), atrogin1 (p = 0.543), or MURF1 (p = 0.693). MSTN, MYF5, and FOXO3 decreased over the 3 h trial period (p < 0.001, p = 0.003, p = 0.004 respectively), whereas MYF6 and MYOD increased (p = 0.026, p = 0.004, respectively). Core temperature was significantly higher in hot (37.2 \pm 0.1 $^{\circ}$ C, p = 0.001) and cold (37.1 \pm 0.1 $^{\circ}$ C, p = 0.013) environments compared to room temperature (36.9 \pm 0.1 $^{\circ}$ C). Whole body oxygen consumption was also significantly higher in hot (0.38 \pm 0.01 L \cdot min $^{-1}$, p < 0.001) and cold (0.52 \pm 0.03 L \cdot min $^{-1}$, p < 0.001) compared to room temperature (0.35 \pm 0.01 L \cdot min $^{-1}$). **CONCLUSIONS:** These data demonstrate that acute temperature exposure alone does not elicit significant changes in skeletal muscle gene expression related to myogenesis and proteolysis. When considered in conjunction with previous research, exercise appears to be a necessary component to observe gene expression alterations between different environmental temperatures in humans. Supported by the National Institute for General Medical Science (NIGMS; 5P20GM103427 and P20GM109090), a component of the National Institutes of Health (NIH).

C-46 Free Communication/Poster - Immunology I

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1610 Board #285 June 1 8:00 AM - 9:30 AM
Changes In Parameters Of Immunological And Oxidative Status In Elite Athletes During Winter

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PURPOSE: The current study monitored markers of immunological and oxidative status in 9 male elite athletes (triathlon and athletics): VO2max: 68 \pm 11 mL/kg/

min, age: 24 \pm 2.5 years, training loads: 13 \pm 1.2 h/week, during 14 weeks in winter. **METHODS:** The resting blood samples were collected at baseline and at the end of the study. Spectrophotometric methods and enzyme-linked immunosorbent assay (ELISA) were used for parameters determination. **RESULTS:** The level of concanavalin A (ConA) stimulated interferon- γ (IFN- γ) from peripheral blood mononuclear cells (PBMCs) was increased (562 (147-852) vs. 1097 (451-1842) pg/mL, p=0.013). Also, the level of tissue growth factor-1 (TGF- β 1) in serum was elevated (2.5 (1.4-5.1) vs. 7.2 (4.9-8.2) ng/mL, p=0.015). There was no change in the level of peptidoglycan (PGN) stimulated interleukin (IL)-10 from PBMCs. There were no significant changes in PBMCs proliferation/viability upon stimulation with ConA and PGN during the study. No changes in superoxide dismutase (SOD), pro-oxidative-anti-oxidative balance (PAB), total oxidant status (TOS) and thiobarbituric acid reactive substances (TBARS) were observed along the study. Total antioxidant status (TAS) was increased (610 \pm 174 vs. 760 \pm 102 μ mol/L, p=0.018) and activity of paraoxonase (PON1) was decreased (523 \pm 295 vs. 335 \pm 183 U/L, p=0.003) at the end of the study. Advanced oxidation protein products (AOPP) were increased (25 \pm 7.9 vs. 42 \pm 7.6 μ mol/L, p=0.011). Negative correlation between TOS and PBMCs proliferation/viability upon stimulation with ConA (p=0.040, r=-0.392) was found, as well as between PAB and proliferation/viability upon stimulation with PGN (p=0.045, r=-0.391). **CONCLUSIONS:** In conclusion, 14 weeks of regular training and competitions in winter induced prominent changes in cytokines, biomarkers of oxidative stress and antioxidative enzyme activity. These perturbations of immune and oxidative status could cause increased susceptibility to infections and consequently impair performances.

1611 Board #286 June 1 8:00 AM - 9:30 AM
SlgA and Upper Respiratory Syndrome During a College Cross Country Season

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 (No relationships reported)

PURPOSE: To examine changes in mucosal immunoglobulin A (SlgA) and the incidence of upper respiratory syndrome (URS) during a college cross country season. **METHODS:** Twenty-two cross country athletes (XC) (20.7 \pm 1.4 years) and twenty-three matched controls (C) (20.4 \pm 1.4 years) served as subjects in this investigation. Using standardized data collection procedures, all participants provided unstimulated resting saliva samples at four targeted time points (pre-season, two in-season, and post season) over a four-month study period. These samples were subsequently analyzed in one batch by an enzyme-linked immunosorbent assay (Salimetrics, Philadelphia, PA), to determine absolute SlgA (μ g/ml) concentration and calculate the secretion rate of SlgA (μ g/min). Throughout the study, subjects completed standard weekly logs indicating signs and symptoms of URS from which a total symptom score (TSS) was calculated according to the method of Gleeson. (2012). Differences between groups and across the duration of the study were examined using repeated measures ANOVA. **RESULTS:** Analysis of SlgA data revealed significant main effects for SlgA, F(1,43) = 15.617, p = .000 with a moderate effect size (.266) as well as a significant Group x Time interaction, F(3,41) = 6.386, p = .001 with a moderate effect size (.318). Analysis of the secretion rate of SlgA data revealed significant main effects for the secretion rate of IgA, F(1,43) = 15.617, p = .000 with a moderate effect size (.223) as well as a significant Group x Time interaction, F(3,41) = 5.998, p = .002 with a moderate effect size (.305). A Bonferroni adjusted multiple comparison test revealed that resting absolute SlgA concentration and secretory SlgA in XC decreased throughout the season but remained unchanged in C. There was no significant difference in the saliva flow rate, F(3,41) = 1.719, p = .178. There was also a group by time interaction for TSS F(1,42) = 5.8, p = .020. XC had both higher TSS scores during the season and a significant negative correlation of moderate strength between those scores and the secretion rate of SlgA (p<.05). **CONCLUSIONS:** These results indicate that a season of college cross country running is associated with a progressive reduction in mucosal SlgA levels and an increase in URS.

1612 Board #287 June 1 8:00 AM - 9:30 AM
IL-6 Linkage To Exercise-induced Shifts In Lipid-related Metabolites: A Metabolomics Analysis

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IL-6 and lipolysis have been linked in cell culture and IL-6 infusion studies, but this has not yet been tested using metabolomics-based procedures that allow the simultaneous evaluation of a high number of metabolites from the lipid super pathway following intensive exercise. **PURPOSE:** Metabolomic profiling and bioinformatic

technologies were used to determine the relationship between exercise-induced increases in IL-6 and lipid-related metabolites. **METHODS:** Male runners (N=24, age 36.5±1.8 y) ran on treadmills to exhaustion (2.26±0.01 h, 24.9±1.3 km, 69.7±1.9% VO_{2max}), with vastus lateralis muscle biopsy and blood samples collected before and after the running bout. **RESULTS:** The runners experienced a 33.7±4.2% decrease in muscle glycogen, 39.0±8.8-, 2.4±0.3-, and 1.4±0.1-fold increases in plasma IL-6, IL-8, and MCP-1, respectively, and 95.0±18.9% and 158±20.6% increases in cortisol and epinephrine, respectively (all, P<0.001). The metabolomics analysis revealed changes in 209 plasma metabolites, especially long- and medium-chain fatty acids, fatty acid oxidation products (dicarboxylate and monohydroxy fatty acids, acylcarnitines), and ketone bodies. OPLS-DA modeling supported a strong separation in pre- and post-exercise samples (R2Y=0.964, Q2Y=0.902). OPLSR analysis failed to produce a viable model for the relationship between IL-6 and all lipid-related metabolites (R2Y = 0.76, Q2Y = -0.0748), but did reveal a relationship between changes in serum cortisol and lipid-related metabolites (R2Y=1, Q2Y=0.434). Multiple structure equation models were evaluated based on IL-6, with the best fit pathway model showing a linkage of exercise time to IL-6, then carnitine, and 13-methylmyristic acid (a marker for adipose tissue lipolysis) and sebacate. **CONCLUSION:** This metabolomics-based analysis showed that the substantial increase in lipid metabolites after prolonged and intensive running was related more to changes in cortisol than increases in IL-6 and epinephrine, or muscle glycogen depletion. Taken together, the metabolomics-based data from this study do not support a strong relationship between the modest increase in IL-6 and the large increase in numerous lipid-related metabolites following prolonged and intensive running.

Funding: Reoxcyn Discoveries Group, Salt Lake City, UT

1613 Board #288 June 1 8:00 AM - 9:30 AM

Apoptosis Of Human Peripheral Blood Mononuclear Cells Following Maximal Aerobic Exercise In Obesity

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(No relationships reported)

PURPOSE: The pro-apoptotic (BAX) and anti-apoptotic (BCL-2) proteins have been shown to play an essential role in the regulation of exercise-mediated leukocyte apoptosis. These apoptosis-related proteins are up-regulated in peripheral blood mononuclear cells (PBMCs) of obese individuals; however, the impact of acute exercise-mediated apoptosis still remains unclear. Therefore, the purpose of this study was to investigate whether or not obesity would modulate the expression of BAX and BCL-2 following maximal aerobic exercise.

METHODS: Twenty one healthy obese (N=10; 22±2yrs) and normal-weight (N=11; 23±4yrs) subjects participated in an acute bout of maximal aerobic exercise. Blood samples were collected prior to, immediately after exercise, and one hour into recovery (RIH) for analyses of BAX and BCL-2 using the Western Blot technique.

RESULTS: A similar expression of BAX and BCL-2 at baseline was observed between obese and normal-weight subjects. Furthermore, repeated measures analyses of variance (ANOVAs) demonstrated a significant elevation in BAX immediately following exercise in both groups ($p = 0.017$). While no group by time interaction was found for BCL-2, a significant decrease from baseline to RIH was observed ($p = 0.010$).

CONCLUSIONS: Our results support that acute exercise mediates a transient alteration of apoptosis in human PBMCs. Further investigation on how exercise training may potentially delay the process of leukocyte apoptosis can promote an effective immune response in obesity.

1614 Board #289 June 1 8:00 AM - 9:30 AM

Effect of Low Level Laser on Nasal Mucosa Immunity of Rats with Six-week Incremental Exercise

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PURPOSE: Nasal mucosal immune suppression, induced by long-term high-intensity training, could lead to an increasing risk of upper respiratory tract infections. This study aimed to examine the effect of laser irradiation on nasal mucosa structure and nasal immune function.

METHODS: 40 male Sprague Dawley rats, aged 8 weeks, were randomly divided into 4 groups: Control (C), Exercise (E), E+Low power laser (EL, 1 mw, 6.79 J/cm²), and E+High power laser (EH, 2 mw, 13.58 J/cm²). The rats in all E-related groups went through an incremental treadmill exercise protocol: 6 days/week, 30 min/day; 10 m/min velocity during wk1, 20 m/min for wk2, with 5 m/min/wk increment in the

following weeks. The laser treatments were He-Ne laser (2 h after exercise, 2 min) at two irradiation point (each side of the nasal ala). Pre- and post-6-week intervention, Structure of mucosa of nose was observed by HE staining, sIgA concentration of nasopharyngeal washing were examined by ELISA, and the expression of CD4⁺ and CD8⁺ T lymphocytes of nasal mucosa were analyzed by immunohistochemistry.

RESULTS: 1) Following changes ($p<0.01$) occurred in Exercise group after 6-wk exercise: nasal mucosa was seriously damaged, cilia layer of free edge essentially fell off, and the decline of sIgA (↓57%, $ES=0.77$) level and ratio of CD4⁺/CD8⁺ (↓41%, $ES=0.53$) were observed in nasal mucosa. 2) Compared with E group, the structure of nasal mucosa were obviously improved in EL group. In addition, the sIgA concentration (↑107%, $p<0.01$, $ES=0.55$), CD4⁺ cells (↑127%, $p<0.01$, $ES=0.59$), and ratio of CD4⁺/CD8⁺ (↑40%, $p<0.05$, $ES=0.36$) of nasal mucosa were enhanced markedly in EL group Compared with that of E group. 3) However, compared with E group, the EH treatment did not show significant effects as those by the EL group ($p>0.05$), with the following changes: sIgA (↑40%, $ES=0.29$), CD8⁺ (↓12%, $ES=0.13$), and ratio of CD4⁺/CD8⁺ (↓20%, $ES=0.15$).

CONCLUSIONS: The long-term high-intensity exercise training would lead to destruction of nasal mucosa structure and the declining of nasal immune function. Low energy laser irradiation, especially EL treatment, had a beneficial effect on nasal mucosa immune function.

1615 Board #290 June 1 8:00 AM - 9:30 AM
Brief Exercise Enhances NK Cell Killing Activity in Children Who Survived Acute Lymphoblastic Leukemia (ALL)

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(No relationships reported)

Natural Killers (NK) cells are unique innate immune cells that increase up to 5 fold in the circulation with brief exercise and are known to play a key role in immune surveillance and first-response defense against pathogens and cancer. **PURPOSE:** To study the effect of brief bout of exercise on NK cells cytotoxic function in both healthy children and those who survived acute lymphoblastic leukemia (ALL) using NK cell killing activity assay. **METHODS:** 8 ALL children in remission and 7 age-matched controls (11-17 y.o.) performed 16 min cycle ergometer interval exercise at a constant work equivalent to 64±1% peak VO₂. PBMCs were isolated before (BL) and immediately after (PK) exercise. Flow-cytometry was used to detect NK cell cytotoxicity against erythroleukemic cells (K562) using NKTEST® kit (Allele Biotechnology, San Diego) in various PBMC effector (E) to target cell (T) ratios (12.5, 25, and 50 to 1). At the 25:1 ratio, IL2 activation was also quantified. NK Kill activity is reported as % (proportion of dead vs. total target cells). A two way ANOVA was used to detect differences between PK vs BL and ALL vs Controls. **RESULTS:** Brief exercise enhanced NK cell killing activity similarly for both ALL and Controls (Figure 1A). NK cell kill activity was significantly increased in response to IL2 at both BL and PK (Figure 1B). Activation by IL2 was reduced in ALL compared to Controls (51% vs. 123%). The reduced activity was partially mitigated following exercise but remained lower than controls (74% vs. 147%). **CONCLUSION:** We speculate that exercise-induced NK cell killing activity may contribute to the previously identified cancer surveillance properties of NK cells. Exercise has the potential to be used as adjunctive therapy in ALL. Supported by UCI SOM Faculty Grant, NIH Grant P01HD-048721 & PERC System Biology Fund.

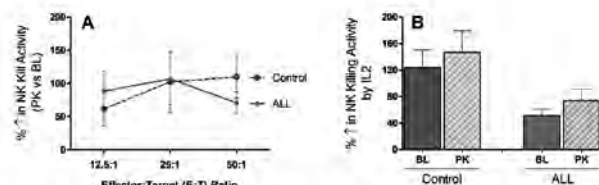


Figure 1: Significant increase in NK kill activity in PBMC in response to PK exercise (A) and to activation by IL2 (B). Note the reduced NK cell killing activity in response to IL2 in ALL survivors.

1616 Board #291 June 1 8:00 AM - 9:30 AM

Acute Exercise Alters Cell Populations Within Lymph Nodes Draining Exercising Muscle

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Previous studies have reported an enhanced antibody response following vaccination coupled with acute exercise. Researchers have speculated that this immunomodulation may be due to the release of damage-associated molecular patterns in response to exercise and the concomitant migration of dendritic cells to lymph nodes. Because the majority of work in this area has been done in humans, rendering the invasive techniques required unrealistic, no study has yet examined the cell populations within the lymph nodes following acute exercise. **PURPOSE:** To determine if acute exercise changes the dendritic cell population within lymph nodes draining the exercising muscle. **METHODS:** Female BALB/c mice received an intramuscular injection of physiological saline in right and left quadriceps, and then performed either 90 minutes of moderate intensity treadmill running (EX) or remained near the treadmill without running (NO EX). Twenty-four hours following the injections, mice were euthanized (n = 7 per treatment group) and inguinal lymph nodes were collected. Cell populations within the inguinal lymph nodes were processed by flow cytometry using the antibodies allophycocyanin-Cy7-conjugated anti-mouse CD11c and Alexa Flour 700-conjugated anti-mouse MHC Class II (MHCII). Results were analyzed using FlowJo. **RESULTS:** Exercise did not significantly alter total cell number within the lymph nodes (EX: $5.86 \times 10^6 \pm 8.37 \times 10^5$ vs. NO EX: $4.82 \times 10^6 \pm 8.44 \times 10^5$, p = 0.40). However, EX mice had both a higher percentage ($16.83 \pm 4.69\%$ vs. $5.25 \pm 1.53\%$, p = 0.03) and absolute number ($8.54 \times 10^5 \pm 1.53 \times 10^5$ vs. $2.73 \times 10^5 \pm 7.24 \times 10^4$, p = 0.00) of CD11c⁺ MHCII⁺ cells present in the inguinal lymph nodes as compared to NO EX mice. Exercise had no effect on the expression of the costimulatory molecules CD80 and CD86 as assessed by mean fluorescence intensity within the CD11c⁺ MHCII⁺ cell populations. **CONCLUSIONS:** Acute exercise alters the cell populations within the lymph nodes draining exercising muscles 24 hours post-injection, although an increase in costimulatory molecule expression is not evident at this time point. Whether these effects are more pronounced at earlier or later time points and the direct results on antibody production following exercise coupled with a vaccine remain to be elucidated.

1617 Board #292 June 1 8:00 AM - 9:30 AM

Progenitor Cell Mobilization Following a Half-Marathon in Elite Wheelchair Athletes

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Progenitor cells circulate in the blood, and are believed to be involved in tissue repair and adaptation. Acute lower body endurance exercise transiently increases various circulating progenitor cell populations in able-bodied individuals. The effects of exercise on progenitor cell mobilization in wheelchair athletes (WCAs) performing upper body exercise remain unknown. **PURPOSE:** To investigate the effects of a half-marathon on progenitor cell mobilization in elite WCAs. **METHODS:** Eight elite endurance WCAs (27.5±4.0 years, 162.5±18.6 cm, 53.5±10.9 kg, 2.4±0.6 ml/kg VO_{2peak}, 21.5±6.7 years post spinal cord injury) completed a 25-km time trial. Peripheral blood samples were collected prior to and immediately upon completion of the trial for analysis of circulating progenitor cells (CPCs: CD34⁺, hematopoietic progenitor cells (HPCs: CD34⁺CD45^{dim}), hematopoietic stem cells (HSCs: CD34⁺CD38⁺CD45^{dim}), endothelial progenitor cells (EPCs: CD34⁺VEGFR2⁺), bone marrow-derived mesenchymal stromal cells (BM-MSCs: CD45⁺CD34⁺CD31⁺CD105⁺), adipose tissue-derived MSCs (AT-MSCs: CD45⁺CD34⁺CD31⁺CD105⁺), and lactate. **RESULTS:** At baseline, the concentration of HPCs were significantly positively correlated to VO_{2peak} (Rho=0.71, p<0.05), the concentration of HSCs tended to be positively correlated to VO_{2peak} (Rho=0.62, p=0.086), and the concentration of AT-MSCs was significantly negatively correlated to VO_{2peak} (Rho=-0.69, p<0.05). Exercise tended to increase the concentration of CPCs (2 fold, p=0.099), and decrease the percentage of HPCs (39%, p<0.05), and HSCs (38%, p=0.057). The exercise-induced change in blood lactate was positively correlated to the change in the concentration of CPCs (Rho=0.88, p<0.0001), EPCs (Rho=0.81, p<0.01), and AT-MSCs (Rho=0.67, p=0.059). **CONCLUSIONS:** In elite WCAs, the quantity of circulating progenitor cells at rest was related to fitness, and the mobilization of progenitor cells was

related to exercise intensity as determined by blood lactate levels. These data have implications for the effects of exercise tissue adaptations in WCA, and for the mechanisms responsible for progenitor cell mobilization in weight-bearing versus non-weight bearing exercise.

1618 Board #293 June 1 8:00 AM - 9:30 AM

Military Recruits Who Typically Sleep <6 Hours Miss Training Due To Upper Respiratory Infection

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The National Sleep Foundation recommends 7–9 hours of sleep per night for young adults. Habitually sleeping <6 hours per night has been shown to lower immunity and increase susceptibility to common cold following exposure to rhinovirus. However, no investigations have examined the importance of sleep duration on upper respiratory infection (URTI) and loss of training days in military recruits. **PURPOSE:** To identify if military recruits who typically sleep <6 hours per night during training suffer a greater incidence of URTI and, as a consequence, miss more training than recruits who meet sleep recommendations. **METHODS:** Participants included 651 British Army recruits aged 22 ± 3 years who completed 13 weeks of Phase 1 military training (67% males, 33% females). Recruits were members of 21 platoons (11 male, 10 female) who commenced training across the seasons (19% winter, 19% spring, 28% summer, and 33% autumn). At week 13, participants completed a questionnaire asking the normal time they went to sleep and awoke during training. Incidence of physician-diagnosed URTI and reduced or missed training days due to URTI were retrieved from medical records. **RESULTS:** Typical sleep duration during training was reported as 7.0 ± 0.8 hours per night with 5% of recruits reporting they normally slept <6 hours and 60% of recruits reporting 7-9 hours of sleep each night. In a logistic regression model, recruits who slept <6 hours per night were 4 times more likely to be diagnosed with URTI compared with recruits who slept 7–9 hours per night after controlling for sex, BMI, alcohol, smoking, and season of recruitment (OR 4.6; 95% CI, 1.7–12.8, P < 0.01). URTI's diagnosed in recruits who slept <6 hours were spread across both sexes, 5 platoons and 3 seasons, showing sufficient heterogeneity. Overall, 49 recruits (8%) were diagnosed with at least one URTI, and 3 recruits (<1%) were diagnosed with two URTI's. On average, each URTI resulted in 2.9 ± 1.5 reduced or missed training days. **CONCLUSION:** These findings show that military recruits who sleep <6 hours per night are more susceptible to URTI and miss more training due to URTI. Future studies should examine interventions to improve sleep hygiene in military training. Supported by MoD, UK.

1619 Board #294 June 1 8:00 AM - 9:30 AM

Exploring the Mechanisms Underlying Exercise-Induced Changes in Natural Killer Cell Cytotoxicity

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(No relationships reported)

Natural Killer (NK) cells are cytotoxic effectors of the innate immune system that eliminate tumor cells. We have previously shown that NK cell cytotoxicity (NKCA) is enhanced by acute bouts of exercise. However, the mechanisms underlying exercise-induced changes in NKCA are not yet fully understood. Exercise-induced mobilization of highly cytotoxic NK cell subsets has been proposed as one mechanism. Alternatively, exercise increases glucocorticoid and cytokines levels, which have also been shown to alter NKCA. **PURPOSE:** To examine the role of shifts in proportions of NK cell subsets, cytokines, and hormones on exercise induced changes in NKCA. **METHODS:** Adults (n=13) cycled 30 min at 115% of their lactate threshold power. Blood was collected pre, post, and 1h post exercise. Effector cells isolated from blood were incubated with K562 or U266 tumor target cells in the presence of autologous serum. NKCA was assessed after 4h by measuring lysed target cells in a flow cytometry based assay. To investigate the effects of factors (hormones and cytokines) released during exercise, pre exercise effectors were incubated with targets in the presence of pre, post, and 1h post exercise serum. The effect of shifts in NK cell subsets was determined by incubating pre, post and 1h post exercise cells with targets in presence of pre exercise serum. We also tested the cytotoxicity of pre, post, and 1h post effectors incubated with serum from the corresponding time point. **RESULTS:** Autologous pre, post, and 1h post exercise serum did not cause tumor cell lysis in the absence of effectors. The cytotoxicity of pre exercise effector cells was significantly increased against U266 target cells when incubated in 1h post exercise serum (Pre vs. post vs. 1h post = 0.318±.039 vs. 0.334±.039 vs. 0.438±.039, p<0.05). There was no

difference in cytotoxicity of pre, post, 1h post effectors incubated with pre-exercise serum (Pre vs. post vs. 1H post = 0.321 ± 0.046 vs. 0.282 ± 0.047 vs. 0.323 ± 0.047 , $p < 0.05$). **CONCLUSION:** 1h post exercise serum enhanced resting NK cell cytotoxicity, indicating that factors present in serum after acute exercise can prime effector cell function. Future work will identify levels of glucocorticoids and cytokines present in 1h post exercise serum.

C-47 Free Communication/Poster - Muscle Dynamics

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
Room: Hall F

1620 Board #295 June 1 9:00 AM - 10:30 AM
Changes in Quadriceps Motoneuron Pool Excitability due to Static Stretch and/or Explosive Contraction
Kyeongun Min, Yongsuk Lee, Jihong Park. *Kyung Hee University, Yongin, Korea, Republic of.*
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(No relationships reported)

PURPOSE: To observe how static stretch and/or explosive contraction (vertical jump) changes quadriceps motoneuron pool excitability (MNPE). **METHODS:** Fifteen healthy people (13 males and 2 females) completed four data collection sessions on separate days with a 48-hour interval between sessions. A 4 (condition) \times 3 (time) cross-over randomised controlled laboratory study was performed. Conditions were A) stretching and jumping, B) control (no stretching) and jumping, C) stretching and control (no jumping), and D) control (no stretching and jumping). Thomas test was used to stretch both quadriceps (30-s \times 3 for each quadriceps). For jumping, two-legged maximal vertical jumps using lower-extremity pre-stretch and double-arm swinging were performed (assessed by Vertec: 3 trials with a-30 s rest interval). To assess quadriceps MNPE, the right side of vastus medialis peak Hoffmann reflexes normalised by peak motor response were recorded at baseline, 0-min post-condition, and 20-min post-condition. For the conditions including the jumping task, jump heights were also recorded after measurements of MNPE at each time point. To test condition effects over time, mixed model analysis of variances were performed and between-time effect sizes (ES) were calculated. **RESULTS:** Quadriceps MNPE did not change among four conditions at any time point ($F_{6,154} = 1.71$, $p = 0.12$). There was a trend that quadriceps MNPE at 0-min post-condition, as compared to the baseline values, was reduced under the condition A (5%, $ES = 0.46$) and C (8%, $ES = 0.43$), and increased under the condition B (10%, $ES = 0.66$). An increased quadriceps MNPE under the condition B appeared to be maintained until the 20-min post-condition measurement (8%, $ES = 0.52$). Jump heights did not change among two conditions (A and B) at any time point ($F_{2,70} = 2.14$, $p = 0.13$). Jump heights between-time ES were very small (< 0.1 for all values). **CONCLUSIONS:** Our data suggest that (1) static stretch may reduce MNPE, (2) explosive contraction may increase MNPE for 20-min, (3) a combination of static stretch and explosive contraction may decrease MNPE, (4) three sets of 30-s stretch does not acutely affect explosive performance, and (5) changes in MNPE minimally influence explosive performance. This study was funded by Yonsei Institute of Sports Science & Exercise Medicine.

1621 Board #296 June 1 9:00 AM - 10:30 AM
Trunk And Hip Flexor Muscle EMG Responses To Four Phases Of Two Different Style Sit-Ups
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(No relationships reported)

We previously found that a modified sit-up (MSU) emphasizing the abdominal muscles and a freestyle (FS) sit-up elicited similar abdominal and hip flexor muscle electromyographic (EMG) activity. **PURPOSE:** To investigate the interaction between muscle activity and trunk movement, this study compared the effects of the MSU and FS on EMG activity and kinematics during four sequential phases of the sit-up, where each of the following was the dominant action: (1) concentric trunk flexion, (2) concentric hip flexion, (3) eccentric hip extension, and (4) eccentric trunk extension. **METHODS:** Twenty male subjects (23.8 ± 3.5 years) performed each exercise for 30 seconds in a counterbalanced order, with five minutes rest between exercises. Rectus abdominis (RA), external oblique (EO), & rectus femoris (RF) EMG, and trunk and hip kinematics were synchronously recorded during exercise. Normalized data were compared via a two-way repeated measures ANOVA with *post-hoc* comparisons. **RESULTS:** For RA there was an effect of phase ($F_{3,17} = 3.40$, $p = 0.042$). RA EMG was greatest overall in phase 2 and greater in MSU than FS in phase 2 (38% versus 23% MVIC, respectively; $t = 5.26$, $p < 0.001$). For EO there was an effect of exercise ($F_{1,19} = 6.79$, $p = 0.017$) and phase ($F_{3,17} = 3.86$, $p = 0.014$). EO EMG was greatest overall

in phases 2 and 3 and greater in MSU than FS in phase 2 (99% versus 35% MVIC, respectively; $t = 3.23$, $p = 0.004$). For RF there was an effect of phase ($F_{3,17} = 2.82$, $p = 0.047$). RF EMG was greatest overall in phases 3 and 4 and greater in FS than MSU in phase 1 (16% versus 7% MVIC, respectively; $t = -2.16$, $p = 0.044$). Repetition time was greater for MSU than FS (9.2 seconds versus 2.7 seconds, respectively). Trunk motion was greatest in phases 1 and 4, hip motion was greatest in phases 2 and 3, and hip motion was greater in FS than MSU in phase 2 (58° versus 35° , respectively; $t = -3.87$, $p = 0.001$) and phase 3 (56° versus 33° , respectively; $t = 4.34$, $p < 0.001$). **CONCLUSIONS:** The MSU elicited a greater response from the abdominal muscles than FS during the hip dominant phases of the sit-up. There was greater hip motion during the FS than the MSU and the RF was more active for the FS than the MSU during the trunk flexion phase. The RF appears to be activated to control eccentric descent in both exercises. There was no funding for this project.

1622 Board #297 June 1 9:00 AM - 10:30 AM
Acute Effects Of Cooling On Muscle Contractile Properties
Armin H. Paravlic, Uroš Marušič, Rado Pišot, Boštjan Šimunič. *Science and Research Centre, Koper, Slovenia.*
(No relationships reported)

In order to complement sport training and to induce regeneration processes of muscle, ice pack application (IPA) is often used by athletes. Physiological mechanisms are relatively well investigated while there is faintly research aimed at investigating muscle contractile properties (MCP) after IPA treatment. To test the acute effects of IPA cooling on MCP, we used tensiomyography (TMG), as a non-invasive and selective method of neuromuscular assessment.

PURPOSE: To investigate the influence of IPA on MCP by TMG method. **METHODS:** Sixteen healthy participants (50% males; 19-20 yr) participated in this study. Tensiomyographic assessment was performed before and immediately after 15 minutes of IPA treatment on vastus medialis. From tensiomyographic response we extracted and analysed delay time (Td), contraction time (Tc), sustain time (Ts), half-relaxation time (Tr), and maximal displacement /Dm). **RESULTS:** After IPA we found that Td, Tc, Ts and Tr values increased ($p < 0.010$) by 6.2% ($ES = 2.61$), 6.0% ($ES = 2.06$), 29.7% ($ES = 1.99$), and 26.6% ($ES = 2.01$), respectively, while Dm decreased ($p = 0.001$) by 12.7% ($ES = 2.61$). **CONCLUSION:** Our results suggest that IPA treatment significantly altered MCP after only 15 minutes of exposure. This plays an important role in skeletal muscle behavior immediately after cooling procedures and should be taken into account when planning training or rehabilitation programs.

1623 Board #298 June 1 9:00 AM - 10:30 AM
Effects of Different Neuromuscular Electrical Stimulation Parameters on Quadriceps Neuromuscular Performance in Competitive Athletes
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(No relationships reported)

Purpose: To evaluate the effects of six weeks of training with two different types of neuromuscular electrostimulation (NMES) currents on muscle performance in competitive athletes. **Methods:** This controlled and randomized clinical trial included 20 athletes, equally divided into three groups: medium frequency current group with 500 μ s (MF-500) ($n = 7$), low frequency current group of with 500 μ s (PC-500) ($n = 5$) and control group (CG) ($n = 8$). Each group had evaluated, before and after the intervention: the peak torque of knee (PT), muscle thickness and signs of electromyography (EMG) of the vastus lateralis (VL), and the sensory discomfort level (VAS). The training with NMES was performed 3 times per week and consisted of 18 sessions, 15 minutes per session (36 isometric involuntary contractions per session), 6s duration in each contraction (with 1s rise time - TON and 1s descent time - TOFF). For statistical analysis of homogeneity was applied Levene's test. Mixed ANOVA test was used to verify the existence of significant differences between the measurements. The significance level was 5%. **Results:** There was no significant difference between any groups for all variables ($p > 0.05$): PT (MF500: pre = 222.5 ± 42.2 Nm and post = 219.9 ± 54 Nm; PC500: pre = 231.1 ± 82.2 Nm and post = 244.3 ± 79.9 Nm; CG: pre = 243 ± 40.1 Nm and post = 225.3 ± 43.2 Nm), muscle thickness (MF500: pre = 22.9 ± 2.5 mm and post = 23.7 ± 2.8 mm; PC500: pre = 23 ± 2.6 mm and post = 23.5 ± 2.7 mm; CG: pre = 25.9 ± 4.7 mm and post = 25.9 ± 4.3 mm) and EMG (MF500: pre = 0.4 ± 0.4 RMS and post = 0.5 ± 0.5 RMS; PC500: pre = 0.7 ± 0.4 RMS and post = 0.7 ± 0.3 RMS; CG: pre = 0.8 ± 0.5 RMS and post = 0.7 ± 0.4 RMS). In addition, all current produced similar levels of discomfort, with no significant difference ($p > 0.05$) in the

VAS (MF500: pre = 9.6 ± 0.5 and post = 9.1 ± 1.5 ; PC500: pre = 9.8 ± 0.5 and post = 9.4 ± 1.3). **Conclusion:** The NMES training applied with medium or low frequency currents and the same pulse duration have the same efficiency and neuromuscular performance in the quadriceps of competitive athletes.

1624 Board #299 June 1 9:00 AM - 10:30 AM
Knee And Shoulder Flexion And Extension Strength Differences Between Genders Along The Force Velocity Curve

Kimberly Huey, Emily Larson, Danielle Buettner, Alec Wilhelmi. *Drake University, Des Moines, IA.* (Sponsor: John Quindry, FACSM)
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 (No relationships reported)

PURPOSE: Limited studies have compared upper and lower body strength and flexion/extension ratio (F/E) differences at various contraction velocities between males and females participating in resistance training. F/E ratios typically range from 0.50 to 0.75 where lower ratios may be indicative of increased injury risk. These experiments tested the hypothesis that the strength differences between genders would decline as contraction speed increased while F/E would not be different between genders. **METHODS:** Subjects (n=10 females and 10 males, mean age 21 ± 0.9 yrs old) completed shoulder and knee flexion and extension on a Biodex isokinetic dynamometer at 60, 180 to 300 %/sec. The time spent performing resistance training was 6.2 ± 0.8 vs. 4.4 ± 0.5 hrs/week for males and females, respectively. Maximal torque normalized to body weight (T/BW) and F/E at each speed were compared between genders at each joint with 2-way ANOVAs. **RESULTS:** At the knee and shoulder T/BW in males was significantly greater than females for flexion and extension at all speeds with the exception of shoulder flexion ($p < 0.05$). For knee extension, male T/BW was 33, 41, and 45% higher than females, at 60, 180, and 300 %/sec respectively. For knee flexion, male T/BW was 31, 36, and 37% higher than females at 60, 180, and 300 %/sec, respectively. For shoulder extension, male T/BW was 36 and 40% higher than females at 60 and 180 %/sec, respectively. T/BW increased with decreased contraction speed for shoulder and knee extension in both genders and knee flexion in males ($p < 0.05$). T/BW at 180 vs. 300 %/sec was not different for knee flexion in females. Knee F/E increased with contraction speed in both genders and was significantly higher in females than males at 180 %/sec ($p < 0.05$). In males and females, respective knee F/E was 0.55 ± 0.3 and 0.63 ± 0.06 at 60 %/sec vs 0.65 ± 0.3 and 0.88 ± 0.09 at 180 %/sec. Shoulder F/E was unaffected by gender or contraction speed. **CONCLUSIONS:** These results suggest the effects of contraction speed on T/BW and F/E between genders is joint specific. Specifically, knee F/E increases more in females than males with increasing contraction speed and T/BW gender differences are smallest during shoulder flexion compared to shoulder extension or knee flexion and extension.

1625 Board #300 June 1 9:00 AM - 10:30 AM
The Strain Of The Pull: Examining The Physiological Effects Of An Endurance Tug-of-War

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 (No relationships reported)

Each fall, Hope College (Holland, MI) hosts an endurance tug-of-war (The Pull) between members of the freshman and sophomore classes. Both teams have three weeks to prepare for the event, which can last upwards of three hours. **PURPOSE:** To examine the physiological effects of training for, and competing in, The Pull. **METHODS:** Seventeen male "Pullers" (Freshman, n=6) from each 18-man team agreed to participate in this study. Pullers' fitness (flexibility, power, muscular strength, and body composition) was assessed at the start (PreTrain) and end (PostTrain) of training. Blood and urine were collected at four time points (PreTrain, PostTrain, PullDay, and PostPull (56-hours post)) to assess hydration (specific gravity (SG)) and muscle damage (creatine kinase (CK)). Fitness data was analyzed using dependent, 2-tailed t-tests. Urine and blood data were analyzed using a one-way, repeated measures ANOVA. **RESULTS:** Fifteen Pullers completed pre and post fitness testing. Pullers' mean flexibility increased during training (24.42 ± 5.2 vs. 31.03 ± 6.1 cm, $p < 0.05$). No other significant changes in fitness markers occurred. Thirteen Pullers reported to each of the blood and urine collection times. The Pullers' mean hydration levels decreased during training (PreTrain: 1.02 ± 0.01 vs. PostTrain: 1.03 ± 0.01 vs. PullDay: 1.03 ± 0.01 , $p < 0.05$), but hydration status returned to baseline levels 56 hours after the event (PostPull: 1.02 ± 0.01). At no time were hydration levels outside of the normal range ($1.0-1.03$). Mean CK levels were above the normal range ($0-320$ mg/dL) at each of the four time points. CK was greatest PreTrain (2113.7 ± 1207.6) and PullDay (1384.8 ± 936.6). These were significantly greater than PostTrain (598 ± 73) and PostPull (910.7 ± 244.7) time points ($p < 0.05$). **CONCLUSIONS:** The first urine

and blood collection (PreTrain) took place three days into training. Elevated CK levels appear to reflect the intense nature of the training, whereas lower values the day of the Pull, indicates a training effect. The lack of improvement in overall fitness suggests modifications to each teams' training regimen may be warranted. Overall, our data suggests that an endurance tug-of-war elicits minimal muscle damage, compared with pre-training, similar to other endurance activities in its physiological impact on the body.

1626 Board #301 June 1 9:00 AM - 10:30 AM
The Effects Of A Heavy Resistance Warm-up On Sprint Speed: A Post Activation Potentiation Study

Abigail Larson, FACSM, Brent Springall, Mark DeBeliso, FACSM. *Southern Utah University, Cedar City, UT.*
 (No relationships reported)

Sprint speed is a fundamental physical characteristic that is necessary for the successful participation in many sports. Post activation potentiation (PAP) is defined as an acute enhancement of muscle power output following an intense muscle conditioning activity. **Purpose:** The purpose of this study was to determine the effects of a PAP conditioning activity on sprint speed with an emphasis on the role of specificity regarding the preparatory conditioning activity. It was hypothesized that a unilateral conditioning activity (barbell lunge) would provide a greater PAP effect on short sprint ability than a bilateral conditioning activity (barbell back squat). **Methods:** Sixteen NCAA Track Athletes participated (7 male, 9 female) in the study. The experiment employed a repeated measures crossover design where, following a familiarization session, each subject completed a randomly assigned a separate warm-up (WU) on three different days with at least 48 hours between sessions. Following the randomly assigned WU, sprint speed was tested over a distance of 36.6 meters as well as quartiles. The WU's were: a dynamic WU, a dynamic WU followed by a unilateral barbell lunge (BL) as the PAP conditioning activity, and a dynamic WU followed by a bilateral back squat (BS) as the PAP conditioning activity. The load of the BL and BS conditioning activities were both 6 repetitions of 80% 1-RM. A repeated measures ANOVA was utilized to determine if there were significant differences between sprint times for each WU strategy. **Results:** There were no statistically significant differences in sprint times between WU conditions at 36.6 m (Dynamic WU: 5.22 ± 0.48 secs, PAP WU SQ: 5.23 ± 0.48 secs, PAP WU BL: 5.23 ± 0.50 secs) or any quartile ($p > 0.05$). **Conclusion:** Within the parameters of this study, neither an intense bilateral or unilateral conditioning activity improved short sprint performance beyond that of a dynamic WU activity.

1627 Board #302 June 1 9:00 AM - 10:30 AM
Effectiveness of Neuromuscular Electrical Stimulation During Rest and Exercise

Hollie Champion¹, Susanna Ek¹, Rolf Frazier¹, Anna Kinslow¹, Caroline McClain¹, Tiago Barreira², Wayland Tseh¹. ¹University of North Carolina Wilmington, Wilmington, NC. ²Syracuse University, Syracuse, NY. (Sponsor: Robert Boyce, FACSM)
 (No relationships reported)

PURPOSE: To determine the effectiveness of neuromuscular electrical stimulation (NMES) as an aid to enhance venous blood return during rest and submaximal exercise. **METHODS:** Twenty apparently healthy males (Age = 35.0 ± 15.0 yrs; Height = 179.9 ± 8.5 cm; Body Mass = 85.4 ± 12.0 kg) provided informed consent prior to participation. In Session 1, participants were familiarized with all equipment. Sessions 2-4 were randomly selected and included the following 5-min trials: a) Rest and Rest+NMES, b) Rest, Arms-Only, Arms+NMES, and c) Rest, Arms+Legs, Arms+Legs+NMES. Physiological variables collected during rest and submaximal exercise were volume of oxygen (VO_2), heart rate (HR), systolic and diastolic blood pressure (SBP and DBP), respiratory exchange ratio (RER), and rate pressure product (RPP). Paired sample t-test was used to determine if there were significant mean differences between the NMES and non-NMES trials. The Bonferroni correction established the alpha level at 0.008. **RESULTS:** From the 18 paired t-tests, the only observed significant mean difference [$t(19) = -6.4$, $p < 0.001$] was RER values between the Arms-Only trial compared to the Arms+NMES trial (0.94 and 1.00, respectively). **CONCLUSION:** While RER displayed a significant difference, collectively, NMES did not elicit any physiological alterations during rest and submaximal exercises within an apparently healthy population. Supported and funded by UNCW Undergraduate Research Fellowship Award.

1628 Board #303 June 1 9:00 AM - 10:30 AM
Effect of Energy Beverage Consumption on Muscle Peak Power and Peak Velocity
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 (No relationships reported)

Effect of Energy Beverage Consumption on Peak Power and Peak Velocity
 Bert H. Jacobson FACSM¹, Garrett M. Hester², Ty B. Palmer³, Kathryn Williams¹, Zachary K. Pope¹, John H. Sellers⁴, Eric C. Conchola¹, Conrad Woolsey⁵, Carlos Estrada¹

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Energy drinks comprise a multibillion dollar market focused on younger, active and competitive individuals. Recently, energy shots (ESs) have become a fast growing entity of the multimillion dollar energy beverage industry.

PURPOSE: To assess the effect of an ES on power and velocity in a forehand stroke (FHS) and a counter movement vertical jump (CVJ). **METHODS:** Participants (male, n=17 and female, n=19) college students were randomly divided into a control group and an experimental group. Pre-tests included 3 FHS and 3 CVJs while peak power and velocities were electronically recorded. Following testing participants were given 57 ml of either an ES or placebo using a double blind format. After a 30 min absorption period, subjects' FHS and SVJs were again tested. **RESULTS:** One-way ANOVA of CVJ yielded no significant difference ($p>0.05$) between the ES and PL groups for peak power or peak velocity. A comparison of gender also yielded no significant ($p>0.05$) difference in either peak power or peak velocity in either the PL or ES groups. For FHS the ES group demonstrated significantly ($p<0.05$) greater improvement in and peak velocity while the PL group did not experience a significant difference in either variable. Following a comparison of gender, females in the ES group registered significantly ($p<0.05$) greater improvement in peak velocity in comparison to males. **CONCLUSION:** The current single dose of stimulants in the ES was adequate to improve performance of smaller muscle groups (shoulder rotators), it may not have been sufficient to affect the larger muscle groups of the lower legs which contribute to the CVJ. By incorporating larger doses of ESs, some benefit may be attained, however; larger doses of EDs have resulted in health complications.

1629 Board #304 June 1 9:00 AM - 10:30 AM
Muscle Activation During Variations of the Short Arc Quadriceps Exercise: An Electromyographic Study
 Michael C. Rabel, Julie Silvestri, Sarah Radwandi, Megan O'Brien, Mathew Hannan, Sheriff Dosoumu. *University of Maryland Eastern Shore, Princess Anne, MD.*
 (No relationships reported)

The vastus medialis obliquus (VMO) muscle is recognized for providing knee control and has been shown to be most active during the final phase of knee extension range of motion. Weakness of this muscle can lead to knee dysfunction, pain, and functional mobility deficits. **PURPOSE:** The purpose of this study was to: 1) determine if the electromyography (EMG) activity of the VMO differed during three variations of the commonly used short-arc quadriceps (SAQ) exercise; and 2) examine gender differences in VMO muscle activation for the same exercises. **METHODS:** Twenty healthy, active, pain-free adults (mean age \pm SD, 24.2 \pm 1.6, and range 22 to 27 years) participated in the study. EMG data were collected from the dominant lower extremity of all subjects (10 males, 10 females) and normalized to a percent of the maximum voluntary isometric contraction (MVIC). Raw EMG signals were sampled at 1500 Hz with a bandwidth of 10-500 Hz. Subjects performed the SAQ exercise and three different variations of the SAQ that included the addition of tibial internal rotation (TIR), hip adduction (HA), and hip extension (HE). Computerized voice commands were used to record and synchronize the data collection process. The mean root mean-square of the EMG signal was normalized to the MVIC. Exercise and gender comparisons were made using the non-parametric Wilcoxon signed-rank test and the Mann-Whitney *U* test, respectively. **RESULTS:** The mean VMO muscle activity values for all subjects were 13.1% (SAQ), 12.5% (IR), 13.7% (HA) and 18.4% (HE). The results of the analysis comparing exercise variations of the SAQ showed that VMO activity was significantly higher with addition of HE ($P<0.001$). The VMO activation between gender groups was significantly higher for females during the SAQ with the addition of TIR (15.2% versus 9.9%, $P=0.03$). **CONCLUSIONS:** Surface EMG was used to examine VMO activity during 3 different variations of the SAQ exercise. Our data suggest that adding HE to the SAQ will activate the VMO at greater levels. The evidence comparing VMO activation between genders is limited. Female subjects in our study displayed greater VMO activation during the SAQ exercise with the addition of TIR. These preliminary findings may facilitate additional research which could assist with exercise selection and progression decisions.

1630 Board #305 June 1 9:00 AM - 10:30 AM
Associations of Hip Extension Torque with Muscle Size of Hip Extensors and Intra-abdominal Pressure
 Kota Tayashiki, Kosuke Hirata, Kiraku Ishida, Hiroaki Kanehisa, Naokazu Miyamoto. *National Institute of Fitness and Sports in Kanoya, Kanoya, Japan.*
 (No relationships reported)

PURPOSE: It is generally considered that the muscle size of the hamstring and/or gluteus maximus (GM) is mainly responsible for the maximal voluntary isometric torque of hip extension. However, there is no evidence supporting this consideration. Thus, it remains unclear whether the muscle size of the hamstring and GM is associated with the maximal voluntary isometric torque of hip extension. On the other hand, we have recently revealed that maximal intra-abdominal pressure (IAP) as well as maximal voluntary isometric torque of hip extension increased after an 8-wk training of the abdominal bracing (Tayashiki et al. 2016). This finding leads us to hypothesize that IAP can be a potential factor contributing to the hip extension torque. The purpose of present study was therefore to clarify the associations of not only the muscle size of the hamstring and GM but also IAP with the maximal voluntary isometric torque of hip extension.

METHODS: Twenty healthy young males voluntarily participated in this study. Anatomical cross-sectional area (ACSA) of the hamstring and thickness of the GM were determined using an ultrasonography apparatus with a linear scanner. Then, each subject performed maximal voluntary isometric contraction of hip extension. In the hip extension task, torque and IAP were simultaneously measured. The IAP was assessed using a pressure transducer placed in the rectum, and determined at the time at which the peak torque was attained.

RESULTS: No significant relations were observed between the peak torque and the ACSA of the hamstring ($r = 0.307$, $P = 0.188$) or the thickness of the GM ($r = 0.405$, $P = 0.076$). On the other hand, the IAP was significantly correlated with the peak torque ($r = 0.504$, $P = 0.024$). This association was still significant even when the ACSA of the hamstring and the thickness of the GM were adjusted statically ($r = 0.486$, $P = 0.041$).

CONCLUSIONS: The current results suggest that maximal voluntary isometric torque of hip extension is attributable to IAP during the task, not to muscle size of the muscle size of the hamstring and GM.

1631 Board #306 June 1 9:00 AM - 10:30 AM
Peak Muscle Activity across Four Sets to Volitional Fatigue between Rest-Pause and Traditional Bench Press.

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 (No relationships reported)

Purpose: This study compared pectoralis major muscle activity (EMG) and lifting volume across four sets to volitional fatigue between a rest-pause and traditional resistance training protocol. **Methods:** Trained males ($N = 20$) were randomly assigned to either a rest-pause or a traditional training group. Participants completed a testing sessions where they performed a one repetition maximum (1RM), and a separate session during which they completed four sets of Smith machine bench press to volitional fatigue at 80% of pretest 1RM with 2-minutes rests between sets for both the rest-pause and traditional lifting protocol. The traditional protocol was allocated no rest between repetitions (reps) while the rest-pause protocol was elicited a four second unloaded rest between each rep. The RMS signal of the last rep during sets 2, 3, and 4 were normalized to the RMS signal of the last rep of set 1 and expressed as a delta (Δ) percent change. Total number of repetition was also recorded to assess lifting volume. **Results:** A 1-way repeated measures ANOVA indicated no differences in Δ change across sets between the traditional and rest-pause protocol ($p > .05$). Furthermore, three independent samples t-tests showed no significant differences in Δ change from set 1 to sets 2, 3, and 4. Lastly, an independent samples t-test revealed the rest-pause protocol showed significantly greater reps ($M = 39.9$ reps, $SD = 9.5$, $N = 10$) in comparison to the traditional protocol ($M = 30.2$ reps, $SD = 6.4$, $N = 10$; $T(18) = 2.685$, $p < .05$. The magnitude of the differences in the means (9.7, 95% CI: -17.3 to -2.) was small ($d = .29$). **Conclusions:** Muscle activity did not change across four sets to volitional fatigue between and within a rest-pause and traditional Smith machine bench press. However, if volume is the focus of training (i.e., hypertrophy phases), the rest-pause resistance training method may be a superior method of training.

1632 Board #307 June 1 9:00 AM - 10:30 AM
Electromyographic Analysis of Left and Right Side Gluteus Medius in Unilateral and Bilateral Bodyweight Exercises
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 (No relationships reported)

A wide variety of exercises directed at gluteus medius muscle (Gmed) activation are used both in athletic performance and for rehabilitation. A common way to increase the load on Gmed is to change from a bilateral (BI) to a unilateral (UNI) stance in the same exercise. Muscle activation levels $\geq 40\%$ MVIC are suggested for strength gains, however, muscle activity lower than that may be useful in developing muscle endurance. Despite numerous studies investigating which exercises best target Gmed, only muscle activity on one side of the body has been investigated, and knowledge about how an exercise affects both left and right side Gmed in BI and UNI stance is lacking. **PURPOSE:** To investigate the single and combined muscle activity magnitude in left and right side Gmed during standing and supine bodyweight exercises performed bilaterally and/or unilaterally. **METHODS:** 15 healthy college-aged subjects performed squat and supine bridge exercises in both a BI and UNI stance, and a UNI standing hip abduction exercise. The dominant (DOM) leg acted as the supporting leg in UNI exercises. Gmed electromyography activity from both left and right side was collected during the 3 exercises and normalized to a maximal voluntary isometric contraction (MVIC). Average μV was collected for 3 repetitions (paced at 2 s) of each exercise (total 6s). **RESULTS:** During the squat, Gmed activity in the DOM leg had a significantly higher ($p < 0.01$) muscle activity in UNI (36.7% MVIC) compared to BI (9.4% MVIC) stance, whereas Gmed in the non-DOM leg was similar for both stances (UNI 10.7 and BI 9.9% MVIC; $p = 0.63$). During supine bridge, Gmed in DOM leg was significantly increased ($p < 0.01$) in UNI (33.2% MVIC) compared to BI (14.7% MVIC). In contrast, the non-DOM leg displayed a significant lower activity ($p < 0.01$) in UNI (7.0% MVIC) compared to BI (15.3% MVIC) stance. For UNI standing hip abduction DOM leg (34.5% MVIC) had higher muscle activation ($p < 0.01$) compared to non-DOM leg (24.7% MVIC). **CONCLUSION:** Highest total muscle activity (left and right side) in Gmed was found in standing hip abduction, whereas Gmed maximum activity on one side only was similar for the DOM leg in UNI stance in all three exercises (33-37% bridge, hip abduction, squat). Knowledge about Gmed activation magnitude on both sides can aid in selection of strengthening exercises which targets Gmed.

1633 Board #308 June 1 9:00 AM - 10:30 AM
Influence of Gastrocnemius Muscle Length on Overhead Squat Movement Compensations Among Active-Duty Firefighters
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The popularity of overhead squat assessments to identify movement compensations that may place an individual at risk for future musculoskeletal injury (MSKI) has grown among practitioners. Previous research suggests that limited ankle dorsiflexion (ADF) range of motion (ROM), due to restricted gastrocnemius muscle length, may result in lower extremity (LE) movement compensations commonly identified during an overhead squat movement. However, this has yet to be examined among the tactical athlete population of firefighters. **PURPOSE:** To examine the influence of gastrocnemius length on lower extremity movement compensations during an overhead squat among active-duty firefighters. **METHODS:** 50 active-duty firefighters (48 males, 2 females) participated in this study (40.8 \pm 7.7 yrs; 178.5 \pm 5.9 cm; 89.8 \pm 10.3 kg). Gastrocnemius muscle length was assessed by passively measuring bilateral ADF ROM ($^{\circ}$) using a goniometer with participants in supine and knees fully extended. Participants then completed a two-leg overhead squat assessment as part of the Fusionetics™ Movement Efficiency (ME) test. Participants were then placed into groups in a binary fashion (yes/no) based upon four bilateral LE movement compensations identified during this assessment and as described by the ME test instructions: foot flattens (FF), foot turns out (FTO), heel raises (HR), and knee moves in (KMI). Independent *t*-tests identified differences in ADF ROM between groups. An $\alpha < .05$ determined statistical significance. **RESULTS:** Participants displaying right FTO exhibited significantly ($p = .041$) lower right ADF ROM (12.0 \pm 4.0 $^{\circ}$ vs. 14.6 \pm 4.9 $^{\circ}$, respectively). Participants displaying left FTO and HR both exhibited significantly ($p = .005$; $p = .005$, respectively) lower left ADF ROM (9.8 \pm 3.5 $^{\circ}$ vs. 13.1 \pm 4.3 $^{\circ}$; 6.0 \pm 4.0 $^{\circ}$ vs. 12.0 \pm 4.0 $^{\circ}$, respectively). Participants with any of the four left LE movement compensations exhibited significantly ($p = .035$) lower left ADF ROM (10.5 \pm 3.7 $^{\circ}$ vs. 13.1 \pm 4.6 $^{\circ}$, respectively). **CONCLUSIONS:** Restricted gastrocnemius muscle length may influence LE movement mechanics observed during an overhead squat assessment among active-duty firefighters. In order to decrease the risk of MSKI among this cohort population, practitioners should incorporate interventions designed to increase gastrocnemius flexibility.

1634 Board #309 June 1 9:00 AM - 10:30 AM
Muscular Contributions to Upper-Body Exercise
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Muscles in the upper-body are important when performing many functional tasks, such as manual labor, sport and recreational activities, and wheelchair propulsion. Evidence suggests that use of the lower-body is critical for optimizing performance during standing upper-body tasks. It is unknown if use of the lower-body is also important during seated upper-body tasks. **PURPOSE:** To identify the contribution of arm, trunk, and leg musculature to submaximal and maximal arm cranking, an exercise model for evaluating upper-body work performance. **METHODS:** Eight healthy males (24 \pm 4 years, 79 \pm 8 kg, 1.8 \pm 0.1 m) performed three seated arm cranking conditions. For the 'normal' condition, participants performed arm cranking, using their arms, trunk, and legs for stabilization. For the 'restricted legs' condition, participants performed arm cranking using their arms and trunk, while the legs were restricted and were not able to be used for stabilization. For the 'restricted trunk and legs' condition, participants performed arm cranking using only their arms, while the trunk and legs were restricted and not able to be used for stabilization. In each condition, participants performed a maximal arm cranking test to determine maximum neuromuscular power and a submaximal arm cranking test to exhaustion to determine peak oxygen consumption (VO_{2peak}). Paired *t*-tests were used to compare differences in maximum neuromuscular power and VO_{2peak} . **RESULTS:** Maximum neuromuscular power produced when the legs were restricted decreased by 24 \pm 10% (762 \pm 63 vs. 579 \pm 55 W, $p < 0.05$). When the trunk and legs were restricted, power decreased further by 28 \pm 9% (762 \pm 63 vs. 543 \pm 53 W, $p < 0.05$). Results also indicated that VO_{2peak} decreased by 16 \pm 12% when the legs were restricted (3.02 \pm 0.8 vs. 2.47 \pm 0.54 L/min, $p < 0.05$) and decreased by 23 \pm 9% when the trunk and legs were restricted (3.02 \pm 0.8 vs. 2.28 \pm 0.43 L/min, $p < 0.05$). **CONCLUSION:** Muscles of the trunk, and especially the lower-body, play a critical role during seated upper-body tasks. Our findings have implications for researchers who use arm cranking as an upper-body exercise model, clinicians who prescribe upper-body exercise to improve health in high risk populations, and athletes performing upper-body exercise.

1635 Board #310 June 1 9:00 AM - 10:30 AM
Emg Characteristics Of Elite Trampoline Athletes' Feet On Impact: Evaluating [i1] Performance With Modified Trampoline Shoes [i1]new Title
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 (No relationships reported)

PURPOSE: Evaluate the effects of ankle taping, general trampoline shoes, and three different modified trampoline shoes and how they affect trampoline techniques during back tuck jumping. **METHODS:** Eighteen athletes (13 men and 5 women; age M = 22.83 years old, SD = 4.06, height M = 167 cm, SD = 7.19 cm and weight = M 57.78kg, SD = 6.29 kg) from the Chinese National Trampoline Team at the Beijing National Trampoline Sport Base who had no major injuries or surgery during the last year. Trigno EMG System was used to measure the EMG signals of bilateral Rectus Femoris, Medial Hamstring, Tibialis Anterior, Lateral Gastrocnemius, and Peroneus Longus while doing a whole set of jumping. The "initial contact" (IC) where from 300 ms to the first or fifth metatarsal head initially makes contact with the trampoline surface. The "full press" (FP) where the calcaneus has the maximum pressure on the net. The "rebound" (RE) where the fifth metatarsal head is exiting the trampoline surface. Five trampoline shoes were tested, 8-shaped, with insoles, combo (8-shaped/insoles), regular shoes with ankles taped, and regular trampoline shoes. Athletes performed five sets of trampoline jumps with randomly worn shoes. Each muscle's iEMG (%MVC*ms) and three different time periods were analyzed. **RESULTS:** The EMG activity increased significantly for Rectus Femoris when wearing 8-shaped and combo shoes. Medial Hamstring had the least EMG activity when wearing combo shoes. EMG values for right dominate leg's Medial Hamstring increased when wearing 8-shaped shoes during full contact period. EMG values for Tibia Anterior decreased on the right dominate leg when wearing 8-shaped shoes during IC period. EMG values for Peroneus Longus increased during the RB might be due to athletes' unfamiliarity with insoles. **CONCLUSIONS:** Wearing the 8-shaped shoe increased right leg Rectus Femoris, Medial Hamstring, and Tibialis anterior EMG activity during IC time and the FP time. This might enable an athlete to increase wanted power to the feet's impact on the net which results in a higher rebound. Right Lateral Gastrocnemius EMG activity decreased during RE time when using 8-shaped shoes which enables the athlete to use the rebound energy from the net better. Interviews with the athletes support the EMG findings that 8-shaped trampoline shoes increase performance.

THURSDAY, JUNE 1, 2017

1636 Board #311 June 1 9:00 AM - 10:30 AM
Comparison Of Emg Activity Between The American And Russian Kettlebell Swings
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Kettlebell exercise is a popular form of resistance training that uses a cast iron ball with a handle, so the participant can swing the kettlebell (K) into different positions. The K Clean has two popular variations: the Russian (R) swing requires the movement of the K to eye level, while the contrasting American (A) swing requires movement of the K overhead. **PURPOSE:** The purpose of this study was to determine the magnitude of muscle recruitment during the A vs R swings by monitoring the electromyography (EMG) of the biceps femoris (BF), rectus femoris (RF), erector spinae (ES) and gluteus maximus (GM) during the bottom (1) and the top (2) of the swing. **METHODS:** A cross-over design was used to assess neuromuscular activation of all four muscles of 20 subjects (age 21.5 ± 2.1 yrs, ht. 171.2 ± 8.7 cm, body mass 70.5 ± 7.9 kg, 12♂). A minimum of 24 hours after familiarization, subjects performed an isometric maximal voluntary contraction (MVC) for 5 seconds in a "deadlift" maneuver with a loaded barbell that was set at the height of the subject's tibial tuberosity. After 15 minutes of rest, subjects were randomly assigned to perform one set of either A or R kettlebell swings. The load of the K was based on completing 8-10 quality K swings. 30 minutes of rest was required prior to the cross-over aspect of the study. **RESULTS:** ANOVA ($p < .05$) was applied to the data. There were no significant difference between trials among matched muscle groups and K positions. Mean EMG (%MVC) during Phase 1 was BF: 96.0 & 92.1, RF: 121.7 & 148.4, GM: 92.1 & 96.4, and ES: 88.5 & 90.5, for A and R, respectively. Mean EMG (%MVC) during Phase 2 was BF: 106.2 & 131.9, RF: 82.0 & 109.5, GM: 36.4 & 51.6, and ES: 77.9 & 85.4 for A and R, respectively. **CONCLUSION:** There is no significant difference in EMG activity in the muscles used during both the American and the Russian kettlebell swings. The use of either A or R technique for K exercise requires almost identical activation of lower extremity and back musculature and thus renders the choice of either technique a subjective decision. Subjective reports of the A technique being more difficult were not confirmed. Additional kettlebell studies should investigate activity of the shoulder musculature.

1637 Board #312 June 1 9:00 AM - 10:30 AM
Comparison Of Quadriceps Femoris Muscle Morphology Using Ultrasonography During Two Different Body Positions
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 (No relationships reported)

PURPOSE: To evaluate the effects of body position on muscle cross-sectional area (mCSA) and echo intensity (EI) of the rectus femoris (RF) muscle in healthy young women.
METHODS: Seventeen healthy females (20.88 ± 1.17 yrs.; 167.30 ± 6.43 cm; 71.44 ± 14.81 kg) underwent 6 ultrasound scans (US) of the RF during two different body positions. For the first position, participants were instructed to lie supinated (lying) on a padded plinth for 5 minutes to allow for potential fluid shifts prior to collecting ultrasound images. For the second position, participants were instructed to sit upright (seated) on the edge of the padded plinth with their leg hanging freely and a 90° angle at the knee. During each position, mCSA and EI were assessed in the dominant limb via three panoramic US scans. Each image was scaled and mCSA and EI were quantified using image analysis software. The best image for each position was used for analysis. Repeated measures analyses of variance (ANOVA) were used to analyze mCSA and EI of the RF across the different body positions (lying vs. seated). **RESULTS:** There was no significant difference in mCSA during the supine (Mean $\pm 95\%$ CI; 10.71 ± 1.57 cm) versus seated (10.95 ± 1.47 cm) positions ($p = 0.166$). Furthermore, there was no significant difference in EI during the supine (34.25 ± 3.08 AU) versus seated (33.27 ± 3.28 AU) positions ($p = 0.301$). **CONCLUSIONS:** The results indicated that a change in body position from supine to seated had no significant effect on the measurement of rectus femoris mCSA or EI from panoramic US scans. However, during visual inspection, possible changes in the shape of the RF were noted (i.e., flattening and widening of the RF while lying compared to seated). Therefore, future investigations may wish to investigate the effects of body position on ultrasound measurements of RF muscle thickness.

1638 Board #313 June 1 9:00 AM - 10:30 AM
Post Activation Potentiation in North American High School Football Players
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Post activation potentiation (PAP) is an acute enhancement of muscular power production resulting from a high intensity potentiating exercise. Practical applications of PAP phenomena as a warm-up strategy are the focus of ongoing research. **PURPOSE:** This study compared the effects of a dynamic and a PAP warm-up strategy on speed and horizontal plane muscular power output. **METHODS:** High School male football players ($n=16$) participated in a repeated measures cross over design study consisting of 3 testing days. Day 1: one repetition maximum (1-RM) back squats were established. Day 2: half of the participants completed a dynamic warm-up (DWU) consisting of dynamic movements (ex. high knees, butt kickers, frog jumps, cherry pickers, lateral slide, karaokes, back pedal) while the other half of the participants performed a PAP warm-up consisting of back squats culminating in a set of 4 repetitions at 85% of 1-RM. Following the warm-ups (4-minutes), the participants performed 3 trials of weighted sled push 91 kilograms (200 lb.) over a 9.1 meter (10 yards) linear path. Following the sled pushes the participants then performed three trials 18.2 meter (20 yard) sprints. Day 3: participants crossed over with respect to the warm-up procedures and again performed the three sled push and sprint trials. Dependent t-tests were used to compare the sled push and sprint times between warm-up conditions. **RESULTS:** Both the 18.2 meter sprint (PAP: 3.19 ± 0.39 , DWU: 3.24 ± 0.39 , $p < 0.01$) and the 91 kilogram sled push (PAP: 4.80 ± 0.67 , DWU: 5.27 ± 0.90 , $p < 0.01$) showed a significant improvement when PAP was utilized as a warm-up rather than the DWU. **CONCLUSIONS:** Within the parameters of the study, it was concluded that PAP as a warm-up strategy enhances sprint ability and horizontal plane muscular power output

1639 Board #314 June 1 9:00 AM - 10:30 AM
The Effects Of Bilateral And Unilateral Protocols On Muscle Power And Rate Of Force Development
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PURPOSE: Postactivation potentiation (PAP) is used to improve the force generating capacity of skeletal muscles. However, no studies have examined if there is a difference in PAP response when comparing a unilateral versus a bilateral conditioning exercise. This is important because differences exist in muscle activation when comparing unilateral and bilateral exercises. This difference plays a role in the apparent strength difference between unilateral and bilateral exercise, called "the bilateral deficit" (BLD). Therefore, the purpose of this investigation was to determine if a unilateral exercise would cause a different PAP response compared to a bilateral exercise.
METHODS: Ten recreationally trained males participated (mean \pm SD; age = 21.9 ± 2.1 yrs; body mass = 83.3 ± 10.5 kg; height = 1.8 ± 0.1 m; BMI = 25.8 ± 3.2 ; percent body fat = $14.8 \pm 3.5\%$). Following a familiarization period and baseline strength testing (5 rep maximum [5RM] for unilateral and bilateral squat), in a randomized repeated measures design, all subjects completed 3 trials: unilateral, bilateral and control. Each trial consisted of a conditioning activity (4 reps at the 5RM load) followed by a maximal voluntary isometric leg extension contraction (60° knee extension) 7 minutes after finishing the conditioning activity.
RESULTS: Neither conditioning activity (unilateral or bilateral squat) resulted in an increased peak torque value expressed in absolute or relative values as compared to control ($P > 0.05$). Interestingly, following both conditioning activities, there was a statistically significant increased time to reach half peak torque compared with the control trials ($P < 0.05$).
CONCLUSIONS: Our results demonstrated that neither conditioning activity (unilateral or bilateral squat) prior to a maximal voluntary isometric contraction caused a PAP response. However, both conditioning activities appeared to cause residual fatigue. Future investigations should expand the time domain to further explore the PAP response.

1640 Board #315 June 1 9:00 AM - 10:30 AM
Changes In Upper-body Strength Are Independent Of Initial Fat-free Mass And Strength Level
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Research indicates that upper-body muscular strength gains following resistance training may be greater in individuals with greater initial fat-free mass (FFM). Further, individuals with lesser initial muscular strength experience greater gains in strength. However, FFM and muscular strength have not been analyzed simultaneously to determine possible interactive effects on strength gain. **PURPOSE:** To evaluate the effect of resistance training using free weights (FW) and machine weights (MW) on changes in upper-body muscular strength when controlling initial FFM and strength. **METHODS:** College men (n = 850) and women (n = 836) enrolled in a required wellness course over 3 years volunteered to participate. Each participant was measured before and after 12 weeks of periodized resistance training for body composition and 1RM bench press using free-weights (FW) or machine weights (MW). Body composition was estimated from gender-specific skinfold prediction equations. MW modalities included a seated horizontal press (SHP) and a supine vertical press (SVP). Bench press training was periodized with progressively heavier loads and reduced repetitions designed to achieve maximum strength improvement. Mode-specific bench press training was supplemented with auxiliary upper- and lower-body exercises performed in 3 sets of 6-10 repetitions. **RESULTS:** A 2 x 3 ANOVA indicated no significant change in FFM or %fat for either gender or training mode. The relationships between initial level and delta FFM (r = -0.10, p<0.001) and %fat (r = -0.24, p<0.001) were significant but weak. A gender x training mode ANCOVA controlling for initial FFM and muscular strength indicated that men (10.4 ± 6.2 kg) gained significantly (p<0.001) more strength than women (7.7 ± 5.4 kg) although %gain was significantly greater in women (22.0 ± 21.1%) than men (14.8 ± 14.0%). Mode-specific differences in strength gain (p<0.001) and a significant interaction (p<0.02) were noted. Strength gain on SHP (11.3 ± 5.6 kg) was greater than SVP (9.0 ± 5.9 kg) which was greater than FW (6.5 ± 5.3 kg). **CONCLUSIONS:** Men gain more upper-body strength than women when differences in initial FFM and strength are accounted for. Training with machines produces greater gains in upper-body muscular strength than FW in initially untrained individuals.

1641 Board #316 June 1 9:00 AM - 10:30 AM
The Effects of Muscle Damage on Muscle Spindle Function
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 (No relationships reported)

The effects of eccentric muscle damage on extrafusal muscle fibers and motor function have been well studied. However, very few studies have examined the effects of muscle damage on sensory function, specifically, whether eccentric contractions damage the intrafusal fibers muscle spindles are wrapped around. **PURPOSE:** To investigate the effects of fatigue and muscle damage on the premotor latency (PML) and reflex magnitude (normalized reflex Torque; nRT) of patellar tendon reflexes. **METHODS:** Fifteen males (mean ± SD: age = 24.1 ± 2.9 yrs.) and fifteen females (age = 21.67 ± 2.1 yrs.) participated in a familiarization trial followed by two experimental sessions, separated by seven (±1) days. The 2 conditions consisted of either fatiguing (CON) or muscle damaging (ECC/CON) contractions at 60°·s⁻¹ until 70% of peak torque (PT) was achieved. Patellar tendon taps were performed at a knee angle of 90° and a reflex hammer fastened to a swing arm was used to provide uniform impacts. PML was calculated as the time between the strike of the hammer to the onset of myoelectric activity in the rectus femoris, and nRT was normalized [% of Pre maximal voluntary contraction (MVC)] at all time points. Reflex assessments and MVCs were completed before (Pre) and following (Post) both the CON and ECC/CON protocols until recovery of PT to Pre values (Recov). A three-way repeated measures ANOVA [gender (males vs females) × condition (CON vs ECC/CON) × time (Pre vs Post vs Recov)] was used to analyze all reflex data. An alpha value of P ≤ 0.05 was considered statistically significant for all comparisons. **RESULTS:** A main effect for time (P = 0.003) was observed in which PML was greater at Recov compared to Pre (P = 0.01). Additionally, a two-way gender × time interaction was observed in which nRT was lower at Post and Recov compared to Pre (P = 0.001-0.002) for the females. No differences were observed across time for the males (P = 1.000). **CONCLUSION:** These findings revealed that changes in PML may not be sensitive to muscle damaging contractions but may have delayed responses as a result of exercise-induced fatigue. Furthermore, reflex magnitude deficits may be evident in females following fatiguing exercise but not likely as a result of muscle damage.

1642 Board #317 June 1 9:00 AM - 10:30 AM
The Effects of Post-activation Potentiation on Contractile Properties and Jump Performance in Athletes
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INTRODUCTION: Post-activation potentiation (PAP) is an acute enhancement in a muscle's ability to generate force due to its previous contractile history. **PURPOSE:** To assess kettlebell swing (KB) exercise as a method of PAP and compare it to common PAP methods of tuck jump (TJ) and depth jump (DJ). **METHODS:** Seven varsity track athletes (age: 21±1yr; mass: 65.9±9.3kg) completed one familiarization, and three test sessions in random order. Each session consisted of a warm-up followed by evoked twitch torques (TT) measured by tibial nerve stimulation (single, doublet and triplet pulses [0.5ms, 100Hz]). After a pre-competition warm-up, participants completed a baseline counter-movement jump (CMJ) followed by the PAP exercise (2 x 5 repetitions). TT was re-assessed at 1, 2, and 3 minutes (T1,T2,T3), and CMJ at 5 and 10 min (T5,T10), post-intervention. TT parameters included peak torque (PT), rate of torque development (RTD), and half relaxation time (HRT). CMJ parameters included peak power, peak force, take-off velocity, and jump height. **RESULTS:** Data were normalized to baseline before conducting repeated measures ANOVA to compare exercise conditions. Condition main effects were observed for single PT at T1 (p=0.02), doublet PT at T1 (p=0.044) and T2 (p=0.049), and triplet PT at T1 (p=0.007) and T2 (p=0.034). KB had the largest change in PT (+11.1±7.8%) compared to TJ (+8.6±11.0%) and DJ (-5.5±14.1%) averaged across T1-T3 (p<0.05). Contractile properties extracted from singlets revealed KB had larger PT (+22±15%) than DJ (-4±21%) at T1 (p=.027), and a prolonged HRT (+9±17%) compared to DJ (-3±14%) at T3 (p=.031). RTD was elevated at T1 (+37.8±36.7%), T2 (+28.8±37.2%) and T3 (+25.7±28.9%; p=.026) but was not different between conditions. No condition effects were found for CMJ at T5 or T10, but effect size was large for take-off velocity (p=0.07; η² = 0.412) at T5, where KB (+1.6±1.1%) and DJ (+2.0±3.3%) were larger than TJ (-1.6±2.7%). **CONCLUSIONS:** KB exhibited a tendency to potentiate evoked torque more than TJ and DJ. KB also exhibited signs of greater lower leg muscle fatigue three minutes after exercise but this did not limit CMJ performance five minutes after exercise.

1643 Board #318 June 1 9:00 AM - 10:30 AM
Comparison Of The Electromyographic Fatigue Thresholds During Taekwondo Specific Tests And Running Cardiopulmonary Exercise Test
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 (No relationships reported)

PURPOSE The aim of the present study is to analyze the electromyographic (EMG) fatigue thresholds during taekwondo specific tests (TKDet) and treadmill running cardiopulmonary exercise test (CPET). **METHODS** 10 male taekwondo athletes (20 ± 2 yrs, body mass 67.5 ± 6.3 Kg, height 176 ± 9 cm) visited the laboratory 3 times. University ethics committee approved the study (opinion #765.698). At the 1st visit, anthropometric assessment and CPET were performed. In counterbalanced order, for the next 2 visits, the athletes performed a Continuous and an Interval Taekwondo Test (cTKDet and iTKDet). CPET was constituted by an individualized ramp protocol (10 min). TKDet were constituted by 1-min progressive stages of kicking sequences, and kicking interval started from 4,6s and reduced 0,4s every minute until participant's fatigue. $\dot{V}O_2$, HR, and rating of perceived exertion (Borg 0-10) were measured during all tests. EMG acquisition was performed with the wireless system connected to a pair of surface electrodes placed in the rectus femoris, according to SENIAM recommendations. EMG signal was recorded continuously during the tests with a frequency of 2000 Hz. EMG was filtered by 3rd order Butterworth band-pass filter (20 - 500 Hz), RMS values were calculated during every non-superimposing windows with 1s duration. EMG thresholds were detected by piecewise regression (two inflections - three segments line). Threshold's responses were analyzed by repeated measures ANOVA, with Bonferroni post-hoc test, after Shapiro-Wilk test confirmed normality. P < 0.05 was adopted for all tests. **RESULTS** Detailed results were present in table 1. Taekwondo athletes presented similar 1st and 2nd EMG threshold responses during the 3 tests. **CONCLUSIONS** Taekwondo tests' EMG threshold responses did not differ from CPET's threshold responses, suggesting a suitable intensity progression and a proportional peripheral fatigue behavior across the stages. **FINANCIAL SUPPORT** CAPES, FAPERJ, and CNPq.

Table 1 – Comparison of cardiopulmonary exercise tests' electromyographic thresholds (n=10).

	CPET	cTKDet	ITKDet	P value (ES)
1st Electromyographic threshold				
VO ₂ (mL.kg ⁻¹ .min ⁻¹)	35.6 ± 3.2 (33.3 - 37.9)	37.9 ± 3.6 (35.3 - 40.5)	36.3 ± 4.9 (33.3 - 39.9)	0.44 (0.31)
VO ₂ (%VO _{2PEAK})	71.5 ± 6.0 (67.2 - 75.8)	72.8 ± 8.6 (66.7 - 79.0)	68.4 ± 8.8 (62.1 - 74.7)	0.42 (0.08)
HR (beats.min ⁻¹)*	160 ± 8 (153 - 167)	173 ± 10 (153 - 178)	170 ± 31 (137 - 177)	0.11 (0.22)
HR (%HR _{PEAK})*	82.7 ± 8.2 (78.5 - 90.4)	86.3 ± 6.3 (79.9 - 89.7)	83.1 ± 9.0 (65.9 - 85.6)	0.20 (0.16)
HRR (%HR)*	76.0 ± 11.1 (70.2 - 86.2)	80.4 ± 7.1 (73.3 - 84.4)	76.1 ± 14.1 (51.1 - 79.3)	0.21 (0.16)
Relative time to 1 st EmgT (% duration)	34.9 ± 9.7 (27.9 - 41.9)	39.4 ± 7.7 (33.9 - 44.9)	36.9 ± 11.7 (28.5 - 45.3)	0.69 (0.04)
Kicks interval stage (s)*	-	3.6 ± 0.4 (3.4 - 3.8)	3.4 ± 0.8 (3.0 - 3.8)	0.36 (-0.29)
Perceived Exertion Scale (0-10)	4 ± 1 (3 - 5)	4 ± 1 (3 - 5)	4 ± 1 (3 - 5)	0.77 (0.03)
2nd Electromyographic threshold				
VO ₂ (mL.kg ⁻¹ .min ⁻¹)	43.1 ± 8.7 (40.5 - 45.8)	44.1 ± 5.0 (40.5 - 47.7)	44.5 ± 7.3 (39.3 - 49.7)	0.75 (0.03)
VO ₂ (%VO _{2PEAK})*	89.0 ± 5.8 (82.0 - 90.0)	85.5 ± 10.8 (78.0 - 91.0)	80.5 ± 15.0 (74.0 - 95.0)	0.73 (0.03)
HR (beats.min ⁻¹)*	175 ± 13 ^c (167 - 186)	186 ± 10 (178 - 189)	183 ± 11 (168 - 189)	0.06 (0.28)
HR (%HR _{PEAK})	92.5 ± 2.6 (90.7 - 94.0)	92.4 ± 3.4 (89.9 - 94.9)	90.5 ± 3.0 (88.6 - 92.6)	0.29 (0.13)
HRR (%HRR)	89.5 ± 3.7 (86.9 - 92.3)	89.2 ± 4.4 (86.2 - 92.4)	86.5 ± 4.2 (83.5 - 89.7)	0.25 (0.14)
Relative time to 2 nd EmgT (% duration)	75.0 ± 10.8 (62.8 - 78.2)	79.1 ± 12.5 (70.2 - 88.0)	71.8 ± 9.2 (65.4 - 78.5)	0.24 (0.15)
Kicks interval (s)*	-	2.2 ± 0.5 (1.4 - 2.2)	1.8 ± 2.6 (1.8 - 2.6)	0.72 (-0.11)
Perceived Exertion Scale (0-10)*	8 ± 2 (5 - 8)	7 ± 4 (4 - 9)	6 ± 3 (4 - 8)	0.15 (0.19)

CPET - treadmill running cardiopulmonary exercise test; cTKDet - continuous taekwondo cardiopulmonary exercise test; ITKDet - interval taekwondo cardiopulmonary exercise test. *p* - significance level. Variables with the absence of asterisk (*) denotes parametric data, presented as mean ± standard deviation and 95% confidence interval of mean (inferior limit - superior limit). * Denotes non-parametric data, presented as median, interquartile range and 95% confidence interval of median (inferior limit - superior limit). Parametric data compared through repeated measures ANOVA (and Bonferroni post-hoc, if necessary). Non-parametric data compared through Friedman test (and Dunn post-hoc, if necessary) (3 columns) or Wilcoxon signed rank test (2 columns). VO₂ - Oxygen uptake. HR - Heart Rate. HRR - Heart Rate Reserve. EmgT - Electromyographic threshold. VO_{2PEAK} - Highest oxygen uptake value observed. HR_{PEAK} - Highest heart rate value observed. Percentage variables (%) were calculated with the peak value observed at each test.

- 1644 Board #319 June 1 9:00 AM - 10:30 AM
The Influence of Exercise Surface Inclination on Trunk and Lower Extremity Muscle Activity During Common Pilates Exercises
 Asia V. Yates¹, Ayla Donlin², George Beneck², Joshua A. Cotter², Evan E. Schick². ¹California State University, Long Beach, Corona, CA. ²California State University, Long Beach, Long Beach, CA.
 (No relationships reported)

Pilates is a common series of exercises used for both clinical and general populations that incorporates a variety of body positions to vary exercise intensity. Several studies have examined muscle activity while performing Pilates exercise, however the effect of surface inclination on muscle activity is limited. **PURPOSE:** The purpose of this study is to compare muscle activity of the lower legs and trunk during common Pilates exercises performed at different angles of support. **METHODS:** Three male and eleven female college aged students (24.1±4.4yrs; 1.7±0.1m; 62.2±17.9kg) were recruited. All subjects performed 4 static (10 second hold) Pilates exercises (boat pose, bridge, plank, and single leg balance) during each of the three surface inclinations: 1) 17° incline, 2) floor, 3) 17° decline. The unilateral muscle activity of the external oblique (EO), rectus abdominus (RA), erector spinae (ES), gluteus medius (MED) and maximus (GM), tibialis anterior (TA), peroneals (PL), and the medial gastrocnemius (GAS) on the right side of the body were recorded using surface electrodes. The average root mean square of muscle activity over three trials was expressed as a percent of the individual muscles maximum voluntary contraction (MVIC) recorded at the beginning of the data collection. The %MVIC for each muscle group were compared using 1-way repeated measures ANOVAs for each pose during the three inclination conditions. **RESULTS:** During the boat pose, %MVIC for the RA was greater in the incline (46%) compared to the decline (19%, *p* = 0.002) and floor (28%, *p* = 0.027). During the decline plank, the %MVIC for the EO (43%) was greater in comparison to both the floor (35%, *p*=0.028) and the incline (29%, *p* = 0.005). The RA muscle activity also showed increased activity when on the decline (30%) in comparison to the incline (20%, *p*=0.036). The single leg balance pose showed greater activation of the TA muscle on the incline (27%) in comparison to the floor (19%, *p*=0.013). No differences were detected during the bridge pose. **CONCLUSION:** The results of this study suggest that trunk muscle activity can be altered by modifying the inclination angle. Such modifications may be useful in planning exercise progressions. Further investigation is required to examine the influence of surface inclination angle and long-term training benefits.

C-48 Free Communication/Poster - Physical Activity and Mental Health

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

- 1645 Board #320 June 1 8:00 AM - 9:30 AM
Effect of a College Course to Reduce Weight Bias among Undergraduate Pursuing a Health Degree
 Aubrianna Rote¹, Christine Lakatos¹, Skylar Love², Lyndi Hewitt¹. ¹University of North Carolina - Asheville, Asheville, NC. ²Texas State University, San Marcos, TX.
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PURPOSE: To examine the effect of a college course on weight bias and body image on explicit and implicit weight bias in health majors. **METHODS:** This 15-week intervention included four groups. The experimental group contained students (*n*=16) in a course with the main focus on weight bias and body image. One comparison group consisted of students (*n*=16) in a health course containing topics on weight management. Another comparison group consisted of students (*n*=18) in a health course unrelated to weight management. The control group consisted of students (*n*=14) in an economics course unrelated to health. Extrinsic weight bias was assessed with the Anti-fat Attitudes Test (AFAT), and implicit weight bias was assessed with the Implicit Attitudes Test for weight. To analyze change in explicit weight bias and if these changes differed by group, a 2x4 repeated measures ANOVA was conducted. Change in implicit weight bias by group was assessed using chi-square tests.

RESULTS: At baseline, most participants had an automatic preference for thin people over fat people that was strong (26.6%), moderate (39.1%), or slight (7.8%). Just 17.2% of participants had no automatic preference between fat and thin people, and few participants had a strong (3.1%), moderate (1.6%), or slight (4.7%) automatic preference for fat people over thin people. There were no significant changes in implicit weight bias pre- and post-semester. For AFAT composite scores, a significant main effect for time was present ($F_{(1,60)} = 5.02, p = .029$), indicating changes in scores pre- and post-semester. The group by time interaction ($F_{(1,60)} = 4.1, p = .01$), demonstrated that these changes significantly differed by group. The simple main effect revealed a significant change (*p* < .001) for the experimental group pre- and post-semester. There were no significant changes in AFAT scores for any other group. **CONCLUSIONS:** No changes in intrinsic weight bias were found in any group. Because intrinsic bias is developed over years and is highly engrained, longer, more intense interventions may be necessary to elicit change. However, post-semester, extrinsic bias significantly decreased in students enrolled in the course focused on weight bias. Thus, this type of course may be a useful tool within educational settings to reduce weight bias, especially among health majors.

- 1646 Board #321 June 1 8:00 AM - 9:30 AM
The Relationship Of Physical Activity Level (Self-reported Versus Objectively Measured) With Depression, Satisfaction With Life, And Cognitive Function In Older Adults
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Evidence has shown relationships between physical activity and mental health and well-being in older adults. Yet, there is little research regarding whether self-reported (SRPA) or objectively measured physical (OMPA) activity is a stronger predictor of mental health and well-being in this population. Therefore, the **PURPOSE** of this study was to examine relationships among SRPA (Community Healthy Activities Model Program for Seniors questionnaire), objectively measured physical activity (Actical accelerometer), and measures of quality of life and mental health, including satisfaction with life (Satisfaction with Life Scale, SWLS), geriatric depressive symptoms (Geriatric Depression Scale: GDS), and cognitive function (Addenbrooke's Cognitive Examination-Revised, ACER) in older adults. We hypothesized that OMPA would be more strongly correlated with these variables of mental health and well-being than SRPA. **METHODS:** Here we report preliminary data from forty-eight older adults (age: 78 ± 8 years, BMI: 27 ± 4 kg·m⁻²) who have successfully completed 7-days of objective physical activity monitoring using Actical accelerometers (Phillips Respironics, Bend, Oregon). All subjects have additionally completed the CHAMPS questionnaire with guidance from study personnel. To examine relationships among SRPA, OMPA, SWLS, GDS, and ACER, partial correlations were conducted while controlling for age and sex. Statistical significance was set to *p* < 0.05. **RESULTS:**

Averages for SRPA and OMPA were 1,495±172 kcal·wk⁻¹ and 87,163±10,139 activity counts·day⁻¹, respectively. SRPA was significantly correlated with OMPA ($r=0.52$, $p<0.05$). Neither SRPA nor OMPA were significantly correlated with SWLS, GDS, or ACER ($p>0.05$). Both SWLS ($r=0.40$, $p<0.05$) and GDS (-0.40 , $p<0.05$) were significantly correlated with ACER. **CONCLUSIONS:** Our preliminary data do not support the hypothesis that physical activity is associated with aspects of mental health and well-being. However, cognitive function was significantly associated with both satisfaction with life and depressive symptoms in older adults. Given the variability in the measures of SRPA and OMPA, we are currently recruiting more subjects to increase the statistical power to detect potential links among physical activity and indices of well-being in older adults.

1647 Board #322 June 1 8:00 AM - 9:30 AM
Does Exercise Help People Living with HIV Improve Their Quality of Life? A meta-analysis.

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 (No relationships reported)

Today human immunodeficiency virus (HIV) has become a manageable chronic disease which still induces both physical and psychological challenges. Exercise as a non-medication treatment could be very beneficial for people suffering from HIV. To date, psychological outcomes such as quality of life have not been examined systematically. Therefore, studies investigating the effects of exercise as a treatment for people living with HIV and its outcomes on quality of life are reviewed in this meta-analysis.

Purpose

To assess the effect of exercise on quality of life with the subscales Vitality and General Health of the HIV Medical Outcome Study.

Methods

Literature search, quality assessment and data extraction were performed independently by two authors (PAZ and JBL). Randomised controlled trials involving people living with HIV, with at least one exercise intervention investigating psychological parameters were considered for inclusion. In order to differentiate the level of quality and to assess the risk of bias of included studies, the Physiotherapy Evidence Database-Scale was used. Standardized mean differences (SMDs) were calculated for each outcome, data were analyzed and assessed for heterogeneity and bias using the Review Manager 5.3.

Results

Vitality was assessed by $n=8$ studies and general health by $n=7$ studies. Exercise significantly improved vitality (SMD=0.35, 95% CI 0.12-0.59, $Z=2.91$, $p=0.004$) and general health (SMD=0.43, 95% CI 0.12-0.75, $Z=2.73$, $p=0.006$) using the random-effect model. Heterogeneity of vitality and general health between the included studies was $I^2=6\%$, $X^2=7.43$ $df=7$, $p=0.39$ and $I^2=39\%$, $X^2=9.90$ $df=6$, $p=0.13$. Participants $n=(pre-/post-intervention)$ EG $n=(163/160)$, CG $n=(142/140)$.

Conclusion

Aerobic exercise, resistance training and yoga improve vitality and general health significantly. In further research, other facets of mental health could also be considered to further understand how PLWH may benefit from physical exercise.

1648 Board #323 June 1 8:00 AM - 9:30 AM
The Relationship Between Physical Activity, Physical Self-Description, And Well-Being In University Students

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 (No relationships reported)

Previous research has provided evidence for relationships between physical activity (PA) and physical self-description (PSD), PA and Well-Being (WB), and PSD and WB. While university students' well-being has been emphasized as an important consideration, there is a lack of research investigating the role that physical activity and physical self-description play in their well-being.

PURPOSE: Given this lack of research, the purpose of this study was to investigate the relationship between PA, PSD, and WB in university students. **METHODS:** A total of 141 participants (female=106, male=35), ages 18 to 25 ($M=21.01$, $SD=2.04$), completed an online survey to participate in the study. The participants' PA levels, PSD, and WB were assessed using the International Physical Activity Questionnaire (IPAQ), Physical Self-Description Questionnaire (PSDQ), and Well-Being (PERMA) questionnaire, respectively. A Pearson product-moment correlation, T-tests, and 2X2 ANOVA were used to examine gender differences and effects between the three

variables. **RESULTS:** Correlation results indicated that there was a significant positive relationship between PA and PSD ($r=.299$, $p<.001$), as well as PSD and WB ($r=.519$, $p<.001$), but there was no significant correlation between PA and WB ($r=.139$, $p>.05$). The results of the t-tests showed no significant gender differences in any of the three variables. The ANOVA indicated that there was no significant interaction between PA level and PSD level on WB, $p<.526$. However, there was a significant main effect for PSD and WB ($p<.001$), indicating that students with a stronger perception of their physical selves have significantly higher well-being in comparison to those with weaker self-perceptions. Surprisingly, PA levels alone had no significant effect on WB nor were there any combined effects of PA engagement and PSD on WB in the university students. **CONCLUSION:** The present study is both consistent and contradictory to previous research. Given that this is the first study to investigate the relationship between these three variables, the results indicate many areas for future research, such as investigating mediating effects of PSD and determining whether differences in WB exist with low versus high levels of PA.

1649 Board #324 June 1 8:00 AM - 9:30 AM
Adapting an Evidence-Based Mental Health Care Model for Mobile Eating Disorder Programs

Rachael E. Flatt¹, C. Barr Taylor¹, Denise E. Wilfley², Ellen E. Fitzsimmons-Craft², Katherine N. Balantekin², Shiri Sadeh-Sharvit¹, Neha J. Goel¹, Marie-Laure Firebaugh², Grace E. Monterubio². ¹Stanford University, Palo Alto, CA. ²Washington University in St. Louis, St. Louis, MO. (Sponsor: Dr. Sherrie Ballantine-Talmadge, FACS) Email: rflatt92@stanford.edu
 (No relationships reported)

Despite the accessibility of mobile technology, there are currently very few evidence-based, personalized mobile intervention programs addressing prevalent mental health disorders, including eating disorders (EDs). Previous studies of college students determined 2-5% have clinical symptoms of EDs, 10-15% have subclinical symptoms, and 35-45% are at high risk.

PURPOSE: To develop and test a mobile technology treatment model including a screening assessment and online programs for female college students at risk of developing an ED or displaying clinical symptoms of EDs.

METHODS: Over three years, 4,922 female students at 27 colleges in the U.S. completed an online screen assessing risk, clinical symptoms, and demographic information. Low-risk subjects were directed to an online healthy weight regulation program, and high-risk subjects were directed to a targeted ED prevention program. Those who screened for clinical EDs based on DSM-5 criteria were offered a referral or an online, guided self-help intervention program (SB-ED) hosted by a technology partner, Lantern, based on randomized condition. Engagement in the SB-ED program was monitored throughout.

RESULTS: Subjects who identified as racial/ethnic minority students (African American, Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native, Hispanic, and/or other; $n=327$) reported more frequent binge eating ($p=.004$) and greater sleep problems ($p=.045$) compared to non-minority students (e.g., European Americans). A preliminary analysis of Year 3 ($n=95$) showed that 78% of subjects completed more than 2 sessions of the SB-ED program and completed an average of 17.8 sessions out of 40 core sessions.

CONCLUSIONS: Based on our preliminary results, mobile technology is an effective way to screen and collect information on at-risk populations for EDs while providing insight into differences in subpopulations. While the trial is not yet complete, this model can be improved and adapted to deliver more personalized and engaging care for various subpopulations. We plan to expand the current model by treating anxiety, depression, and EDs in student-athletes and by creating sports psychology-focused and transitional/retirement programs.

1650 Board #325 June 1 8:00 AM - 9:30 AM
The Effect of Resistance Exercise Training on Anxiety Symptoms: A Systematic Review and Meta-Analysis

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 (No relationships reported)

Compared to aerobic exercise, the effects of resistance exercise on symptoms of anxiety are understudied.

Purpose: To estimate the population effect size for resistance exercise training (RET) effects on anxiety symptoms and to determine whether variables of logical, theoretical, and/or prior empirical relation to anxiety moderate the overall effect.

Methods: 29 effects were derived from 15 articles published before November, 2016 located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 596 participants and included randomization to RET or a non-active control condition and measurement of anxiety at baseline, mid- and/or post-

intervention. Hedges' *d* effect sizes were computed and random effects models were used for all analyses. Meta-regression quantified the extent to which participant and trial characteristics moderated the mean effect.

Results: RET significantly reduced anxiety symptoms by a mean effect delta (Δ) of 0.38 (95%CI: 0.22-0.54; $\tau=4.61$; $p<0.001$). Significant heterogeneity was not indicated ($Q_1(28)=36.80$, $p>0.12$; $I^2=26.6\%$, 95%CI: 7.30%-41.91%). Anxiety reductions were significantly moderated by whether or not the trial primary outcome was anxiety ($\beta=0.42$, $p<0.01$). Larger effects were derived from trials in which anxiety was the primary outcome ($\Delta=0.54$; 95%CI: 0.34-0.73; $k=18$) compared to trials in which anxiety was not the primary outcome ($\Delta=0.20$; 95%CI: -0.05-0.44; $k=11$; $\tau=2.57$, $p<0.01$). The mean effect did not significantly vary based on gender ($\beta=-0.30$), age ($\beta=-0.10$), health status ($\beta=0.28$), type of control condition ($\beta=-0.30$), program length ($\beta=0.20$), exercise intensity ($\beta=0.29$), exercise frequency ($\beta=0.15$), or the anxiety recall timeframe ($\beta=-0.11$) (all $p>0.08$). Non-significantly larger effects were found among females ($\Delta=0.55$), among otherwise healthy adults ($\Delta=0.53$), for trials in which a no-treatment control was used ($\Delta=0.54$), resistance exercise programs ≥ 12 weeks ($\Delta=0.51$), and for moderate-to-vigorous intensities ($\Delta=0.46$).

Conclusions: RET significantly improves anxiety symptoms. Improvements were not moderated by sex, health status, or based on features of RET. Future trials should focus on anxiety as the primary outcome and compare RET to other empirically-supported therapies.

1651 Board #326 June 1 8:00 AM - 9:30 AM
The Synergistic Effects Of Exercise In Combination With Other Antidepressant Therapies.

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 (No relationships reported)

PURPOSE: Major depressive disorder (MDD) is a global public-health concern. Current anti-depressant treatments are far from satisfactory leaving half of patients undertreated. Research has found exercise alone to be an effective treatment for people suffering with mild to moderate depression however its mechanism of action remains unclear. There is also a lack of research investigating the effects of exercise in combination with other conventional antidepressant therapies in people suffering with severe depression such as MDD. The aim of this study is twofold: first, to investigate the effects of an eight week exercise program in combination with antidepressant medication and intensive group therapy in improving depressive symptoms, anxiety and sleep quality; secondly, to identify changes in brain derived neurotrophic factor (BDNF) which is known to be reduced in people suffering with MDD.

METHODS: Sixteen sedentary participants were recruited from the Lakeridge Mental Health Day Treatment (LMHDT) program in Oshawa, Ontario, Canada. All participants had a clinical diagnosis of MDD based on DSM-IV criteria and an unstructured clinical interview conducted by hospital psychiatrists. Participants were assigned either to an eight week, supervised, moderate intensity exercise program plus LMHDT group or the LMHDT only group. Depression scores were determined using the Beck Depression Inventory (BDI), sleep quality by the Pittsburgh Sleep Quality Index (PSQI) and plasma BDNF was quantified by ELISA. All variables were measured at baseline and again at eight weeks.

RESULTS: Following the eight weeks of combination treatment the exercise group showed a greater decrease in depression scores, $F(1,14)=10.18$, $p=0.007$, $d=2.04$, a greater improvement in sleep quality, $F(1,14)=4.81$, $p=0.046$, $d=1.28$ and a greater increase in plasma BDNF concentration, $F(1,14)=12.47$, $p=0.003$, $d=1.99$ compared to the non-exercise group. The exercise group also had a greater decrease in anxiety scores although there was no significant difference between the two groups, $F(1,14)=0.25$, $p=0.623$, $d=0.33$.

CONCLUSIONS: This project has the potential to provide a tool to improve exercise prescription and to guide development of combined treatment approaches in order to optimize treatment outcomes for people suffering with MDD.

1652 Board #327 June 1 8:00 AM - 9:30 AM
Physical Activity Levels and Psychological Well-being/ Ill-being in Costa Rican College Students

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BACKGROUND: Research shows that early experiences in college settings might cause psychological distress in students, while psychological well-being is associated with psychosocial protective factors. Conditions that would promote well-being and minimize or reduce the effects of ill-being are important for generating healthy experiences throughout college life and possibly beyond. While previous research has shown that physical activity contributes to well-being in various populations,

evidence regarding physical activity and well-being/ill-being in the Costa Rican college population is lacking. **PURPOSE:** To compare psychological well-being and ill-being indicators of Costa Rican college students according to their physical activity level. **METHODS:** In this observational study, 233 freshmen (age 19.0 ± 2.2 years, 135 female) completed psychological well-being and ill-being measures (PANAS, SWLS, Subjective Vitality Scale, PERMA profiler, STAI and BDI-II) as well as the short form of the IPAQ. Students were categorized into low, moderate or high physical activity levels following the IPAQ guidelines. Separate ANOVA tests were performed according to physical activity category and selected outcomes. **RESULTS:** Students with high physical activity levels scored higher in subjective vitality (5.17 ± 0.98) and positive affect (35.43 ± 7.02) compared to students with low physical activity (4.62 ± 1.13 and 32.03 ± 7.44) ($p = 0.005$ and $p < 0.001$), and reported higher self-rated health (8.15 ± 1.34) than those with moderate (7.19 ± 1.80) and low (6.99 ± 1.91) physical activity levels ($p = 0.01$). Students in the moderate and high physical activity categories were more likely to experience flow experiences related to the engagement component of well-being (7.85 ± 1.26 and 7.86 ± 1.14) compared to those with low physical activity levels (7.23 ± 1.44) ($p = 0.004$). No statistically significant differences were found in psychological ill-being indicators ($p > 0.05$ for all). **CONCLUSIONS:** College students who are more physically active experience higher levels of psychological well-being. These results support the importance of providing additional opportunities for Costa Rican college students to become more physically active. Supported by NIH Grant U54GM104942

1653 Board #328 June 1 8:00 AM - 9:30 AM
Relationship Between Time Spent Sedentary and Psychological Distress in Middle-Aged and Older Adults

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 (No relationships reported)

BACKGROUND: In Australia, depression is ranked third highest in terms of burden of disease, after cancer and cardiovascular disease. Given the high lifetime prevalence of depression, the financial and productivity impact are significant. In order to develop appropriate interventions, it is important to establish the factors that can impact on depression. Sedentary behaviour is one factor that has shown an association with depression. **PURPOSE:** To investigate the cross-sectional relationship between sedentary behaviour and psychological distress in a large sample of middle-aged and older adults in Australia. **METHODS:** Participants were 140,093 adults aged 45 years and older (mean age = 62.7 ± 11.2 years) drawn from the baseline survey of The 45 and Up Study, a large-scale longitudinal cohort study of a range of health and social indicators in adults aged 45 years and older from across New South Wales, the most populous state in Australia. Self-reported sitting time was used as a measure of sedentary behaviour, and psychological distress was measured with the Kessler Psychological Distress Scale (Kessler-10). **RESULTS:** Linear regression showed a statistically significant association between sitting time and psychological distress ($B = 0.04$; $t(140,093) = 16.3$, $p < 0.001$). Pairwise comparisons within univariate analysis showed that, compared to individuals who sat more than 5 hours/day ($n = 67,226$), those who sat 0-5 hours/day ($n = 72,867$) had lower levels of psychological distress ($F = 182.3$, $p < 0.001$). **CONCLUSIONS:** The findings demonstrate a strong association between sitting time and psychological distress in a large sample of middle-aged and older adults. These findings can be used to inform the development of interventions to reduce psychological distress in adult populations.

1654 Board #329 June 1 8:00 AM - 9:30 AM
Endocannabinoid Responses Following an Aerobic Exercise Session in Individuals with and without Post-Traumatic Stress Disorder

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Recent therapeutic interventions have targeted the endocannabinoid (eCB) system in an effort to improve symptoms of Post-Traumatic Stress Disorder (PTSD). Exercise may be one such treatment approach, as exercise has been shown to increase circulating concentrations of endocannabinoids (anandamide, AEA; 2-arachidonylglycerol, 2AG) and related biogenic lipids (oleoylethanolamine, OEA; palmitoylethanolamine, PEA) in healthy individuals. However, the eCB responses to exercise in individuals with PTSD have not been investigated. **PURPOSE:** The purpose of this study was to examine eCB responses following aerobic exercise in individuals with and without PTSD. **METHODS:** Twenty-four (12 PTSD and 12 control) men and women (26 ± 6 yrs) participated in this study. Participants engaged in an aerobic exercise session in which they walked or ran on a treadmill for 30 minutes

at a moderate-intensity (70-75% MHR; 12-15 RPE). Blood draws were performed before and after exercise in order to quantify circulating concentrations of eCBs. Data were analyzed using 2 (group: PTSD, control) x 2 (time: pre-, post-exercise) repeated measures ANOVAs and Cohen's *d* effect size calculations. **RESULTS:** There were no significant ($p > 0.05$) differences between groups in RPE, HR, treadmill speed or incline throughout the exercise session. AEA, 2-AG, and OEA were found to increase significantly ($p < 0.05$) in both groups following exercise, while PEA did not change ($p > 0.05$) following exercise. Effect size calculations indicated the healthy controls vs. adults with PTSD experienced a greater magnitude of change for AEA (controls = 1.21; PTSD = 0.45), 2-AG (controls = 0.43; PTSD = 0.21) and OEA (controls = 0.70; PTSD = 0.46). **CONCLUSION:** These findings suggest that the eCB system is activated in adults with PTSD following moderate-intensity aerobic exercise. However, further research examining the eCB system is warranted as the magnitude of change for eCBs and related biogenic lipids was greater among healthy controls compared to individuals with PTSD.

Supported by the UW Virginia Horne Henry Fund and the Advancing a Healthier Wisconsin Endowment at the Medical College of Wisconsin

1655 Board #330 June 1 8:00 AM - 9:30 AM
Mental Health, Cardiorespiratory Fitness And Brain Volumes: Cross-sectional And Longitudinal Results From The Hunt-MRI Study

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 (No relationships reported)

PURPOSE: To explore whether cross-sectional and longitudinal mental health measures predict brain volumes in a general population, and whether there is an interaction effect between mental health and estimated cardiorespiratory fitness (eCRF) on brain volumes.

METHODS: 754 participants (52% women, mean age 59 yr) from the Nord-Trøndelag Health Study HUNT MRI cohort, who had also participated in HUNT 2 (1995-97), were included. Mental health was assessed using the Hospital Anxiety and Depression Scale (HADS). HADS-A (anxiety), HADS-D (depression), and HADS-T (total) were used in the analyses. Changes in HADS scores from HUNT 2 to HUNT 3 were stratified based on changes of 1 standard deviation into 3 groups: increased, decreased, and stable symptoms. eCRF was estimated based on self-reported physical activity, sex, age, waist circumference, and resting heart rate. Brain MRI was performed using a 1.5 T GE Signa HDx 1.5 T MRI scanner, and the T1 weighted 3D scan (ADNI volume) was used. Brain parenchymal fraction (BPF), bilateral hippocampus and amygdala volumes were obtained in FreeSurfer V5.3.0. A generalized linear model with gamma distribution was used to assess main effects of HADS, change in HADS, and interaction effects of HADS and eCRF, on BPF (adjusted for age and sex), bilateral hippocampus and amygdala volumes (adjusted for age, sex, and intracranial volume).

RESULTS: HADS-D, HADS-A, and HADS-T scores at HUNT 3 significantly predicted BPF ($p < .05$), showing smaller BPF with higher HADS scores. In addition, change in HADS-D, HADS-A, and HADS-T significantly predicted BPF ($p < .05$), with smaller BPF in the increased group when compared to the stable group. Change in HADS-A and HADS-T significantly predicted amygdala volume ($p < .05$), with smallest volume in the increased group when compared to the stable group. Finally, change in HADS-T significantly predicted hippocampus volume ($p < .05$), with smaller volume in the increased and decreased group when compared to the stable group. There were no significant effects of HADS score at HUNT 2 on brain volumes, nor was there any significant interaction between HADS and eCRF on brain volumes.

CONCLUSION: Cross-sectional HADS and changes in HADS from middle-age into early old age have important implications for brain volumes, but eCRF was not found to moderate this relationship.

1656 Board #331 June 1 8:00 AM - 9:30 AM
Psychological Responses to Standard Care and Exercise in Individuals with Substance Use Disorders

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 (No relationships reported)

Exercise has significant therapeutic effects for the treatment of depression and anxiety. Substance use is highly comorbid with depression and anxiety, although individuals with substance use disorders (SUD) are typically excluded from exercise interventions. Thus, there is little evidence informing whether or not exercise can alleviate psychological distress among SUD patients, which could aid their recovery. **PURPOSE:** To examine the effect of exercise, in addition to standard care, on

psychological outcomes among individuals newly-enrolled in SUD treatment.

METHODS: Twenty-one SUD patients (35 ± 9 yrs) were recruited from local Intensive Outpatient Treatment Programs to participate in this study. Participants were randomized to either treatment-as-usual (TAU, at their outpatient clinic) or TAU plus aerobic exercise training (EX). EX participants engaged in supervised, moderate-intensity exercise sessions 3xs/wk for 6 wks. TAU participants came into the laboratory once per week for assessments and a quiet rest session. Throughout the intervention, participants from both groups completed questionnaires evaluating mood states and mood disorders, perceived stress, psychophysical withdrawal, self-efficacy to abstain from substance use, and drug craving. Data were analyzed using a series of mixed model ANOVAs to determine whether there were group differences in psychological outcomes over time. **RESULTS:** Over 6 weeks, there were significant reductions in anxiety, perceived stress, and drug craving ($p < 0.05$); however, these reductions did not differ between groups ($p > 0.05$). There were no significant changes from baseline in withdrawal symptoms or self-efficacy ($p > 0.05$). Acutely, both exercise and quiet rest sessions led to transient decreases in craving, tension, depression, anger, confusion, and fatigue ($p < 0.05$). In addition, the EX group experienced acute increases in vigor ($p < 0.05$). **CONCLUSION:** The results from this study suggest that participation in an aerobic exercise training program during SUD treatment was associated with similar reductions in anxiety, stress, and drug craving as standard care. Furthermore, exercise produced the additional benefit of increases in vigor. Supported by the National Institute on Drug Abuse (R36DA040140) and the UW Virginia Horne Henry Fund.

1657 Board #332 June 1 8:00 AM - 9:30 AM
The Relation Between Personality and Physical Activity in Older Adults Living in a Retirement Community

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 (No relationships reported)

The relation between personality traits and physical activity (PA) is well researched in younger populations; however, most studies on personality and PA have relied on self-report measures. There is also a lack of evidence for the association between personality and PA specifically in older adults. **PURPOSE:** This study examined the relation between Five Factor Model personality traits and objective measures of PA in older adults. **METHODS:** Sixty-nine participants (80.2 ± 7.1 yrs; BMI: 27.5 ± 5.0 kg/m²) wore the ActiGraph ActiSleep monitor for 7 days and completed the NEO Personality Inventory-3 First Half. ActiGraph data were analyzed using Freedson Adult (1998) cut points. Each participant's average 15-hour daily moderate-to-vigorous physical activity (MVPA) and average daily steps were determined from all valid days. Partial correlations were used to examine the relation between PA measures and personality, controlling for age, gender, and number of days the activity monitor was worn. Significance was accepted at $p \leq 0.05$. **RESULTS:** Seventy-five percent of participants were female. Mean MVPA was 113.3 ± 64.9 min/day and average step counts were 8832 ± 2917 steps/day. Extraversion, Agreeableness, and Conscientiousness were associated with more MVPA ($r_s = .35, .36, \text{ and } .28$, respectively) and more steps per day ($r_s = .25, .36, \text{ and } .24$); Neuroticism was associated with fewer steps ($r = -.26$). **CONCLUSION:** These findings are consistent with self-report evidence that personality traits are associated with PA levels in older adults.

C-49 Free Communication/Poster - Physical Activity Assessment in Youth

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1658 Board #333 June 1 8:00 AM - 9:30 AM
Comparison of Self-Reported Physical Activity with Objectively Measured Physical Activity in Undergraduate Students

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 (No relationships reported)

The short-form of the International Physical Activity Questionnaire (IPAQ) is widely used to assess physical activity (PA), however, research suggests the validity of the IPAQ is inconsistent across studies.

PURPOSE: To investigate differences between estimates of sedentary behavior and PA from the IPAQ and accelerometry in undergraduate students.

METHODS: 56 students (mean \pm SD: age 20.6 ± 1.4 y; BMI 24.4 ± 3.6 kg/m²; and VO_{2peak} 45.7 ± 7.7 mL/kg/min) participated in the study. Step counts and time spent in sedentary behavior, light, moderate, and vigorous PA were measured by an Actigraph GT3X+ for 7 days during waking hours. Following accelerometer wear, students self-reported their time spent sitting and in PA with the IPAQ. Partial correlations were used to assess associations among time spent sitting and in PA between the IPAQ and accelerometer while controlling for age, sex, and accelerometer wear time. The agreement between methods was assessed via Bland-Altman plots using 95% limits of agreement. The ability of the IPAQ to correctly classify students as meeting the PA guidelines was analyzed with McNemar's test.

RESULTS: IPAQ sitting time was associated with accelerometer sedentary time ($r=0.38, p<0.01$). IPAQ walking time was associated with accelerometer light PA ($r=0.33, p=0.02$) but not step counts ($r=0.20, p=0.16$). Although IPAQ moderate ($r=0.34, p=0.02$) and vigorous PA ($r=0.47, p<0.01$) were associated with accelerometer values, minutes spent in moderate-to-vigorous PA were underestimated by the IPAQ (409.1 ± 50.1 vs. 520.4 ± 29.6 min/week, respectively). Bland-Altman plots revealed acceptable agreement between methods. However, bias was evident for all PA intensities, with students tending to under-report moderate and over-report vigorous PA. Proportional bias existed for vigorous PA, indicating as the amount of vigorous PA increased, so did the error between methods. The IPAQ indicated that 71% of participants met PA guidelines compared with 55% for the accelerometer ($p=0.09$).

CONCLUSIONS: Researchers should exercise caution when interpreting PA assessed via the IPAQ in undergraduate students. Although correlations appear acceptable, significant bias may be present. However, the IPAQ may be a viable tool for assessing whether students meet current PA guidelines.
Funded by NIH 1U54GM104944

1659 Board #334 June 1 8:00 AM - 9:30 AM

Examining Fifth-Grade In-School Physical Activity Patterns: How Many Days of Monitoring Are Needed?

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(No relationships reported)

PURPOSE: The purpose of the study was to determine the minimum number of days necessary to estimate mean physical activity levels, as both moderate-to-vigorous physical activity (MVPA) and steps per day, in fifth-grade students using objective physical activity monitors across two semesters. **METHODS:** Activity patterns were assessed during two school semesters, spring ($N = 82$ boys & 84 girls) and fall ($N = 89$ boys & 91 girls), from 10-12 year old fifth-grade students in four Midwestern elementary schools. Data was collected using wrist worn activity trackers. The devices were administered by teachers at the start of each school day and collected at the end of each school day for two consecutive weeks. Monitors measured MVPA and steps per day. Demographic and anthropometric data were also recorded (age, height, weight). All data was uploaded to the monitor's manufacturer website and then collected by the researchers. Steps and MVPA were examined, individually, with Cronbach's alpha to determine how many days of measurement were needed to assess mean activity patterns. **RESULTS:** The reliability analysis suggested that at least four days of measurement were needed to achieve an alpha of 0.80 for both steps ($\alpha = 0.825, 95\% \text{ CI } [0.777-0.865]$) and MVPA ($\alpha = 0.839, 95\% \text{ CI } [0.795-0.87]$) during spring collection. During the fall semester, at least four days were also necessary to achieve a reliability of 0.80 in steps ($\alpha = 0.803, 95\% \text{ CI } [0.751-0.846]$) and MVPA ($\alpha = 0.811, 95\% \text{ CI } [0.761-0.852]$). However, fall five-day activity patterns did exhibit greater variability than four-day activity patterns in both steps ($\alpha = 0.784, 95\% \text{ CI } [0.730-0.830]$) and MVPA ($\alpha = 0.794, 95\% \text{ CI } [0.742-0.838]$). **CONCLUSIONS:** These results indicate that four-day activity monitoring protocols most accurately estimate the mean in-school physical activity patterns, steps and MVPA, in fifth grades students. It should be noted that the results indicate consistency was not improved by a fifth day of measurement in steps and MVPA during a five-day collection period.

1660 Board #335 June 1 8:00 AM - 9:30 AM

Accuracy of Smartwatches in Assessing College Students' Energy Expenditure in Exercise with Different Intensities

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(No relationships reported)

PURPOSE: Despite the recent prevalence of health wearable devices (e.g., smartwatches), the validity and reliability of smartwatches' physiological outcomes remain largely unexplored. This study was designed to examine the accuracy of the Microsoft Band (MS), Fitbit Surge HR (FB), TomTom Cardio Watch (TT) and Apple Watch (AW) in assessing energy expenditure (EE) during three exercise sessions with different intensities.

METHODS: Participants were 25 college students (12 males; $M_{age} = 23.52, SD = \pm 1.04$) from Southcenter region in China. They completed three separate 10-minute exercise sessions at light physical activity (LPA, walking at 3.0 km/h), moderate PA (MPA, running at 5.0 km/h), and vigorous PA (VPA, running at 7.0 km/h) conditions on the Hpcosmos treadmill at a highly controlled laboratory. In this study, the AW and TT were placed on the right wrist while the FB and MS were worn on the left wrist. All demographic information (i.e., height, weight, age, gender) was loaded onto each smartwatch prior to testing. EEs of smartwatches were then validated against EE data from a Actigraph wGT3X accelerometer worn on the right side of waist.

RESULTS: ANOVAs with repeated measures revealed significant differences between smartwatches for EE, $F(9, 16)=45.73, p<0.01, \eta^2=0.98$. When validated against accelerometer, post-hoc comparisons suggested significantly different EE assessments for the FB at LPA and MPA conditions ($p<0.01$), and for MS and FB at the VPA ($p<0.01$). Interclass correlations between the accelerometer and smartwatches revealed reliability for EE for the TT at LPA ($r=0.65, p<0.01$), for the FB, TT and AW at MPA ($r=0.53-0.59, p<0.01$), and for MS, FB and TT at VPA ($r=0.59-0.65, p<0.01$). However, only the TT demonstrated excellent agreement with the accelerometer at LPA with coefficient of variation of 2.0%. Additionally, Bland-Altman plots yielded satisfactory precision/no bias for FB and TT measurements against the accelerometers at all conditions ($p<0.05$), for MS at LPA and VPA ($p<0.05$), and for AW at VPA ($p<0.05$).

CONCLUSIONS: Findings suggested EE measurements of smartwatches are far from ideal in terms of validity and reliability. In this study the most valid and reliable measurements were from the TT. Future study may investigate the validity and reliability of smartwatch measurements in everyday life.

1661 Board #336 June 1 8:00 AM - 9:30 AM

Relationships of Objectively Measured Parent-Child Physical Activity and Sedentary Behavior in Toddlers

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(No relationships reported)

Parents play an important role in shaping their children's lifestyle behaviors, particularly in early childhood. However, there is a lack of evidence about whether there are associations between parents' and toddlers' objectively measured physical activity (PA) and sedentary behavior (SB). **PURPOSE:** To determine the relationships between parent-child PA and SB. **METHODS:** This study was a cross-sectional study of 24 toddlers (2.2 ± 0.5 yrs; 12 boys and 12 girls) and their mothers (33.4 ± 4.5 yrs) and fathers (34.7 ± 6.2 yrs) in Kyoto, Japan. All participants wore an accelerometer on their waist for seven days except for during water activities and while sleeping (including naps). We measured toddlers' PA and SB as well as parents' SB, light intensity physical activity (LPA), and moderate-to-vigorous intensity physical activity (MVPA), and calculated the proportions of the total accelerometer wear time for each (%PA, %SB, %LPA, and %MVPA). Partial correlations that adjusted for toddlers' sex, age, childcare situation, mothers' work situation, and household income were used to analyze the associations between toddlers' and parents' physical activity variables. **RESULTS:** Toddlers' %PA was moderately associated with mothers' %SB ($r = -0.58, p = 0.009$), %LPA ($r = 0.55, p = 0.014$) and %MVPA ($r = 0.51, p = 0.026$) on weekdays, as well as with mothers' %SB ($r = -0.54, p = 0.017$) and %LPA ($r = 0.55, p = 0.014$) on weekends. However, no significant associations were observed between toddlers' %PA and fathers' %SB ($r = -0.12$), %LPA ($r = 0.04$) and %MVPA ($r = 0.25, p = 0.293$) on weekdays, as well as with fathers' %SB ($r = -0.05$), %LPA ($r = 0.13$), %MVPA ($r = -0.24, p = 0.323$) and mothers' %MVPA ($r = 0.01$) on weekends. **CONCLUSION:** These results suggest that mothers' PA and SB, but not fathers', correlates with their children's PA in early childhood. Supported by JSPS KAKENHI Grant Number 15K21576.

1662 Board #337 June 1 8:00 AM - 9:30 AM

Accuracy of Accelerometer-based Activity Energy Expenditure Prediction Equations for Children ages 3 to 6 years

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(No relationships reported)

Accelerometers have been widely used to measure activity energy expenditure (AEE) in free-living environments for young children. However, little research has examined the accuracy of accelerometer-based AEE prediction equations in preschool age children.

Purpose: To compare the estimates of AEE from accelerometer-based prediction equations with AEE measured by indirect calorimetry in 3-6-year-old children.

Methods: A total of 28 preschool age children (Female: 46%, Age: 4.6 ± 1.0 yrs, BMI: 16.4 ± 1.5 kg/m²) wore a portable indirect calorimetry, Oxycan Mobile (OM), and an

ActiGraph GT3X+ accelerometer (AG) on their right hip simultaneously while they were participating in variety of activities of daily living. The activity protocol was 33 minutes in total, and consisted of watching TV while laying/sitting, playing with toys, walking/exploring, soccer/running and basketball/throwing. Breath-by-breath measures from OM were averaged into minute-by-minute VO_2 ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) and AEE ($\text{kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). Additionally, accelerometer-based VO_2 and AEE were estimated using Pate's (PT) and Puyau's (PY) equations, respectively. The accuracy of each equation was examined against AEE and VO_2 measures from OM using Pearson correlations, dependent t-tests and mean absolute percent error (MAPE).

Results: Overall, the estimates of AEE and VO_2 from accelerometer-based equations were highly correlated with those from OM (VO_2 : $r = 0.78, p < .05$, AEE: $r = 0.80, p < .05$). When compared with measures from OM, the PT and PY equations significantly underestimated VO_2 (mean difference (MD) = $-1.93 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}, p < .05$) and AEE (MD = $-0.04 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}, p < .05$) respectively. The overall MAPEs were 9.2% for PT and 52.1% for PY. For moderate-to-vigorous physical activity (MVPA), the correlations were moderate for the PT and PY equations (VO_2 : $r = 0.54, p < .05$, AEE: $r = 0.58, p < .05$). The PT and PY equations underestimated VO_2 (MD = $-4.75 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}, p < .05$) and AEE (MD = $-0.07 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}, p < .05$) for MVPA respectively.

Conclusions: Relatively high correlations support the validity of accelerometer-based AEE prediction equations. However, researchers should be aware that accelerometer based prediction equations may underestimate AEE and VO_2 , especially for MVPA in 3-6-year-old children.

1663 Board #338 June 1 8:00 AM - 9:30 AM

Estimating Physical Activity Intensity in Youth With Accelerometers: A Flexible Suite of Tools

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(No relationships reported)

Using accelerometers to assess physical activity (PA) behavior in youth populations is challenging, in part because bouts of youth PA tend to be erratic. As new accelerometry methods emerge, they are often difficult to compare, due to differences in the intended wear location and data format. **PURPOSE:** This study developed and validated a youth-specific suite of methods based conceptually on the bout-identifying Sojourn method. The study's aim was to estimate PA behavior from hip- or wrist-worn accelerometers, with either activity counts (AC) or raw acceleration (RA) as the output. **METHODS:** Data from a previous study were used to train artificial neural networks (ANNs) to predict activity intensity (sedentary, light, or moderate-to-vigorous PA (MVPA)) for the different pairings of attachment sites and device outputs using indirect calorimetry as the criterion measure. The ANNs were invoked and combined with decision trees and bout-identification code (adapted from the Sojourn method) to generate estimates of PA intensity. An independent validation in free-living was then performed with 27 participants who performed self-selected activities for one hour. Direct observation served as the criterion for time spent in each activity intensity. Percent accuracy, kappa statistics, sensitivity, and specificity were calculated to assess the validity of each method. **RESULTS:** In the initial validation, the new methods achieved a mean accuracy of 67.9% ($\kappa = 0.39$) for the hip and 59.5% ($\kappa = 0.28$) for the wrist, and accuracy was higher for the AC methods (Hip AC: 71.7%; Wrist AC: 65.1%) compared to the RA methods (Hip RA: 64.0%; Wrist RA: 53.9%). Results for the free-living validation are shown in the table. **CONCLUSION:** The new suite of methods provides several options to effectively assess MVPA behavior in youth, with evident limitations when using RA from wrist-worn devices, and uniform limitations for estimating lower intensities.

Method	% Accuracy	Kappa	Sensitivity	Specificity	
Hip AC	71.70%	0.44	Sedentary	0.75	0.95
			Light	0.49	0.80
			MVPA	0.78	0.75
Wrist AC	65.10%	0.32	Sedentary	0.67	0.90
			Light	0.28	0.84
			MVPA	0.81	0.62
Hip RA	64.00%	0.34	Sedentary	0.72	0.87
			Light	0.36	0.81
			MVPA	0.75	0.71
Wrist RA	53.90%	0.24	Sedentary	0.50	0.93
			Light	0.58	0.57
			MVPA	0.53	0.78

1664 Board #339 June 1 8:00 AM - 9:30 AM

Not All Physical Activity Guidelines Are Created Equal: A Comparison Of Compliance In Preschool Children

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Insufficient physical activity (PA) is one factor that has been shown to contribute to overweight and obesity. Increasing PA has been advised as a strategy for the treatment and prevention of obesity. Multiple PA recommendations have been established for preschool-age children. These recommendations are highly variable and differ in intensity and duration. Within the last few years, new guidelines have been issued from independent expert panels in the United States, Australia, and United Kingdom: Guideline A) $\geq 15 \text{ min/hr}$ of total PA (TPA) every day and Guideline B) $\geq 180 \text{ min/day}$ (or $\geq 3 \text{ hr/day}$) of TPA every day. **PURPOSE:** The purpose of this study was to compare compliance between Guidelines A and B in a cross-sectional sample of preschool children. **METHODS:** PA was assessed for 7 days in 241 preschool-age children via accelerometer (ActiGraph GT3X+). A total of 197 children (4±1 yrs.; 100 boys, 97 girls) met PA wear time standards and were utilized for data analysis using age appropriate cut-points. The main outcome of interest was TPA (sum of light, moderate, and vigorous intensity PA). TPA was used to determine the number of subjects meeting Guidelines A and B. Differences in the frequency of preschool children meeting Guidelines A and B were compared via chi-square with statistical significance set at $p \leq 0.05$. Data are presented as mean ± SD. **RESULTS:** Descriptive characteristics of the subjects are as follows; height: $103.69 \pm 6.54 \text{ cm}$, weight: $17.27 \pm 2.68 \text{ kg}$, BMI percentile: 57.25 ± 27.65 . Mean TPA was $11.76 \pm 2.84 \text{ min/hr}$ and $164.5 \pm 39.79 \text{ min/day}$. A greater number of children met Guideline B ($n=71$; 36%) than Guideline A ($n=23$; 11%), $p < 0.001$. None of the subjects met Guideline A during all waking hours every day. On average, subjects met Guideline A 4 hr/day. Only $n=10$; 5% of subjects met Guideline B every day. **CONCLUSION:** There is a high degree of variability between the frequency of subjects meeting Guidelines A and B. Considering that on average, subjects met Guideline A only 4 hours/day showcases that children are engaging in long bouts of activity as well as long bouts of sedentary time throughout the day. A majority of children are not meeting these new guidelines and further efforts aimed at increasing PA among preschool-age children should focus on breaking-up long sedentary bouts with activity.

1665 Board #340 June 1 8:00 AM - 9:30 AM

International Physical Activity Questionnaire (IPAQ-SF) for Chinese College Students: A Validation Study

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Purpose: To validate the International Physical Activity Questionnaire-Short Form (IPAQ-SF) for Chinese college students using health-related fitness tests. **Methods:** 2513 (1698 males & 815 females; Aged $18.8 \pm 0.8 \text{ yr}$; Height = $170.1 \pm 7.8 \text{ cm}$; Weight = $63.1 \pm 11.3 \text{ kg}$; BMI = 21.6 ± 2.7) college students from a Chinese university were assessed using both IPAQ-SF and a set of physical fitness tests, including vital capacity (VC), step test, standing long jump (SLJ), and 50-M dash for everyone, sit-ups and 800-M run/walk for female students, push-ups and 1000-M for male students. Total, vigorous, moderate and walking MET-hours per week were derived from IPAQ-SF first and then correlated with physical fitness test scores. **Results:** Descriptive statistics of IPAQ-SF and fitness tests were summarized as below:

	Total-METs	Vigorous-METs	Moderate-METs	Walking-METs	BMI	VC	Step Test	SLJ	Pull ups	Sit ups	50-M dash(s)	800-M (s)	1000-M (s)
Mean	1407.0	627.2	566.8	213.0	21.6	3727.4	217.5	217.5	10.3	45.4	7.4	240.8	242.4
SD	807.2	571.2	422.3	269.0	2.7	815.6	32.3	32.3	7.4	7.1	0.8	24.1	23.7

The correlations between the IPAQ-SF and the fitness tests were summarized as below:

	BMI	VC	Step test	SLJ	Pull-ups	50-M dash	800-M	1000-M
Vigorous-METs	.239**	.294**	.258**	.247**	.043**	0.017	-.258**	-.091*
Moderate-METs	.121**	.185**	.096**	.081**	0.023	0.023	-.108**	0.035
Walking-METs	.113**	.122**	0.036	0.014	-0.028	-0.02	-.045**	0.022
Total-METs	.270**	.346**	.245**	.228**	.033*	0.023	-.254**	-0.033

* $p < 0.05$, ** $p < 0.01$

Conclusion: Consistent with the findings of other validation studies, only low correlations between physical activity time measured by IPAQ-SF and physical fitness were found, which provide some validity evidences to support the Chinese version of IPAQ-SF.

THURSDAY, JUNE 1, 2017

1666 Board #341 June 1 8:00 AM - 9:30 AM

Effect of Wearing a Portable Metabolic Unit on Children's Physical Activity Level and Enjoyment

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(No relationships reported)

Researchers use portable metabolic units (PMUs) to assess the physical expenditure of children in free-living settings, with the assumption that physical activity level and participation are not affected due to the PMU's light weight and small size. However, any effect would potentially impact research on energy expenditure, monitor validation, or activity enjoyment or prescription. **PURPOSE:** The purpose of this study was to assess differences in accelerometer-derived activity level and enjoyment while wearing a PMU versus not wearing the PMU during a variety of common children's games (e.g., tag).

METHODS: Youth (N=26; 8-12 y; 15 males, 8 overweight) played a combination of 29 games (mean 4.8 min each) while 1) wearing and 2) not wearing a PMU. During both conditions, children wore a triaxial accelerometer on their right hip to determine total vertical axis counts and counts/min, steps, and vector magnitude counts. After every game, participants responded to questions about their enjoyment on a 9-item facial affective scale. Because children participated in different numbers of games, each child's data for each condition were averaged across all games played. Paired t-tests determined if activity level and enjoyment were different while wearing the PMU.

RESULTS: The PMU weighed 1.2-1.3 kg depending on whether the small or large backpack size was worn. The average relative weight of the PMU was 3.5% of the participant's weight. When comparing wearing the PMU to not wearing the PMU, enjoyment (7.2 ± 1.7 vs. 7.4 ± 1.5 ; $p=0.369$), counts (14124 ± 3527 vs. 14911 ± 3902 ; $p=0.329$), counts/min (2932 ± 749 vs. 3107 ± 843 , $p=0.311$), steps (295 ± 70 vs. 302 ± 71 , $p=0.526$), and vector magnitude (23309 ± 4318 vs. 24188 ± 4949 , $p=0.371$) were lower, but not significantly different.

CONCLUSIONS: In this sample, wearing the PMU did not affect accelerometer-derived activity level or enjoyment, but more research is justified because of the small sample size. Additionally, future research should examine if the effect of the PMU varies by physical activity intensity. Different age groups should also be explored, since the effect may be more noticeable in younger populations, for which the relative weight of the PMU is greater.

1667 Board #342 June 1 8:00 AM - 9:30 AM

Comparison Of Hip And Wrist Accelerometers In Pre-adolescents During Free-living And Semi-structured Physical Activity

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(No relationships reported)

The dose-response relationship between physical activity (PA) and health is not well understood. The development of accelerometer-based motion sensors make it possible to objectively measure several dimensions of PA in free-living contexts. These devices have traditionally been worn on the hip, however there has been a recent trend to place these monitors on the wrist. **PURPOSE:** 1) To examine the accuracy of a hip (Evenson algorithm) and wrist-worn (Crouter algorithm) accelerometer for categorizing PA intensity in pre-adolescent girls during dance classes using direct observation (D.O.) as the criterion measure. 2) To compare the validity of the hip and wrist-worn accelerometer algorithms for classifying girls as meeting or not meeting PA guidelines. **METHODS:** For aim 1, participants (N = 6; Age = 10.22 ± 2.38) were video recorded while wearing hip and wrist accelerometers during a dance class. Data was analyzed using the Kruskal-Wallis Test. For aim 2, participants (N = 20; Age = 8.6 ± 1.6) wore a hip and wrist accelerometer concurrently for seven consecutive days. Fisher Exact Test was used to compare similarity between wrist and hip accelerometry data. **RESULTS:** For aim 1, compared to D.O., the wrist-worn accelerometer was inaccurate in measuring time spent in light PA (D.O. = 44.77 ± 6.82 ; wrist = 5.27 ± 4.98), vigorous PA (D.O. = 0.50 ± 1.01 ; wrist = 27.65 ± 22.87) and MVPA (D.O. = 6.59 ± 5.34 ; wrist = 44.14 ± 7.57). The hip-worn accelerometer was inaccurate in measuring time spent in sedentary time (D.O. = 1.39 ± 2.18 ; hip = 12.38 ± 8.25), light PA (D.O. = 44.77 ± 6.82 ; hip = 30.23 ± 5.47), vigorous PA (D.O. = 0.50 ± 1.01 ; hip = 4.05 ± 3.56) and total PA (D.O. = 51.36 ± 2.19 ; hip = 40.46 ± 8.25). For aim 2, there was no location differences for meeting PA guidelines for 1-2 days. However, there was a significant difference for 3-4 days (OR = 7.01) and ≥ 5 days (OR = 7.01). **CONCLUSION:** Both the hip and wrist-worn accelerometer algorithms provided poor classification accuracy for PA during dance class. Relative to the hip-worn accelerometer, the wrist-worn accelerometer was more likely to classify girls as meeting guidelines for PA. Future research should move away from cut-point methods and use pattern recognition algorithms that leverage the rich data available in the acceleration signal.

ACSM May 30 – June 3, 2017

1668 Board #343 June 1 8:00 AM - 9:30 AM

Comparison Of Accelerometer And Pedometer Measured Physical Activity In Rural Elementary Schools.

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(No relationships reported)

Schools are an ideal setting for physical activity (PA) promotion efforts. Objective methods to monitor moderate-to-vigorous PA (MVPA) have emphasized accelerometers, which can be cost prohibitive. To monitor the success of promotion efforts, schools need access to low-cost, valid and reliable tools. Using pedometers to count accumulated steps above 120 steps/min has been suggested as an alternative MVPA measure.

PURPOSE: To determine if using the 120 steps/min threshold with pedometers to measure children's MVPA at school provides equivalent MVPA estimates compared to research-grade accelerometers.

METHODS: Children (n=316, 52.8% boys) from six rural elementary schools (grades 1, 3, and 5) had their PA monitored at school over 4 consecutive days. Two PA monitors were placed on an elastic belt and positioned over each child's right hip. Pedometer data were downloaded daily and accelerometer data were processed using the Evenson cutpoints in 15 s epochs. MVPA estimates from the monitors were compared with: 1) t-tests, 2) Pearson correlations, and 3) Bland-Altman plots.

RESULTS: Pedometers measured ($M \pm SD$) 17.5 ± 6.4 min of MVPA during the school day, while accelerometers measured 24.0 ± 9.0 min of MVPA ($p < 0.001$; Table 1). The correlation between pedometer- and accelerometer-determined MVPA was 0.64. Correlations for boys and girls were 0.63 and 0.67, respectively. Grade-level correlations ranged from 0.54 to 0.66. Bland-Altman plots indicated the limits of agreement ranged from -7.4 to 23.5 min of MVPA.

CONCLUSION: Although pedometer-determined MVPA was moderately correlated with accelerometer-determined MVPA, the two measures do not appear to be equivalent. Further research should explore the potential to correct this discrepancy between devices.

Table 1. School-based MVPA Minutes

Variables	Pedometer	Accelerometer
Sex		
Boys	18.3 \pm 6.9*	26.7 \pm 9.5
Girls	16.6 \pm 5.6*	20.9 \pm 7.2
Grade		
1 st	17.8 \pm 5.8*	24.6 \pm 9.2
3 rd	19.7 \pm 5.9*	26.6 \pm 8.2
5 th	15.1 \pm 6.6*	20.9 \pm 8.6

Note. Values presented as $M \pm SD$. * $p < 0.001$.

Supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, grant award number 2011-68001-30020.

1669 Board #344 June 1 8:00 AM - 9:30 AM

Intensity of Commonly Reported Classroom-Based Physical Activity Opportunities in Public Schools

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PURPOSE: The purpose of this study was to examine and determine the intensity levels of classroom-based physical activity (CBPA) opportunities offered in public school classrooms. **METHODS:** Colorado schools (N = 101) in school districts (N = 25) receiving funding from the Kaiser Permanente Thriving Schools initiative reported CBPA opportunities using an online data collection tool over a two-year period (2014-2016). Using a randomized stratified sampling technique, 20-30% of pre-kindergarten through 12th grade teachers in each school were selected each week to report CBPA. Data collected included the type of CBPA opportunity offered, the number of students in the classroom, and the students' grade level. These responses resulted in N = 18,445 possible CBPA opportunities, which were cleaned to exclude responses indicating that no CBPA could take place (e.g., snow day) for a total of N = 18,210 usable responses. A researcher qualitatively determined the intensity of CBPA opportunities using the 2011 Compendium of Physical Activities as a guideline; two additional researchers confirmed the coded categories. A descriptive analysis of CBPA opportunities was conducted to describe the proportion of opportunities whose intensity levels were light (LPA), moderate (MPA), vigorous (VPA), sedentary (SED), and those of

Denver, Colorado

unknown intensity. Chi-square analyses were utilized to examine differences between proportions of intensity levels offered by semester. Kruskal-Wallis tests were utilized to examine differences in proportion of CBPA intensity offered by grade level. **RESULTS:** Most CBPA opportunities were MPA (58.7%), followed by VPA (17.6%) and LPA (11.5%). Few responses were SED (0.5%), and 11.6% were of indeterminate intensity. There was a significant difference in the intensity of CBPA opportunities by semester, with a greater proportion of more physically intense activities reported during the fall versus spring semesters ($p < 0.0001$). There was also a significant difference in the intensity levels of CBPA offered by grade, with a general trend of decreasing intensity as grade level increased ($p < 0.0001$). **CONCLUSIONS:** This study provides insight into the physical activity actually occurring in classrooms; however, additional research should be conducted on the CBPA opportunities offered in public schools.

1670 Board #345 June 1 8:00 AM - 9:30 AM
The Impact Of Epoch Length On Intensity Of Physical Activity Among Fourth Grade Children

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Purpose: Research examining the impact of epoch length and cut point (CP) selection on estimates of physical activity (PA) is limited to preschool children. This study fills a void by examining the influence of epoch length on estimates of time spent in sedentary, light PA (LPA), and MVPA across different published CP for elementary school children.

Methods: Participants were 265 4th graders ($M_{age} = 9.4$ years; 52% female) from 3 elementary schools in the control condition of the Texas I-CAN! project. Students wore accelerometers over one school week. Data were collected in 5 sec epochs and reintegrated into 10s, 15s, 30s, and 60s epochs. Five children's CP (Freedson, Evenson, Mattocks, Puyau, Pulsford) classified PA intensity. One-way, RM ANOVAs explored impact of epoch length on PA estimates across CP.

Results: Epoch length significantly impacted estimates of time spent in each category of PA. These differences held across each CP used. For sedentary behavior, *Post hoc* Bonferroni tests showed that all epoch lengths differed from each other within all CP ($p < .001$), except Puyau between 15s and 60s ($p = 1.0$; $d < .01$ to $d = 1.51$). For LPA, *post hoc* Bonferroni tests showed that all epoch lengths differed from each other within all CP ($p < .001$), except Puyau between 30s and 60s ($p = .41$; $d = .01$ to $d = 1.13$). For MVPA, *post hoc* Bonferroni tests showed that all epoch lengths differed from each other ($p < .001$; $d = .09$ to $d = 1.17$). Longer epoch length was associated with less time in sedentary and more time in LPA for all CP. Longer epoch length was related to less time spent in MVPA for all CP except Freedson, which led to greater time spent in MVPA. This resulted in differences in the proportion of children classified as meeting recommendations for daily PA (60 min of MVPA). No children met daily PA recommendations, except when Freedson CPs were used. With Freedson CP, longer epoch lengths resulted in larger percentages of children meeting daily PA recommendations (75.8% at 5s to 87.5% at 60s).

Conclusion: Epoch length and CP selection exert substantial influence on estimates of PA intensity among children. Since results from school-based, PA intervention inform public health and policy decisions, future research should use a criterion reference to determine which epoch length and CP combination provides the most accurate representation.

1671 Board #346 June 1 8:00 AM - 9:30 AM
Validity of a Sedentary Behavior Guideline for Youth

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Sedentary behavior (SB) has been identified as an independent risk factor for many health outcomes such as metabolism, cardiovascular and obesity. The Canada research group provided SB guideline that is no more than 2 hours of SB per day. The SB guideline also indicated lower levels of SB are associated with higher level of fitness. Little is known about the validity of the SB guideline.

PURPOSE: The purpose of this study is to examine the validity of Canada sedentary behavior guideline for Youth.

METHODS: Data from NHANES National Youth Fitness Survey (NNYFS) 2012 were analyzed for this study. A total of 432 participants (221 males) aged 12-15 years completed the survey and a physical fitness examination. The NNYFS questionnaire included two questions regarding recreational SB; in the past 30 days how many hours of TV or videos were watched and how many hours of computer use. Recreation SB was categorized in two levels: (1) 2 hours and less per day; (2) more than 2 hours per day. Health related fitness consisted of body composition, muscular strength and

cardiorespiratory fitness. Body composition was measured by BMI, muscular strength was measured by plank, and cardiorespiratory was measured by VO₂max in NNYFS examination. To validate SB guideline, the general linear model was used to examine the association between the recreational SB and health related fitness after controlling the covariates (i.e., age, gender, and physical activity).

RESULTS: After adjusting the covariates, recreational SB was related to plank, $F(1, 427) = 4.14, p = .043$. Recreational SB, however, was not related to VO₂max and BMI, $F(1, 427) = 1.62, p = .20$ and $F(1, 427) = 0.67, p = .413$, respectively.

CONCLUSIONS: Recreational SB was only associated with muscular strength. The lack of validity for the SB guideline may be due to surrogate measure of SB used in the current study. Further validity research is needed using more accurate measures of SB.

1672 Board #347 June 1 8:00 AM - 9:30 AM
Testing of a Novel Direct Observation Method for Children's Free Play Activity

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 (No relationships reported)

PURPOSE: Direct Observation (DO) has been used as a criterion measure of children's physical activity (PA) since the early 1990's. A limitation of these DO systems include researchers instantaneously recording only the highest activity level performed in a given time interval. Therefore, the purpose of this study is to compare the estimates of time spent in activity intensity categories using a novel video recorded DO methodology, compared to accelerometer data.

METHODS: Children ages 6-10 years old participated in a simulated free play session. Toys, equipment, and a sibling or friend were available to facilitate a full range of activity intensities; sedentary (SED), light (LPA), moderate (MPA), and vigorous (VPA) for 30 minutes. Participants wore an ActiGraph GT3X+ (AG) over their right hip (AG-H) and non-dominant wrist (AG-W). The sessions were recorded with a GoPro™ video camera and, using Noldus™ behavioral observation software, an activity intensity category was assigned each time the child changed their activity. Two observers independently coded every 30-minute session. The percent of time spent in each PA category (calculated from the Noldus software) was compared between AG and DO using Spearman-Rank Correlations and Wilcoxon Rank-Sum Tests.

RESULTS: Twelve children completed this study (8.9±1.2 yrs; 33% female). DO and AG-H were moderately correlated for all intensity categories ($r=0.32$ to 0.7), except for MPA ($r=0.15$). Mean values of percent of time spent in activity intensity categories were similar between DO and AG-H ($p = 0.11$ to 0.83), except for MPA (DO 12%±5%, AG-H 18%±8%, $p=0.02$). DO and AG-W showed weak or negative associates for all intensity categories ($r=-0.6$ to 0.09). The AG-W underestimated percent of time spent in SED, LPA, and MPA ($p<0.001$ for all) but overestimated VPA (DO 13%±5%, AG-W 81%±10%, $p=0.0001$), compared to DO.

CONCLUSIONS: Based on these results, the novel DO system tested here is promising but needs to be further refined to better distinguish moderate intensity activities from light or vigorous movement. Caution is warranted when interpreting wrist accelerometer data from free-living children.

C-50 Free Communication/Poster - Sports Biomechanics

Thursday, June 1, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

1673 Board #348 June 1 9:00 AM - 10:30 AM
Rotational Head Acceleration of Thrown Person with Break-fall skills by Judo Throwing Techniques

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PURPOSE: Although the judo is an official Olympic event that played worldwide, serious head injuries, especially acute subdural hematomas (ASDHs) have occasionally occurred during judo competition or practice in Japan. Rotational head acceleration (RHA) at the head impact is considered as a major factor influencing the mechanisms for head injuries. On the other hand, the break-fall technique called "ukemi" has been developed in judo to prevent head collision against the judo-floor (mat) and to minimize its damages. However, the RHA-decreasing effect of ukemi on thrown

person has not been fully understood. The purpose of this study was to evaluate RHAs of a thrown judo expert and to compare them with the values previously obtained by an anthropomorphic test device (ATD) experiment without ukemi.

METHODS: One male judo expert (thrower) repeatedly threw another male judo expert (faller) for 4 times with Osoto-gari (Osoto) and with Uchi-gari (Uuchi) techniques respectively, because most ASDHs in judo have occurred with these two throwing techniques. The faller took ukemi adequately without head collision against mat in all trials. A 3-axis angular rate sensor was mounted on the center of the faller's forehead and the angular velocities of the head were measured. In order to evaluate the magnitude of faller's impact of the head, we calculated the RHA from the angular velocities. Kinematic data of the faller's head were also recorded during trials using digital video cameras. The RHAs of ATD thrown by the same judo expert were obtained from our previous study (Murayama et al., 2013).

RESULTS: Kinematic data showed that the faller fell backwards without any head collisions against the mat in both throwing techniques. In all trials, a large acceleration appeared at the body contact phase to the mat. The peak resultants RHAs of faller (Osoto, 740.7 ± 139.2 rad/s²; Uuchi, 581.5 ± 69.5 rad/s²) were significantly lower than those observed in ATD (Osoto, $4,572.6 \pm 357.4$ rad/s²; Uuchi, 2176.0 ± 826.6 rad/s², $p < 0.05$ in both techniques).

CONCLUSIONS: These results suggested that an acquisition of adequate ukemi technique could substantially reduce the RHA on head impact and the risk of severe head injuries in judo.

1674 Board #349 June 1 9:00 AM - 10:30 AM
Influence Of Proprioceptive Intervention On Joint Configuration During Sprint Starts In Elite Collegiate Sprinters

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 (No relationships reported)

Purpose: An effective block clearance (BC) is crucial to the success of competitive sprinters. To have success a sprinter must exert an impulse to change his/her momentum while also staying low to the ground, in order to maximize the amount of forward force. The purpose of this experiment was to investigate the influence of proprioceptive priming on the kinetics and kinematics of the sprint start. **Methods:** Three female (age: 20yrs±1.73, height: 1.64m±.07, weight: 58.78kg±9.11) and three male collegiate sprinters (age: 23yrs±3.464, height: 1.84m±.08, weight: 75.3kg±4.46) participated in the study. Participants performed two baseline (BL) trials and two proprioceptive (PR) trials involving a resistance band. Participants were fitted with a full body 55-marker set, 3D kinematics were recorded with a 12-camera motion capture system sampling at 250Hz. Kinetic analysis included assessments of Impulse, Angle of GRF (Sagittal plane), and Average Force. Kinematic analysis included stride rate (SR) and stride length (SL), ground time (GT) and air time (AT), peak toe height during swing phase of sprinting gait, and segment angles. Segment angles were measured for the rear lower leg (RLL) at ankle cross along with the RLL at take-off during the first two steps (S1AC, S1TO, S2AC, S2TO). **Results:** There were no significant changes in impulse or average force between interventions. There was, however, a significant difference between the force angle produced during proprioceptive ($51.7^\circ \pm 3.6$) and combination ($46.6^\circ \pm 8.6$) interventions ($p < 0.05$). Kinematic data were reported for BL and PR, respectively. As for S1, average peak toe height was $0.262 \text{ m} \pm .114$, and $0.241 \text{ m} \pm .054$. During S2, average peak toe height was $0.239 \pm .054 \text{ m}$, and $.232 \text{ m} \pm .057$. There was a significant decrease in peak toe height post-intervention for BC ($p < 0.05$). The RLL angle at S1AC were $63.88^\circ \pm 15.61$ and $70^\circ \pm 16.81$ along with $67.48^\circ \pm 10.29$ and $77.78^\circ \pm 13.28$ at S2AC. The angles for S1TO were $158.30^\circ \pm 4.30$ and $153.94^\circ \pm 4.61$ RLL. **Conclusion:** Proprioceptive training resulted in an improvement in ground time values during the sprint start and reduced peak toe height for all phases, but showed mixed results for air time. These results suggest that proprioceptive priming has the potential to improve sprint start mechanics and performance.

1675 Board #350 June 1 9:00 AM - 10:30 AM
Observing First Time Use Of The Backstroke Starting Device In Competitive Swimmers

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 (No relationships reported)

INTRODUCTION Since FINA's initial approval for use of the backstroke starting device (ledge) in competition, these devices are now readily available in the marketplace. However, the use of these devices in collegiate, high school, and age-group competitions has yet to be legislated or implemented. Most importantly, no data exist for novice or inexperienced swimmers from the perspective of racing

start safety. **PURPOSE** To determine whether or not maximum head depth (MHD), velocity at max head depth (V_{MHD}), distance at max head depth (D_{MHD}), and entry angle (E_{Angle}) attained when executing backstroke starts vary as a function of using the backstroke starting device in less experienced swimmers (i.e. novice backstroke starting device users). **METHODS** 26 swimmers (8 collegiate, age: 21.5 ± 1.2 yr and 18 high school, age: 16.2 ± 1.5 yr) were filmed in a water depth of 1.59 m performing two backstroke starts (1st trial no device; N_{DEV} 2nd trial with the device; W_{DEV}) in the sagittal plane at a sampling frequency of 120 Hz with cameras positioned at three points; 1m (above water), 1m (below water), and 3m (below water) from the starting end wall. Data for MHD, V_{MHD} , D_{MHD} , entry angle were tracked using Simi Reality Motion Systems software. Independent t-tests were used to compare between ability level and within each starting condition. Paired t-tests were used to compare between starting conditions within each ability level. **RESULTS** MHD, V_{MHD} , D_{MHD} , and entry angle were significantly ($p < 0.05$) greater in collegiate swimmers when compared to high school swimmers in both starting conditions (N_{DEV} : MHD; 1.14 ± 0.29 vs. 0.48 ± 0.17 m, V_{MHD} : 1.98 ± 0.75 vs. 1.04 ± 0.41 m·sec⁻¹, D_{MHD} : 5.14 ± 0.34 vs. 4.06 ± 0.50 m, E_{Angle} : $3.78 \pm 6.1^\circ$ vs. $30.7 \pm 6.4^\circ$ respectively, and W_{DEV} : MHD; 1.02 ± 0.18 vs. 0.53 ± 0.20 m, V_{MHD} : 1.63 ± 0.46 vs. 1.04 ± 0.38 m·sec⁻¹, D_{MHD} : 5.04 ± 0.31 vs. 4.28 ± 0.55 m, E_{Angle} : $9.9 \pm 10.2^\circ$ vs. $31.2 \pm 7.0^\circ$ College vs Novice respectively). Only E_{Angle} significantly ($p < 0.05$) increased in high school swimmers when using the backstroke starting device ($3.78 \pm 6.1^\circ$ vs. $9.9 \pm 10.2^\circ$). **CONCLUSION** It appears that the recently introduced backstroke device tested causes few changes in common parameters that allow stratification of risk for swimmers executing racing starts. This appears true for the expert as well as the novice swimmer.

1676 Board #351 June 1 9:00 AM - 10:30 AM
A Common Drill Exercise In A World Champion Breaststroker - Does It Offer What It Promises?

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Breaststroke swimmers at all levels perform the common drill exercise of two leg kicks to one arm pull at submaximal effort for improving competitive performance through optimizing the timing between the arms and legs.

PURPOSE: The aim of this study was to investigate whether this exercise can lead to a more beneficial timing and muscle activation patterns in a world champion when performed at different effort levels.

METHODS: Muscle activation of one male world champion (28 yrs, 24 BMI kg/m²) was collected during 25 m of normal breaststroke at maximal effort and during 25 m of two leg kicks to one arm pull at 60% (medium) and 80% (high) of maximal effort using electromyography. Electrodes were placed on triceps brachii, biceps brachii, trapezius, pectoralis major, gastrocnemius, tibialis anterior, biceps femoris and rectus femoris and sampled at 1000 Hz. The signals were amplitude normalized to the individual maximal voluntary contraction. Muscular on- and offset had a threshold level of 20% of the peak. Each stroke phase (leg propulsion, leg glide and leg recovery) was identified through 3D kinematics and was interpolated to 50 time points. Descriptive statistics were used for the average muscle activation and each phase equals 100%.

RESULTS: During leg glide, biceps brachii and pectoralis major activated 2% earlier in the exercise at high effort, but 8% later at medium effort compared to swimming at maximal effort. The exercise showed that biceps femoris was activated during the entire leg recovery at medium and high effort, but at normal swimming at maximal effort it was activated for the last 86%. Tibialis anterior activated 28% later during leg recovery for the exercise at medium and high effort compared to swimming at maximal effort. At high effort the exercise showed a longer activation for triceps brachii during leg propulsion (38%), compared to 6% at medium effort and 10% at swimming with maximal effort.

CONCLUSION: The exercise needs to be performed at high effort and not medium effort in order to practice an earlier timing between the arms and legs. The drill exercise at both effort levels are suitable to optimize the muscle activation during leg recovery, as the earlier activation in biceps femoris combined with the later activation in tibialis anterior can reduce the time spent in this non-propulsive high resistance phase.

1677 Board #352 June 1 9:00 AM - 10:30 AM
Bilateral Force Comparisons during a Demi-Plié Relevé Movement in Ballet Dance

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 (No relationships reported)

PURPOSE: Ballet dance is unique in that the physical performance must not interfere with the artistry of the movement, which makes bilateral balance in any ballet movement most important. Ballet dancers tend to favour one leg and ankle over another during different movements when the movements are supposed to be

completed as symmetrical as possible (Lin et al., 2014). The purpose of this study was to determine the changes in left/right ground reaction forces (GRF) during a Demi-Plié Relevé movement before and after training in beginner level ballet dance program. **METHODS:** Twenty-one college ballet students (2 males and 19 females; weight = 692.4 ± 125.5 N) performed three sets of eight Demi-Plié Relevé movements at the beginning (pre-test) and end (post-test) of a 15-week beginning ballet class. The participants trained in class for an average of 2.5 hours per week. Participants performed the Demi-Plié Relevé with each foot placed on a separate force platform (AMTI) to isolate GRFs associated with each foot. The peak vertical GRFs were analyzed for 16 of 24 movements. For each individual, an average peak difference was calculated between the left and right foot. The left/right peak vertical GRF differences were compared.

RESULTS: The average pretest difference was 72.1 ± 63.3 N, while the posttest difference was 37.9 ± 45.4 N. Pre-test differences ranged between 6.1 and 203.7 N, while post-test differences ranged between 0.4 and 82.2 N. A statistically significant difference between pre- and post-test was found ($t(20) = 2.44, p = 0.024$). There was a moderate effect size ($d\text{-value} = 0.53$).

CONCLUSION: Bilateral GRF differences in the pre-test accounted for 10% of body weight and were reduced to 5% in the post-test. It is noted that those subjects with small initial differences did not improve much, while those with large differences improved significantly. Results suggest that with proper instruction, ballet dancers can improve the symmetry of force production in a Demi-Plié Relevé movement.

1678 Board #353 June 1 9:00 AM - 10:30 AM
The Mechanomyographic Activity of the Upper Trapezius Muscle is Heterogeneous in Response to Eccentric Exercise

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 (No relationships reported)

The Mechanomyographic Activity of the Upper Trapezius Muscle is Heterogeneous in Response to Eccentric Exercise

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The mechanomyography (MMG) signal provides information on the intrinsic muscle mechanical activity. Heterogeneous MMG activity has been reported during endurance contraction but no studies have investigated the effects of high intensity eccentric exercise on the spatio-temporal MMG activity of the upper trapezius muscle.

PURPOSE: To investigate changes in spatio-temporal MMG activity of the upper trapezius muscle before and after eccentric exercise in healthy subjects. **METHODS:** Sixteen volunteers performed high intensity eccentric exercise (5 bouts of 10 eccentric contractions at 100% max) involving the upper trapezius muscle on the dominant side. MMG signals were detected by means of 12 accelerometers forming a pentagon over the upper trapezius muscle. MMG recordings were made during submaximal exercise consisting of static arm flexion and abduction at 90° for 30 sec before and 24 hours after the eccentric exercise. Average rectified value (ARV) and percentage of determinism (%DET) of the MMG signals were computed to estimate the level of muscular activation and the amount of regularity of the MMG signals. **RESULTS:** During static abduction, there were significant increases in ARV and %DET from before to 24 hours after eccentric exercise, respectively from 0.028 ± 0.011 to 0.030 ± 0.009 m.s⁻² and from 56.3 ± 12.3 to 59.3 ± 11.3 % ($P < 0.001$ for both). The ARV and %DET depended also on the accelerometer locations during static flexion and abduction with higher values in the cranial and lateral part of the upper trapezius ($P < 0.001$). **CONCLUSION:** Inhomogeneous MMG activity in the upper trapezius muscle following high intensity eccentric exercise was found underlining the importance of using multiple recording sites when assessing MMG activity. Changes in the intrinsic properties of the upper trapezius delineated by increased MMG activity and regularity were revealed after high intensity eccentric exercise.

Supported by GigtForeningen R77-A1202.

1679 Board #354 June 1 9:00 AM - 10:30 AM
Effects of a 4-Week Intrinsic Foot Muscle Exercise Program on Motor Function

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 (No relationships reported)

PURPOSE: The purpose of this single-blinded randomized control trial was to study the effects of a 4-week intrinsic foot muscle (IFM) exercise program on motor function, perceived difficulty, and IFM motor activation measured using ultrasound imaging (USI) during three IFM exercises. **METHODS:** 24 healthy, recreationally active young adults with no history of ankle or foot injury who have never performed IFM exercises participated (12 males, 12 females; mean age = 21.5 ± 4.8 years;

BMI = 23.5 ± 2.9 kg/m²). Following randomization, participants allocated to the intervention group received a progressive home IFM exercise program performed daily. Participants in the control group did not receive any intervention and were asked not to alter their physical activity during the trial. Clinician-assessed motor performance (4-point scale: 0=does not initiate movement, 3=performs exercise in standard pattern), patient perceived difficulty (5 point Likert scale: 1=very easy, 5=very difficult), and USI motor activation measures (active thickness/resting) of the abductor hallucis (AbdH), flexor digitorum brevis (FDB), quadratus plantae (QP), and flexor hallucis brevis (FHB) were assessed during a toe spread out, hallux extension, and lesser toe extension exercise. The Wilcoxon signed rank test was used to assess the pre to post intervention motor performance and perceived difficulty measures. Repeated measures ANOVAs were used to analyze the USI measures. **RESULTS:** The intervention group demonstrated significant improvement in motor performance in the toe spread out exercise (pre = 1.9 ± 0.5 , post = 2.6 ± 0.5 , $p = .008$) and less perceived difficulty in the toe spread out (pre = 3.1 ± 1.3 , post = 2.3 ± 1.2 , $p = .01$), isolated hallux extension (pre = 3.2 ± 1.5 , post = 2.0 ± 1.2 , $p = .005$), and lesser toe extension (pre = 1.9 ± 0.7 , post = 1.2 ± 0.4 , $p = .03$) exercises. Both groups demonstrated increased USI motor activation in the AbdH during the toe spread out exercise (intervention: pre = $1.07 \pm .06$, post = $1.11 \pm .08$; control: pre = $1.08 \pm .06$, post = $1.11 \pm .06$, $p = .05$). No other significant main effects or group by time interactions were observed. **CONCLUSION:** A 4-week IFM exercise intervention resulted in improved motor performance and decreased perceived difficulty when performing the exercises, but not changes in USI measures of IFM activation.

1680 Board #355 June 1 9:00 AM - 10:30 AM
Influence of Experience and Attentional Focus in a Single Arm Isokinetic Elbow Flexion

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Previous research has shown that adopting an external focus (i.e., movement of the handle), rather than an internal focus (i.e., muscle contraction) increases force output and decreases muscle activation during an elbow flexion movement in men and women with strength training experience. However, little is known about the influence of attentional focus in novice populations. **PURPOSE:** To determine the influence of attentional focuses on muscle activation and force output among experienced and inexperienced males performing a unilateral isokinetic elbow flexion. **METHODS:** Fourteen male participants with >3 years of strength-training experience (EX group mean age 20.6 ± 0.9) and 9 novice participants with <6 months of resistance training experience (NOV group mean age 19.5 ± 1.0) performed 10 repetitions of a unilateral elbow flexion using a Biodex System 4 dynamometer. Repetitions were performed under 3 conditions (a control followed by randomly assigned internal and external focuses) at a speed of 60° (s⁻¹). Peak torque (N·m) was measured by the Biodex, and peak muscle activation (mV) of the biceps brachii was measured using surface EMG. **RESULTS:** Within-group differences were analyzed using a repeated measures MANOVA. In the EX group, an external focus showed significantly higher peak torque (65.3 ± 3.2 N·m) than both the control (60.0 ± 3.2 N·m) and internal (50.1 ± 4.2 N·m) focus (all $p < 0.05$). For the NOV group, there were no significant differences in peak torque production between any conditions. Further, there were no within-group significant differences in peak muscle activation for either group. **CONCLUSION:** Supporting previous research, our results show that adopting an external focus yields greater force output than an internal focus for experienced populations. However, no difference in force output is observed in novices with an external or internal focus. Thus, instructing experienced individuals to adopt an external focus may be beneficial for exercises where maximum force output is the goal, but additional research is needed to better understand the influence of attentional focus for similar exercises among novices. Supported by University of St. Thomas Collaborative Inquiry Grant.

1681 Board #356 June 1 9:00 AM - 10:30 AM
Core Muscle Function and Endurance in Patients with Patellofemoral Pain following Impairment-Based Rehabilitation

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 (No relationships reported)

Patellofemoral pain (PFP) is a common knee injury suffered among active individuals and rehabilitation programs for PFP have attempted to target hip muscle dysfunction. However, the role of core musculature in this pathology is not as prevalent in current literature. **PURPOSE:** To examine the effects of a 4-week impairment-based rehabilitation program with a core-focused component. Muscle activity during a single leg squat (Tra thickness) and endurance (forward and side plank times) were compared before and after rehabilitation. **METHODS:** 19 PFP patients (23.7 ± 4.8 yrs, 14F, 5M) completed 12 clinician-supervised rehabilitation sessions over a 4-week

period. The rehabilitation program was based on individual patient deficits, measured prior to their first session, in lower extremity range of motion, strength, core weakness, and in movement patterns during functional tasks. Patients were also progressed based on their specific performance, inline with the individual impairment-based model. Prior to the first session and following the final session, USI thickness measures of TrA during a single leg squat (SLS) and plank times (forward, right, left) were collected. For the USI measures, TrA thickness at peak knee flexion during a SLS was normalized by dividing by the thickness in quiet stance. Forward planks and bilateral side planks were timed to failure. Paired t-tests were utilized to compare all measures before and after rehabilitation. **RESULTS:** There was no significant difference in TrA activity during the SLS following rehabilitation ($0.08 \pm 0.23 \text{ cm}$, $P=.14$). A significant increase in plank time was seen in both the right ($14.4 \pm 18.3 \text{ sec}$, $P=.05$) and left side planks ($10.5 \pm 22.1 \text{ sec}$, $P<.01$). A 2-second increase in forward plank time was shown, but did not reach significance ($2.22 \pm 36.0 \text{ sec}$, $P=.79$). **CONCLUSION:** The absence of change in core muscle activity during the SLS may indicate varying motor strategies to complete the functional task before and after rehabilitation. Significant findings in increased endurance via side planks support the inclusion of a core muscle focus in an impairment-based rehabilitation. Core stability does play a role in PFP and the contribution of task-specific (SLS) and endurance demands should be considered in impairment evaluation while designing a rehabilitation plan.

1682 Board #357 June 1 9:00 AM - 10:30 AM
Single-leg Squat: Interrater Reliability And Sex Differences In Medial Knee Displacement In Collegiate Athletes
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 (No relationships reported)

The Single Leg Squat (SLS) is a commonly performed clinical screening tool used to identify faulty lower extremity biomechanics, specifically dynamic knee valgus. Despite this use, few studies have investigated its reliability or examined if sex-differences exist in SLS performance in athletic populations. **PURPOSE:** Determine interrater reliability of the SLS and investigate whether occurrence of medial knee displacement (MKD) differed between male and female collegiate athletes. **METHODS:** Ninety-two injury-free Division I collegiate athletes completed SLS testing as part of their preparticipation exam, including 46 men (age= $18.6 \pm 1.6 \text{ y}$, height= $183.5 \pm 7.9 \text{ cm}$, mass= $91.0 \pm 18.9 \text{ kg}$) and 46 women (age= $18.6 \pm 1.6 \text{ y}$, height= $169.1 \pm 9.5 \text{ cm}$, mass= $65.4 \pm 10.4 \text{ kg}$). Participants completed 5 consecutive SLSs on each leg while being recorded with a standard video camera from the frontal plane view. Videos were slowed and paused for scoring purposes. Participants were assigned a positive (+) SLS score if the midpoint of the patella moved to the great toe during the SLS in at least 3 of the 5 trials. Trials were scored by 2 members of the research team (GM, RM). Frequency counts were calculated and agreement of the SLS was analyzed with an unweighted kappa statistic for a subset of 50 participants. Pearson Chi-square tests were used to evaluate the association between sex and SLS performance. **RESULTS:** The interrater reliability for the right and left-leg SLS scores was 0.762 and 0.634, respectively, which indicated a substantial level of agreement. The overall percent agreement was 85%. More than half (50 of 92; 54.3%) of all athletes had a (+) SLS test result in at least 1 leg; 29.3% (27 of 92) had a (+) SLS in both legs. No association was found between sex and a (+) SLS score in at least 1 leg ($\chi^2=0.175$; $p=0.675$, OR=1.19, 95%CI=0.52-2.71). Although not significant, females were roughly twice as likely ($\chi^2=2.57$; $p=0.109$, OR=2.11, 95%CI=0.84-5.30) to have a (+) SLS score on both legs in comparison to males. **CONCLUSION:** The interrater reliability for the MKD component of the SLS demonstrated a substantial level of agreement. Although not significant, female collegiate athletes displayed a greater occurrence of bilateral MKD than male collegiate athletes. Future work will determine if SLS performance is a predictor of injury in collegiate athletes.

1683 Board #358 June 1 9:00 AM - 10:30 AM
Angular Momentum Comparison of Two Collegiate Discus Throwers of Different Skill Level
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 (No relationships reported)

The discus throw is a highly technical event that requires the athlete to perform a sequence of high-speed movements to maximize throw distance. Previous research has demonstrated that release velocity in the horizontal and vertical directions are crucial to throw distance. It has also been shown that angular momentum about the vertical axis (Z AngMom) contributes to horizontal release velocity while angular momentum about the sagittal axis (Y AngMom) contributes to vertical release velocity. However, little research exists on angular momentum differences between throwers of different skill levels. **PURPOSE:** To determine the differences in angular momentum between

two collegiate discus throwers of different skill level. **METHODS:** Two male athletes performed two throws in a laboratory setting. Whole-body kinematics were recorded from 59 retro-reflective markers using a 14-camera motion capture system. Whole-body angular momentum was calculated about the vertical (Z) and sagittal (Y) axes. Maximum angular momentum and angular momentum at release were recorded. Percent differences in Z AngMom and Y AngMom between throwers were calculated. **RESULTS:** Subject A (190 cm; 125.6 kg) has thrown a personal best of 63.38 m and is a former NCAA national champion. Subject B (190.5 cm; 110.3 kg) has thrown a personal best of 57.93 m and failed to qualify for post-season competition. Maximum Z AngMom occurred early during the first single-support phase and was 11.7% greater for Subject B ($79.79 \pm 0.96 \text{ vs. } 71.79 \pm 1.22 \text{ kg} \cdot \text{m}^2 \cdot \text{s}^{-1}$). However, at the point of release, Subject A had 28.8% greater Z AngMom ($65.80 \pm 0.67 \text{ vs. } 49.26 \pm 0.08 \text{ kg} \cdot \text{m}^2 \cdot \text{s}^{-1}$). Maximum Y AngMom occurred late during the delivery phase and was 43.2% greater for Subject A ($-38.33 \pm 2.95 \text{ vs. } -24.71 \pm 0.53 \text{ kg} \cdot \text{m}^2 \cdot \text{s}^{-1}$). At the point of release, Subject A had 166.6% greater Y AngMom ($-23.59 \pm 1.97 \text{ vs. } -2.15 \pm 2.31 \text{ kg} \cdot \text{m}^2 \cdot \text{s}^{-1}$). **CONCLUSION:** Subject A achieved greater Z and Y AngMom at release which likely contributes to a greater throw distance. Subject B achieved a greater maximum Z AngMom than Subject A, but was unable to maintain high Z AngMom and Y AngMom at release. The results of this investigation showed that the elite athlete was able to maintain high levels of angular momentum throughout the throw, whereas the other athlete had a significant loss of angular momentum at release.

1684 Board #359 June 1 9:00 AM - 10:30 AM
Predictors of Outcomes after ACL Reconstruction Differ Based on Meniscus Involvement
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 (No relationships reported)

Quadriceps and hamstring muscle strength have been shown to predict self-reported knee function, often quantified by the Knee Osteoarthritis Outcome Score (KOOS), in patients with anterior cruciate ligament reconstructed (ACLR) knees. Since up to 60% of these patients experience concomitant meniscal injury it is possible that relationships between muscle function and subjective function may differ based on meniscal involvement. Understanding these relationships may provide greater understanding of determinants of poor subjective function and allow for more individualized treatment strategies to improve outcomes post-ACLR. **Purpose:** To determine predictors of self-reported knee function in ACLR patients with and without concomitant meniscal surgery. **Methods:** 97 patients with a primary, unilateral ACLR (age= 27 ± 8.7 years, mass= $74.8 \pm 16.6 \text{ kg}$, time since surgery= $6.8 \pm 2.8 \text{ mo.}$) participated near the time of return to unrestricted activity. Patients were separated into 3 groups: ACLR only (n=35), ACLR with meniscectomy (n=29), or ACLR with meniscal repair (n=33). Isokinetic peak knee extension and flexion torque was measured at 180°/sec. Subjective knee function was measured with the KOOS. We performed stepwise multiple linear regression to predict total KOOS score for each ACLR group. Predictors were total work, average power, and peak torque for knee extension and flexion for the involved limb normalized to body mass and as a symmetry index compared to the healthy contralateral limb. Predictors added to the model all had statistically significant R-square change ($P<.05$). **Results:** ACLR only: involved knee flexion power explained 25% of the variance in KOOS total score ($R^2=.251$, $P=.002$). ACLR with meniscal repair: knee extension limb symmetry explained 19% of the variance in KOOS total score ($R^2=.190$, $P=.01$). ACLR and meniscectomy: the regression model resulted in no predictors of KOOS total score. **Conclusion:** Measures of thigh muscle strength were significant predictors of self-reported outcome in patients with ACLR. Meniscal involvement reduced the overall variance explained in PRO and altered the predictors included. Clinicians should be aware of other factors besides quadriceps and hamstring strength that may influence outcomes post-ACLR, especially in patients with concomitant meniscectomy.

1685 Board #360 June 1 9:00 AM - 10:30 AM
Analysis of Time Distribution Pattern and Surface Electromyography Characteristics of Wheelchair Racing "Butterfly" Technique
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Wheelchair racers, like sprinters, have special movement pattern, especially when adopting a "butterfly" technique. Yet, the surface electromyography (SEMG) characteristics of this technique have not been well studied.

PURPOSE: To determine the time distribution pattern and sEMG characteristics of the wheelchair racing "butterfly" technique (WRBT).

METHODS: 10 wheelchair racers on the Chinese national team (6 males, 4 females), who were classed as T54, were recruited for the study. Four Panasonic high-speed cameras were placed in different locations to monitor the kinematics characteristics of participants in a designated area, and one Biomonitor Megawin6000 sEMG tester with eight electrode units was installed on eight muscles (biceps, triceps, flexor carpi radialis, extensor carpi radialis, erector spinae, rectus abdominis, abdominal oblique, and upper trapezius) to record muscle activity. The Kwon3D video management software was used to analyze the movement pattern and time distribution, and MegaWin software (2.3a12 edition) was used to analyze sEMG characteristics and calculate integral electromyography (iEMG). Descriptive statistics were computed using IBM SPSS (version 22.0) for the data.

RESULTS: When participants implemented WRBT to complete the test, the ratio of their push phase (PP) and recovery phase (RP) was approximately 1:3.58. During PP, the maximum percentage of iEMG was in the biceps (24.54±2.96%), with rectus abdominis (3.80±2.32%) having minimum value. Correspondingly, the muscle activity of triceps was the maximum (26.98±3.88%), and rectus abdominis (3.45±1.47%) remained the minimum at the PP. The muscle activities of the wrist joints and shoulder joints had higher activity than other muscles tested during the PP and RP.

CONCLUSION: The time distribution pattern and sEMG characteristics of WRBT were studied, which indicates that, to reduce possible injuries, the wheelchair racers may need improving muscular strength of their wrists and upper limbs.

(1-kg) necessary to detect peak (PK) and average (AVG) sprinting power (P), velocity (V) and force (F); peak rate of force production (RFD) was also collected. Following a 5-min rest period, the athletes completed another sprint (S2) at a resistance that equated to approximately 5% of their body mass. The athletes then rested for approximately 4–7 minutes before completing their final sprint (S3) with minimal resistance (1-kg). An analysis of variance with repeated measures was used to assess differences between each sprinting condition. **RESULTS:** Significant ($p < 0.05$) main effects were observed for all sprinting kinetic measures except V_{PK} ($p = 0.067$). Compared to S1, a reduction ($p < 0.006$) in 20-m sprint time (S1: 3.76 ± 0.23 sec; S2: 3.9 ± 0.34 sec), stride length (S1: 1.39 ± 0.16 m; S2: 1.09 ± 0.18 m), P_{AVG} (S1: 140 ± 18 Watts; S2: 302 ± 66 Watts), P_{PK} (S1: 375 ± 41 Watts; S2: 617 ± 82 Watts), V_{AVG} (S1: 5.70 ± 0.51 m · s⁻¹; S2: 5.32 ± 0.50 m · s⁻¹), F_{AVG} (S1: 23.8 ± 1.2 N; S2: 55.7 ± 8.8 N), F_{PK} (S1: 49.7 ± 1.3 N; S2: 82.1 ± 7.8 N), and RFD (S1: 5855 ± 436 N · sec; S2: 9981 ± 813 N · sec). However, only RFD was greater at S3 (6139 ± 389 N · sec, $p < 0.001$) compared to S1. **CONCLUSION:** Completing a short, resisted-sprint with a load equating to 5% of body mass within 4–7 minutes of a short sprint (~20-meters) does not appear to affect sprinting time or kinetics. However, it does appear to enhance rate of force production.

1686 Board #361 June 1 9:00 AM - 10:30 AM

Influence of Hybrid III Head and Neck Position to Frontal Impacts

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Collisions in sport occur with the head and neck in various positions. While research has shown that the response of the head differs between front and side impacts, the current understanding of how relatively small changes in head position influence head accelerations and the forces on the neck during impacts remains unclear. **PURPOSE:** To determine the influence of head position on the accelerations of a biofidelic headform as well as the loads at the atlanto-occipital joint in all 6 degrees of freedom during frontal impacts.

METHODS: A hybrid III male 50% head-neck assembly instrumented with accelerometers, angular rate sensors and force transducers (sampling rate = 30,000 Hz) was impacted in the frontal quadrant 6 cm above the reference plane with a cylindrical pneumatic impactor (mass = 13.78 kg) at 5.5 m/s. The head-neck assembly was placed in 4 combinations of pitch and yaw angles (-7.5° and 0°, -7.5° and -10°, -22.5° and 0°, -22.5° and -10°). The head was impacted in each position 5 times. The maximum resultant linear and angular accelerations as well as force and moment were calculated for each impact. A 2-way ANOVA (pitch x yaw) was used to test for differences in resultant accelerations and loads ($\alpha = 0.05$).

RESULTS: A pitch angle of 7.5° resulted in statistically greater maximum resultant angular acceleration (6319 ± 255.4 rad/s²; main effect: $p < 0.001$), but a smaller maximum resultant force (354.9 ± 8.9 N; main effect: $p < 0.001$) and moment (6.01 ± 0.4 N·m; main effect: $p < 0.001$) than a pitch angle of 22.5° (angular: 4356 ± 380.8 rad/s²; force: 552.7 ± 5.8 N; moment: 13.6 ± 0.6 N·m). Though there was a pitch and yaw main effect for linear acceleration (pitch: $p = 0.025$; yaw: $p < 0.001$) along with a yaw main effect for moment, the clinical relevance of these mean differences (linear acceleration: pitch: 1.2 g; yaw: 2.2 g; moment: yaw: -0.5 N·m) remains undetermined. There was also no yaw main effect for any of the other measures, nor was there an interaction between pitch and yaw for any of the dependent variables ($p > 0.073$).

CONCLUSIONS: Tilting the head-neck anteriorly alters the dynamic response of the headform by reducing angular acceleration, but may increase the overall loads experienced at the atlanto-occipital joint. The clinical meaningfulness of our findings related to changes in yaw require further exploration.

1687 Board #362 June 1 9:00 AM - 10:30 AM

A Robotic Resisted-sprint Improves Rate Of Force Development During A 20 Meter Sprint In Athletes

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PURPOSE: Examine the effect of a resisted sprint on 20-m sprinting kinetics.

METHODS: Following a standardized warm-up, twenty-three (male = 10, female = 13) division 1 basketball players completed three maximal 20-m sprint trials while tethered to a robotic resistance. During the first sprint (S1), the minimal resistance

D-07 Thematic Poster - Body Composition and Health

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 101

1719 **Chair:** Peter W. Grandjean, FACSM. *Baylor University, Waco, TX.*
(No relationships reported)

1720 Board #1 June 1 1:00 PM - 3:00 PM
Age Related Decline in VO₂max and Lean Body Mass in Masters Athletes

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Improving physical performance of athletes is an important goal to success in sports achievements. Aging influences both body composition and results in a decline in maximal oxygen consumption (VO₂max). This decline results from several factors, including increased body fat and reduced maximal cardiac output. Sex differences in age-related decline in VO₂max and lean body mass (LBM) in Masters Athletes is still not fully understood. **PURPOSE:** To examine the sex differences in the age-related decline in VO₂max and LBM in Masters Athletes. **METHODS:** A total of 26 master athletes (females: n=14, males: n=12), 26 to 60 years of age, participated in this cross-sectional study. VO₂max was determined via Vmax Encore metabolic system. Lean body mass was evaluated by dual energy X-ray absorptiometry (DXA). **RESULTS:** There were no significant differences in VO₂max (40.1±8.7 and 38.2±12.1 mL/kg/minute) (t (24) = 1.29, P=0.208) and age (36.5±5.4 and 41.4±9.1 years) (t (24) = -0.784, P=0.441) between males and females, respectively. Males had a significantly greater LBM than females (t (24) = 5.59, P=0.00) (61.7±9.1 kg and 44.2±6.9, respectively). For males, there was no significant correlation between age and VO₂max (r = -0.31, P=0.32), age and LBM (r = -0.23, P=0.47), or VO₂max and LBM (r = 0.04, P=0.89). For females, there was a significant negative correlation between age and VO₂max (r = -0.603, P=0.02); but no significant correlations were found between age and LBM (r = -0.244, P=0.40) and VO₂max and LBM (r = 0.121, P=0.68). There was not a significant age-related decline in VO₂max in males and females (r² = 0.09, r² = 0.36, respectively) or in LBM (r² = 0.05, r² = 0.06, respectively). **CONCLUSION:** Although there were declines in VO₂max in both men and women, these age-related declines were not significant. In addition, age-related declines in LBM were not significant in this sample of Masters Athletes. These represent data from an unfunded research project

1721 Board #2 June 1 1:00 PM - 3:00 PM
Development And Validation Of Body Fat Prediction Equation In 20-69 Adults

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PURPOSE: Skinfold thickness is commonly measured in clinical and field settings for the assessment of body fat percentage (BF%) because this method is low cost. A study was conducted to develop prediction equation for total body fat using surface anthropometric measures in adults aged 20-69 years old. **METHODS:** Data from 1225 healthy, yellow adults were used. The cohort was then divided into validation and cross-validation groups. Prediction equation was developed by using regression analyses in 1141 Chinese adults aged 20-69 years old. These adults were recruited from a larger randomly sampled population-based study. The independent variables included sex, age, height, mass, body mass index, chest girth, waist girth, hip girth, and skinfold thickness at nine sites. The dependent variable was total body fat percentage and was measured using dual-energy X-ray absorptiometry (DXA). Multiple linear regression was used to determine the best prediction equation for fat percentage. A total of 84 additional samples were included to verify the validity of the equation. Tests for accuracy included R² and Bland-Altman plots. **RESULTS:** Using multiple linear regression analyses, the best equation for predicting FM (R² = 0.758) included sex, age, height, body weight, body mass index, chest girth, hip girth, subscapular skinfold, triceps skinfold, biceps skinfold, chest skinfold,

axillary line section skinfold, abdominal skinfold, front thigh skin fold, and medial calf skinfold as independent variables. After cross-validation, the new prediction equation (PE) was found to be valid in 20, 40, and 60 years old men and women (P<0.05). Bland-Altman plots showed limited agreement between body fat percentage (BF%) calculated with the prediction equation (PE) and BF% measured with dual-energy X-ray absorptiometry (DXA) in adults aged 20-29, 40-49, and 60-69 years old. **CONCLUSIONS:** A prediction equation was developed, and this was able to predict total body fat of adults aged 20-69 years old using surface anthropometric measurements with high predictive accuracy.

1722 Board #3 June 1 1:00 PM - 3:00 PM
Analysis Of Visceral Fat Tissue Via Dual-energy X-ray Absorptiometry And Magnetic Resonance Imaging

Parker N. Hyde, Nathan Lamba, Christopher Crabtree, Debbie Scandling, Jay A. Short, Richard A. LaFountain, Teryn N. Sapper, Madison L. Bowling, Vincent J. Miller, Fionn T. Mc Swiney, Ryan M. Dickerson, Orlando P. Simonetti, Jeff S. Volek. *The Ohio State University, Columbus, OH.*
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Increased visceral adipose tissue (VAT) is strongly associated with insulin resistance and cardiometabolic diseases. It is difficult to separate subcutaneous from visceral adipose tissue using standard body composition techniques, but recently dual energy x-ray absorptiometry (DXA) has emerged as a method to quantify VAT. **Purpose:** The objective of this study was to assess the correlation between VAT derived from DXA and multi-slice magnetic resonance imaging. **Methods:** Twenty-two pairs of DXA and MRI scans were obtained from obese participants with metabolic syndrome. All matched DXA and MRI scans were completed within 72-hours of each other. VAT was imaged using both 3T MRI scanner and DXA. MRI VAT calculation was estimated via a novel program which automatically segments and measures VAT as well as subcutaneous adipose tissue. Pearson product moment correlations were assessed to determine the strength of association between the MRI and criterion DXA. Bland-Altman analysis was completed to assess the bias and limits of agreement of the two methods. **Results:** Mean MRI VAT and DXA VAT were 4748.44 cm³±1366.59cm³ and 2693.10±920.07 cm³, respectively. A strong correlation was observed between MRI and DXA (r=0.891; p<0.05). Bland-Altman analysis demonstrated bias, upper and lower limits of agreement were 2226.16 cm³, 3548.73 cm³ and 903.583 cm³, respectively. **Conclusion:** Large differences in means were expected due to the MRI imaging a larger anatomical region (L5 to T9) compared to DXA (20% distance from iliac crest to base of skull). Our results indicate that quantification of VAT determined from DXA and a novel multi-slice MRI protocol are highly correlated, suggesting that either method could be used to provide important insight into disease risk status and effectiveness of therapeutic interventions.

1723 Board #4 June 1 1:00 PM - 3:00 PM
Is Unhealthy Fat Mass Disguised By A Healthy BMI In Females With Eating Disorders?

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The chaotic eating behavior, with or without periods with restrictive eating and compensatory behavior, in bulimia nervosa (BN) and binge eating disorder (BED) can cause metabolic health challenges, with negative implications for regulation of body weight and composition. Despite the knowledge on how body composition and specifically abdominal fat mass relates to various health variables, body mass index (BMI) is still widely used as a health indicator for individuals and populations. Few studies have investigated the fat distribution and the prevalence of abdominal adiposity among women with BN and BED. **PURPOSE:** To investigate the prevalence of abdominal adiposity and examine the ability of BMI to identify women with increased abdominal adiposity in a group of treatment seeking women with BN and BED. **METHODS:** Baseline data from an ongoing RCT treatment study for females meeting the DSM-5 criteria for BN or BED (BN n = 62 and BED n =26, aged 28 ± 5 years) were used. Height (cm) and weight (kg) were measured. Abdominal adiposity was measured with dual-energy x-ray absorptiometry (DXA) (Lunar iDXA, GE Healthcare, enCORE Software, Version 14.10.022) by performing a whole-body scan. Android gynoid fat mass ratio (AG ratio) were calculated by the DXA software (AG ratio = % android fat mass / % gynoid fat mass). Abdominal adiposity was defined as an AGRatio >0.7. **RESULTS:** The prevalence of abdominal adiposity was 63 % in the BN and 73 % in the BED group. In all, 54 % and 81 % of cases with abdominal adiposity in the BN and BED group, respectively, were identified by BMI. **CONCLUSIONS:** The results indicate that unhealthy fat mass is being disguised by a healthy BMI in females with eating disorders. Furthermore, our findings highlights the importance of 1) assessing body composition and abdominal obesity rather than only body weight

and/or BMI in females with BN and BED and 2) the need for utilizing interdisciplinary treatment (including physical exercise and dietary therapy) to properly address this physiological and metabolic challenge.

controlling low-grade inflammation and immune function in obese Hispanic females. The amount of training or fat loss in this study may not be enough to induce changes in adiponectin.

1724 Board #5 June 1 1:00 PM - 3:00 PM
Bias Between DXA And BIA Varies Based On Quantity Of Fat Mass And Fat-free Mass
 Grant M. Tinsley¹, Jeffrey S. Forsse², Elisa Morales², Peter W. Grandjean, FACSM². ¹Texas Tech University, Lubbock, TX. ²Baylor University, Waco, TX. (Sponsor: Peter Grandjean, FACSM)
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PURPOSE: Dual-energy x-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are common methods of body composition assessment, but the agreement between these methods varies. The present analysis sought to identify both fixed and proportional biases between DXA and BIA in young active adults under strictly standardized conditions.
METHODS: Bias between DXA and single-frequency BIA was evaluated at six different time points in 48 young, active male and female adults consuming standardized diets. Bland Altman plots were generated to assess the agreement between devices for fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%). Fixed bias was evaluated via mean differences (DXA value - BIA value) and 95% confidence intervals, and proportional bias was evaluated via linear regression analysis.
RESULTS: Substantial fixed bias was present for body composition estimates. Mean differences for DXA and BIA were present in females and males for BF% (5%; 6%), FM (2.6 kg; 3.9 kg), and FFM (-3 kg; -4.6 kg). Both genders also exhibited proportional bias for FM and FFM, but the magnitude of bias was greater in females, as indicated by regression coefficients (FM: $r = -.34$ in F, $r = -.25$ in M; FFM: $r = .63$ in F, $r = .25$ in M). In individuals with less FM, the mean difference between DXA and BIA was high, indicating that BIA underestimated FM relative to DXA. However, in individuals with greater FM, better agreement was seen. Similarly, the mean difference in FFM estimates was greater in individuals with less FFM. In some individuals with high quantities of FM or FFM, the relationship between devices was reversed such that BIA overestimated FM and underestimated FFM.
CONCLUSIONS: Fixed and proportional biases exist between DXA and BIA when used in young predominantly normal weight adults. Although this limits the ability to compare body composition information obtained by these technologies, the degree of disagreement varies substantially based on quantity of fat mass and fat-free mass such that all-encompassing statements regarding the comparability of these technologies cannot presently be made. While BIA commonly overestimated fat-free mass and underestimated fat mass relative to DXA, this relationship was reversed in some individuals.

1725 Board #6 June 1 1:00 PM - 3:00 PM
Effects Of Aerobic Exercise Training Intensity On Inflammatory Cytokines In Obese Hispanic Females
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 (No relationships reported)

Inflammatory cytokines are useful biomarkers in predicting development of metabolic and cardiovascular diseases and may be positively affected by physical activity and weight loss. Despite much interest in chronic low-level inflammation in obese population, effect of aerobic training intensity on inflammatory cytokines remains elusive. **PURPOSE:** The purpose of this study was to investigate effects of 12-week aerobic exercise training at high and low intensities on changes in pro-/anti-inflammatory cytokines. **METHODS:** Forty-one inactive obese Hispanic females (mean BMI = 34.5 kg/m², aged 21-39years), were divided into one of three groups : high intensity training group (HT: running at 70% VO_{2max}, n=14), low intensity training group (LT: walking at 50% VO_{2max}, n=14), and control group (CON, n=13). Exercise volume was similar for both training groups [initial energy expenditure (EE): 13.5 METs-h/w] and EE was increased by 4.5 METs-h/w every four weeks in both training groups. Two-way repeated measures ANCOVA and Tukey post hoc tests were used for data analysis. **RESULTS:** 12 weeks of aerobic exercise resulted in significantly lower levels of TNF- α in both HT (4.46 \pm .98 pg/mL, Mean \pm SD \rightarrow 3.66 \pm .80, P=.006) and LT (4.35 \pm .79 \rightarrow 4.05 \pm .77, P=.027). A significant decrease in CRP was observed in HT (6.23 \pm .52 mg/L \rightarrow 5.92 \pm .68, P=.035), but not in LT (6.13 \pm .71 mg/L \rightarrow 6.01 \pm .77, P=.416). However, level of adiponectin was not significantly changed in any groups. **CONCLUSIONS:** Significant decreases in TNF- α and CRP were found following high intensity aerobic exercise training while low intensity training reduced TNF- α only. The greater changes of pro-inflammatory cytokines in HL indicates high intensity aerobic exercise training may be more beneficial than low intensity training for

1726 Board #7 June 1 1:00 PM - 3:00 PM
Influence of Menopause and Fat Mass Distribution on Lipids and Lipoproteins in Normal-Weight Obese Women
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 (No relationships reported)

Normal-weight obesity (NWO), defined as a normal body mass index (BMI), but possessing a high body fat percentage (BF), has been associated with increased risk for cardiovascular disease (CVD) comparable to women with obesity. Following menopause, fat redistribution and increased risk for dyslipidemia are common; however, the effect of menopausal-related shifts in fat distribution and lipids and lipoproteins in NWO women remains to be determined.
PURPOSE: To determine the influence of menopausal status on changes in regional abdominal and hip fat masses and lipids and lipoproteins in NWO women.
METHODS: Sedentary, non-smoking women (n=214), not taking medications for the treatment of dyslipidemia, were grouped based on two categories: 1) menstrual status: premenopausal (PRE) or postmenopausal (POST) and 2) BF status: non-obese (BMI <25 kg/m² and BF <36%), NWO (BMI <25 kg/m² and BF >36%), or obese (BMI >25 kg/m² and BF >36%). Fasting (12 hr) serum samples were analyzed for lipid and lipoprotein-cholesterol concentrations. Percent BF and abdominal and hip regional fat masses were quantified by DXA. A 2x3 ANOVA was used to identify differences between groups. Statistical significance was set at P<0.05.
RESULTS: Independent of menopausal status, both abdominal and hip fat mass in NWO was 27-39% (P<0.001) greater than non-obese women, but 37-43% (P<0.001) less than obese women. Cholesterol was greater in non-obese (186 \pm 33 vs. 212 \pm 28 mg/dL, P=0.001), NWO (196 \pm 35 vs. 219 \pm 26 mg/dL, P=0.028), and obese (201 \pm 34 vs. 223 \pm 25 mg/dL, P=0.005) POST women when compared to PRE women. LDL-C was not different between non-obese PRE and POST women; however, LDL-C was greater in POST women who are NWO (111 \pm 36 vs. 131 \pm 25 mg/dL, P=0.034) and obese (121 \pm 30 vs. 138 \pm 23 mg/dL, P=0.017) when compared to PRE women. In contrast, HDL-C was lower in only non-obese POST women (62 \pm 13 vs. 75 \pm 14 mg/dL, P<0.001) when compared to non-obese PRE women. In POST women, only HDL-C was significantly lower (62 \pm 15 vs. 75 \pm 14 mg/dL, P=0.010) in NWO than non-obese women.
CONCLUSIONS: Based on these findings, menopausal status was not associated with a change in fat distribution; however, the age-related changes in lipids and lipoproteins appear to be due to a change in menopausal status, not shifts in fat distribution.

1727 Board #8 June 1 1:00 PM - 3:00 PM
Measurement of Subcutaneous Adipose Tissue in Pre-School Children using Ultrasound
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 (No relationships reported)

Studies analyzing the weight status of children, especially in overweight and obese children, often use skinfold measurements as part of a standard anthropometric assessment. This commonly used method to assess body fat has inherent shortcomings in accuracy and reliability. In the HAPPY CHILD study (Healthy eating, Active Play-Promoting a healthy lifestyle in Young CHILDren), we used ultrasound to measure subcutaneous adipose tissue (SAT) in pre-school children. In taking these measurements, we applied a recently introduced protocol developed by the International Olympic Committee (IOC) Working Group on Body Composition, Health and Performance (under the auspices of the IOC Medical Commission). **PURPOSE:** To determine if the above-mentioned protocol for ultrasound measurements of SAT is a feasible method to assess body fat in pre-school children, aged 3-5 years. **METHODS:** Ultrasound measurements of SAT were taken at eight body sites from 112 children in ten kindergartens. Site marking was performed in reference to a child's body height. The sum of SAT (D) from these eight sites is reported as: D_{incl} (including embedded structures) and D_{excl} (excluding embedded structures). Fat patterning profiles were established, and boys were compared to girls. **RESULTS:** Fat patterning profiles of 59 boys and 53 girls with an average age of 4.05 years \pm 0.72 were established. A comparison of SAT thickness using the Mann-Whitney U test showed a significant difference between girls and boys in the sum of SAT: D_{incl} in girls was 52.91 mm \pm 19.03 (D_{excl}: 47.46 mm \pm 18.05) vs. 46.9 mm \pm 18.48 (D_{excl}: 41.27 mm \pm 17.27) in boys (D_{incl}: p = 0.036; D_{excl}: p = 0.024). Both groups had the highest SAT values at the

lateral thigh and the lowest values at the erector spinae. **CONCLUSION:** The applied protocol for ultrasound measurements of SAT is a feasible method to assess body fat in pre-school children. The results show that the girls have a higher amount of SAT than the boys. Adjustments in calculation of measurement sites may be necessary in some cases, depending on the length of a child's limbs.

D-08 Thematic Poster - Bone Quality in Special Populations

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 505

1728 **Chair:** Lisa Ferguson-Stegall. *Hamline University, Saint Paul, MN.*

(No relationships reported)

1729 Board #1 June 1 1:00 PM - 3:00 PM

Sclerostin And Biomarkers Of Bone Health, Energy And Vitamin D Status In Elite Male Athletes

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Sclerostin is a hormone secreted by osteocytes that inhibits bone formation and is affected by mechanical loading. Few studies have investigated serum sclerostin levels in athletes and no investigations have focused on elite long-distance runners.

PURPOSE: The aim of this study was to investigate serum levels of sclerostin in male and female long-distance runners and to explore their association with bone mineral density (BMD), bone turnover, energy and vitamin D status. **METHODS:** Twenty-five elite distance runners (23±6 yrs; M=13, F=12) had their BMD assessed by dual energy x-ray absorptiometry (DXA) and blood samples taken in the fasted state and before exercise on one occasion. Blood samples were analysed for serum sclerostin, N-terminal propeptide of procollagen type I (PINP), C-terminal telopeptide of type I collagen (CTX), 25 hydroxy vitamin D [25(OH)D] and free triiodothyronine (FT3) levels. Comparisons between M and F were made using independent t-tests with Bonferroni correction. Analysis of covariance was used to control for potential confounders when making comparisons and Pearson correlations analysed variables for relationships. **RESULTS:** Serum sclerostin levels were not significantly different between males and females (0.45±0.10ng/mL versus 0.41±0.12 ng/mL unpaired t-test, $P=0.398$). In males, serum sclerostin correlated positively with CTX ($r=0.72$, $p=0.006$) and FT3 ($r=0.62$, $p=0.023$) and this association remained significant after adjustments for age and weight. No other significant associations were observed for sclerostin and any other biomarkers. **CONCLUSIONS:** Serum sclerostin levels in elite distance runners were not influenced by sex, but were significantly associated with biomarkers of bone resorption and may be related to energy availability in elite male distance runners. Further research is needed to explore the clinical implications of measuring sclerostin in elite distance runners.

1730 Board #2 June 1 1:00 PM - 3:00 PM

A 1-Year Longitudinal Study of the Bone Mineral Density of Division I College Distance Runners

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(No relationships reported)

PURPOSE: The purpose of this investigation was to examine the changes in bone mineral density (BMD) in a Division I cross-country team over a 1-year period. **METHODS:** Fourteen men (66.8 ± 4.6 kg; 178.7 ± 5.0 cm; 20.4 ± 1.0 yrs; 20.9 ± 1.1 BMI) and nine women (52.1 ± 5.9 kg; 161.8 ± 6.9 cm; 20.2 ± 1.0 yrs; 20.3 ± 1.1 BMI) collegiate distance runners volunteered for bone scans using dual-energy x-ray absorptiometry (DXA). Initial scans were conducted at the beginning of the cross-country season, a second scan at the beginning of the spring track season and a third scan was conducted at the beginning of the following cross-country season. Scan sites included the lumbar spine, proximal femur, and non-dominant forearm. A repeated measured analysis of covariance was utilized to determine any differences between BMD at the three time points. Lean body mass was the co-variant during the statistical analysis. A p -value of 0.05 was used for significance.

RESULTS: The results of the statistical analysis show a significant increase ($p = 0.039$) in whole body lean mass for the group between the first scan and the third scan. When whole body lean mass was accounted for, there were no significant differences in BMD across the three scans or between the sexes for anterior-posterior spine, lateral spine, femoral neck, radius/ulna ultra-distal, or whole body analyses. There was a significant interaction between scan and sex for total hip BMD ($p = 0.023$). The males had a significant ($p = 0.025$) decrease in total hip BMD between scans 1 and 2 and a significant increase ($p = 0.004$) in total hip BMD between scans 2 and 3. The females showed a trend ($p = 0.086$) toward an increase in total hip BMD between scan 1 and 2 and a trend ($p = 0.057$) toward a decrease in total hip BMD between scans 2 and 3. **CONCLUSIONS:** The results of this investigation indicate that runners may experience small changes in BMD at the hip over the course of a training year with no measureable changes at other bone sites. Even though whole body lean mass increased in this group over the one year training period, BMD was maintained. Further investigation is needed to explore reasons for annual BMD maintenance in young-adult, male and female collegiate runners experiencing seasonal fluctuations in skeletal health.

1731 Board #3 June 1 1:00 PM - 3:00 PM

Bone Metabolic Response to 216 km Ultra-Marathon Running

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Physical exercise is a known source of increased bone turnover. Playing sports is recommended for preventing osteoporosis. The positive effects on bone mass of short-duration, high-impact exercise is well accepted. Bone mass can be considered as net product of bone formation and bone resorption. However, although weight-bearing in nature, endurance running has been shown to increase bone resorption but not formation in some populations potentially increasing the risk of stress fractures. Ultra-endurance running puts enormous strain on the whole human body including the bones. **PURPOSE:** To assess changes in biochemical markers of bone metabolism after given sub-sections of an acute, weight-bearing ultra-endurance race. **METHODS:** Venous blood samples were obtained from five highly-trained male ultra-endurance athletes (mean±SD: age 53.8±10.4 yrs, height 175.8±11.1 cm, body mass 75.9±8.4 kg) before the start of the race (km0), after completion of one (km42), two (km84) and three (km126) marathon distances and after finishing the race (km216) for the analysis of bone formation marker bone alkaline phosphatase (BAP), bone resorption markers tartrate-resistant acid phosphatase (TRAP-5b) and beta-crosslaps (CTX) as well as calcium (Ca) and phosphate (Phos). Furthermore, Vitamin D (VitD) concentration was measured at km0. **RESULTS:** Normal levels of VitD were observed in all athletes. Both markers of bone resorption and Phos only demonstrated small fluctuations throughout the race with no significant time effect ($p>0.05$). However, BAP and Ca revealed a significant time effect ($p<0.05$). BAP was higher at km42 (12.5±4.7 µg/l) and km84 (13.2±4.5 µg/l) compared to km216 (11.0±3.3 µg/l; both $p<0.05$). At km216, also Ca (2.4±0.2 mmol/l) was lower (all $p<0.05$) than corresponding values at km42, km84 and km126 (2.6±0.3, 2.6±0.2, 2.5±0.2 mmol/l), respectively. **CONCLUSIONS:** The unchanged CTX and TRAP-5b with concentrations well within the clinical reference range indicate that this acute, weight-bearing, one-stage ultra-endurance foot race did not cause an increased bone resorption while the results of the bone formation marker BAP suggests no particularly beneficial effect. Considering all results together it can be concluded that this type of exercise seems to have no acute detrimental effect on bone mineralization.

1732 Board #4 June 1 1:00 PM - 3:00 PM

Seasonal Differences In Bone Characteristics In Elite Team Sport Players

Ian Varley¹, Ryan Williams¹, Julie P. Greeves², Rachel Izard³, Craig Sale, FACSM¹. ¹Nottingham Trent University, Nottingham, United Kingdom. ²Women Ground Close Combat Review, Andover, United Kingdom. ³Headquarters Army Recruiting and Training Division, Upavon, United Kingdom. (Sponsor: Prof. Craig Sale, FACSM)

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The size and structure of bone is influenced by habitual mechanical loading. In elite team sport players, it remains unclear whether bone structural properties change during a playing season and if sport specific bone adaptations occur. Purpose: To compare bone characteristics between different team sports and determine whether seasonal

differences in bone characteristics occur. Method: Fifty-nine elite team sport players (17 soccer players, 12 cricketers and 30 rugby players) gave informed consent to take part in a study approved by the National Research Ethics Service. Bone scans were performed before pre-season training, after pre-season training, during mid-season and at the end of the season. The timeframe between each scan varied between sports. Dual-energy X-ray absorptiometry (DXA) was used to assess whole body bone mineral density (BMD) (g/cm³), bone area (BA) (cm²) and bone mineral content (BMC) (g). Peripheral quantitative computed tomography (pQCT) was used to assess tibial cross sectional area (mm²), cortical thickness (CT) (mm), periosteal circumference (PC) (mm) and strength strain index (SSI) (mm³) at the 4, 14, 38 and 66% sites. Results: In rugby players whole body BA was higher after pre-season training in comparison to mid-season (2854.8 ± 173.8 vs 2846.9 ± 177.0 g; P=0.013) and SSI was lower (38%) at mid-season compared with before pre-season (2546.7 ± 551.6 vs 2769.1 ± 307.2 mm³; P= 0.003). Cricketers had a reduced SSI (14%) at the end of the season compared with before pre-season (2387.5 ± 433.2 vs 2513.3 ± 412.6 mm³; P= 0.04). Soccer players showed no seasonal changes in the bone characteristics assessed. Rugby players had greater BMD, BA and BMC in comparison to soccer players and cricketers at all time points (P<0.05). When adjusted for body mass, however, soccer players had higher BMD, BA, CT, PC and SSI in comparison to cricketers and rugby players at all time points (P<0.05). Discussion: These data suggest that the specific loading patterns occurring during soccer training and match-play are more osteogenic than those during rugby and cricket. Seasonal differences in bone characteristics suggest that bone structural properties change over a playing season in elite team sport players, which is an important consideration for periodisation of training load and injury prevention.

1733 Board #5 June 1 1:00 PM - 3:00 PM

Total and Regional BMD Comparison of Collegiate Male and Female Athletes

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(No relationships reported)

INTRODUCTION: Bone mineral density (BMD) is a measure that can be used to determine density of a bone, bone region, or skeleton relative to a sample size or to a standardized population. Shown in previous studies, runners and swimmers can show lower BMD than athletes in ball sports or inactive controls **PURPOSE:** Compare BMD between swimmers, runners and soccer players. **METHODS:** Volunteers from collegiate cross country, women's soccer, and women's swimming teams were recruited. Ages ranged from 18-25 years with male (n=15) and female (n=36) athletes. DEXA was used to measure BMD. Age and gender were self-reported by the participants, all subsequent data was generated from the DEXA scan. Total and regional BMD data were collected from the DEXA output. Results are reported as a mean and standard deviation. One-way ANOVA was used to analyze differences between groups in total and regional BMD and Tukey post hoc testing determined significance between two groups. Significance was set at p < 0.05 and when Tukey's post hoc comparison of 95% confidence intervals did not contain zero. **RESULTS:** Regional BMD included the arms, legs, pelvis, spine, and head. The values for arms and legs are averages of the left and right arm, and left and right leg. Men's endurance running (1.256 g/cm², 0.948 g/cm², and 1.529 g/cm²) was significantly higher than women's endurance running (1.187 g/cm², 0.828 g/cm², and 1.351 g/cm²) in total BMD, arms, and legs. Also, men's endurance running (1.529 g/cm²) had significantly higher BMD in the legs than women's soccer (1.427 g/cm²) and women's swimming (1.293 g/cm²). Women's swimming (0.912 g/cm²) was found to have higher arm BMD than women's endurance running (.828 g/cm²). Women's soccer (1.427 g/cm² and 1.356 g/cm²) had a higher BMD in the legs and pelvis than the women's swimming (1.293 g/cm² and 1.228 g/cm²) and higher pelvis than the women's endurance runners (1.221 g/cm²). No significant difference was found between any of the sports for spine and head regional BMD. **CONCLUSION:** Running may have a slight benefit in female athlete's BMD and that swimmers may have a higher arm BMD than female runners. Of note is that the sport involving multi-planar, multi-speed directional forces (women's soccer) demonstrated the densest bones in the lower extremity in comparison to the other sports.

1734 Board #6

June 1 1:00 PM - 3:00 PM

Changes in Tibial Bone Density and Microarchitecture in Response to British Army Infantry Training

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British Army infantry training is characterised by prolonged periods of weight-bearing exercise and dynamic high impact activities. Due to the high mechanical loading, early structural adaptations along the tibial diaphysis have been reported following military training. Less is known about microstructural adaptations to mechanical loading in young adult men. **PURPOSE:** To examine training-induced adaptations in bone density and trabecular (Tb) microarchitecture at the distal tibia using *in vivo* high-resolution peripheral quantitative computed tomography (HR-pQCT) in response to British Army infantry training. **METHODS:** Tibial bone density and Tb microarchitecture were measured using HR-pQCT (Xtreme CT, Scanco Medical, Switzerland) in 30 healthy male British Army infantry recruits (21 ± 2 years, 1.76 ± 0.05 m, 76.2 ± 9.2 kg). HR-pQCT scans were performed at the distal tibia of the dominant leg in week 1 (baseline) and in week 13 (follow-up) of initial military infantry training. **RESULTS:** Significant increases in cortical area (141 ± 27 vs 146 ± 29 mm², P = 0.013), cortical thickness (1.22 ± 0.26 vs 1.28 ± 0.29 mm, P < 0.001), total bone density (339 ± 40 vs 347 ± 45 mg HA/cm³, P = 0.014), total Tb bone density (228 ± 23 vs 232 ± 23, mg HA/cm³, P = 0.004), Tb density in the subendocortical [outer] region (293 ± 27 vs 297 ± 28 mg HA/cm³, P = 0.009) and Tb density in the central region (184 ± 23 vs 187 ± 22, P = 0.005) were observed between weeks one and week 13. Conversely, compared to week one, there were reductions in Tb area at week 13 (727 ± 128 vs 721 ± 131 mm², respectively, P = 0.017). **CONCLUSION:** Changes in bone density and Tb microarchitecture likely contribute to improved bone strength of the human tibia in response to periods of increased mechanical loading. High compressive stresses of military training likely contribute to these early tibial adaptations. This work was funded by UK MOD (Army).

1735 Board #7

June 1 1:00 PM - 3:00 PM

Pre And Postpartum Body Composition: A Case Study In Pregnancy, Lactation, And Physical Activity

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(No relationships reported)

Women who experience typical healthy pregnancies undergo significant changes in body composition, especially fat mass and bone mineral density. These changes have short and long term implications for health and wellbeing but are challenging to study, especially in combination with other factors that influence body composition. **PURPOSE:** The purpose of this case study is to examine the body composition changes of a woman in her early 30s from pre-pregnancy to one year postpartum. **METHODS:** Dual-energy x-ray absorptiometry scans were performed four times, six months prior to conception and 10 days, 120 days, and 375 days after delivery. At each scan the participant was asked about lactation status, physical activity, and supplementation. Percent change was calculated for each variable of interest to describe changes over the examination period. **RESULTS:** Compared to pre-pregnancy, considerable increases in fat mass (40.97%) and body fat percentage (29.4%BF increased to 36.0%BF) was seen 10 days postpartum. Four months later both were still elevated but were found to be lower 12 months after delivery than pre-pregnancy. Bone mineral density and bone mineral content decreased slightly (0.49% and 1.62%, respectively) from pre to 10 days postpartum and decreased considerably more at 120 days (4.68% and 6.10%) and 375 days (9.20% and 9.87%). Site-specific estimates indicate that larger decreases were seen in the trunk (12.1%), spine (13.5%), and pelvis (12.4%). Fortunately, the participant had a young-adult t-score of 2.0 prior to pregnancy and remained above average even after 12 months of lactation. At each appointment, the participant reported being physically active throughout the day but did not exercise consistently over any of the study period. **CONCLUSIONS:** For this individual 12 months of lactation and a generally active lifestyle, but not formal exercise, was sufficient to return body fat and lean mass to pre-pregnancy levels. Total bone mineral density and bone mass remain considerably lower than pre-pregnancy and should be tracked and intervention taken if weaning does not improve levels.

D-09 Thematic Poster - Heat Exposure/Cooling Methods

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 403

1736 **Chair:** Craig Crandall, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.*

(No relationships reported)

1737 **Board #1** June 1 1:00 PM - 3:00 PM
The Effect Of Drink Temperature On Sweating Response And Performance During Exercise In The Heat

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(No relationships reported)

Drink temperature disproportionately influences sweating rate and volume during low intensity exercise in temperate conditions that permit full sweat evaporation. Specifically, cold drinks may reduce sweat production and hot drinks are thought to increase it by stimulation of a gut thermoreceptor. Consequently, cold drinks may have a negative influence on thermoregulatory responses during exercise in the heat. **PURPOSE:** The effect of drink temperature has yet to be examined on the sweat response, thermoregulation and performance in hot, dry conditions using an ecologically valid protocol with measurement of regional sweating responses. **METHODS:** Ten trained cyclists completed three trials prior to and during which they ingested 3.2 mL.kg⁻¹ of a COLD (5.3 ± 1.7 °C) or HOT drink (49.0 ± 1.9 °C), which was contrasted to a no drink CONTROL. They cycled in hot, dry conditions (34.5 ± 0.6 °C & 22 ± 1% RH) for 60-minutes at 55% of pre-determined maximal power output (P_{max}) and then completed a test to exhaustion at 80% P_{max}. Thermal (rectal temperature T_{rec}, 8-site skin temperature T_{msk}) and local sweat rate responses (absorbent sweat pad & galvanic skin conductance GSC) were recorded. TTE duration indicated the performance effect. Comparisons were made using ANOVA. Data are displayed as mean [SD] **RESULTS:** Participant's TTE performance was significantly worse in the CONTROL (170 [132] s) condition (p<0.05) than the COLD (371 [272] s) and HOT drink (367 [301] s) conditions which did not differ. Throughout the fixed intensity exercise period, local sweat responses at the bicep and upper back were not different (p>0.05) between any of the test conditions (e.g. grand mean [SD] Bicep GSC CONTROL 15.2 [8.0] μS, HOT 17.3 [8.0] μS & COLD 14.0 [6.0] μS). Temperature responses were higher (p<0.05) in the CONTROL than both drink conditions at the core (T_{rec}, CONTROL 38.3 [0.5] °C, COLD 38.0 [0.5] °C, HOT 38.1 [0.5] °C) but not the skin (CONTROL 34.5 [0.2] °C, COLD 34.5 [0.3] °C, HOT 34.6 [0.3] °C) **CONCLUSION:** Drink temperature did not influence performance, temperature responses or regional sweat responses during high-intensity exercise in hot, dry conditions. Consumption of fluid, irrespective of its temperature, provided a benefit to exercise performance in the heat in contrast to not drinking. Supported by European Hydration Institute Grant.

1738 **Board #2** June 1 1:00 PM - 3:00 PM
Voluntary Intake of Ice Slurry Beverages and Exercise Performance During Heat Stress

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(No relationships reported)

Previous investigators reported that voluntary intake of cold fluid is greater than warm fluid due to more favorable palatability, resulting in better maintenance of hydration status and improved exercise performance. It remains unclear whether ingestion of ice slurry beverages compared to cold fluid during exercise yields superior results.

PURPOSE: The purpose of this study was to compare voluntary intake of ice slurry beverages to cold fluid and examine its effect on exercise performance in a hot environment. **METHODS:** Eight participants (mean ± SD; age = 24 ± 4 y, height = 175.2 ± 7.8 cm, mass = 79.6 ± 11.2 kg, body fat = 13.0 ± 5.2%) completed a pretest in 22 °C to determine a maximal workload (W_{max}). Then in 2 separate counterbalanced trials they cycled at 50% W_{max} in 35 °C for 60 min followed by a 15-min time trial to complete as much work as possible. Subjects ingested cold fluid (11.1 ± 2.4 °C) or ice slurry (-1.3 ± 0.3 °C) beverages ad libitum during each 60-min trial. **RESULTS:** Subjects ingested significantly more cold fluid than ice slurry (cold fluid: 1,074.7 ± 442.1 g, ice slurry: 526.9 ± 214.1 g; P = 0.001) but still avoided 2% body mass

loss in both conditions. However, 15-min time trial performance was not different between conditions (cold fluid: 119.5 ± 34.8 kJ, ice slurry: 114.6 ± 20.9 kJ; P = 0.59). **CONCLUSION:** Participants had similar cycling performances despite ingesting half as much ice slurry as cold fluid, suggesting ice slurry beverages might be an efficient means of exercise hydration.

1739 **Board #3** June 1 1:00 PM - 3:00 PM
Effect Of L (-) Menthol On Exercise At A Fixed-RPE In The Heat

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(No relationships reported)

Cooling strategies can be beneficial for athletes during exercise in the heat by lowering thermal discomfort through reductions in core and/or skin temperatures. However, thermoregulatory behaviour may also be modified by non-thermal cooling interventions, such as an L (-) Menthol mouth rinse. **PURPOSE:** To investigate the effects of an L (-) Menthol rinse on thermal sensation, thermal comfort, power output and physiological responses to cycling exercise at a fixed rating of perceived exertion (RPE-16) in the heat.

METHODS: Eight well-trained, non-acclimated males (Age 26 ± 5 years; VO_{2max} 57.5 ± 4.1 mL.kg⁻¹.min⁻¹) completed a familiarisation and two fixed RPE 16 trials. Participants swilled either L (-) Menthol rinse (M) 0.01%, 0.64 mM) or apple flavoured placebo (P) FlavDrops, MyProtein) for 5 s immediately before and at 10 min intervals during an exercise trial in the heat (T_{amb} 35.2 ± 0.6°C; RH 47 ± 3%) whilst blinded to the purpose of the study. Exercise terminated when power output fell to ≤70% of the initial power output. Peak power was measured with isokinetic sprints pre- and immediately-post trial. Skin and core temperature, thermal sensation, thermal comfort, VO₂ and heart rate were recorded during all trials. Data are presented as the mean ± SD; and analyzed with a two-way repeated measure ANOVA with significance set at p<0.05.

RESULTS: Trial duration was 5% longer in M condition (M vs P: 23.0 ± 3.5 vs. 21.8 ± 2.3 min, p<0.05). Power in the M condition had a tendency to be higher for the first 50% of trial duration but was not different overall (172.0 ± 18.7 vs 167.2 ± 18.5 W, p=0.196). Post-trial isokinetic peak power was reduced in M condition but unchanged in P (M: 9.0 ± 7.6%, p<0.05; P: 2.7 ± 6.2 %, p>0.05). There was no change in, core and skin temperature, VO₂ and heart rate between conditions (p>0.05). Thermal sensation reduced across the M trial (2.4 ± 1.1 vs 2.8 ± 0.9, p<0.05), but thermal comfort was unchanged.

CONCLUSIONS: Swilling an L (-) Menthol mouth rinse appears to lower the perception of heat reflected by an alternate pacing strategy increasing both exercise time and workload, during a fixed RPE cycling exercise trial in ~35°C. The decrease in post-trial peak power in the L (-) Menthol condition may have been due to an increased level of peripheral fatigue caused by higher work maintained during the first 50% of the trial.

1740 **Board #4** June 1 1:00 PM - 3:00 PM
Investigating the Potential Mechanisms Responsible for Aerobic Performance Improvements with Neck Cooling in the Heat

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(No relationships reported)

PURPOSE: To assess the mechanisms responsible for previously reported improvements in aerobic performance in the heat with neck cooling. **METHODS:** Eight subjects (4 M, 4 F) cycled in 34°C, 30%RH at a self-selected power output (PO) with a fixed rating of perceived exertion of 16 ("hard" to "very hard") for 90 min or until PO reduced to <70% of their initial value. Participants freely altered PO but were blinded to all performance feedback. Each participant completed four experimental trials: no cooling (CON), neck cooling (NEC), abdominal cooling (ABD), or neck cooling with menthol (MEN). Esophageal (T_{es}), rectal (T_{re}), and skin temperature (T_{sk}) were measured throughout. Whole body thermal sensation (TS_{wb}) and thermal sensation of the neck (TS_{neck}) were measured on a visual analogue scale ranging from 0mm [very cold] to 200mm [very hot].

RESULTS: Mean PO (CON: 170±43 W, NEC: 173±45 W, ABD: 167±38 W, MEN: 168±41 W), exercise duration (CON: 65±22 min, NEC: 65±17 min, ABD: 66±22 min, MEN: 66±18 min) and total work (CON: 620±264 kJ, NEC: 668±280 kJ, ABD: 609±252 kJ, MEN: 643±242 kJ) were similar between trials (P>0.05). Changes in T_{es} were similar (CON: 1.36±0.34°C, NEC: 1.37±0.32°C, ABD: 1.28±0.36°C, MEN: 1.41±0.42°C; P=0.55), but changes in T_{re} were smaller with ABD (0.98±0.40°C) compared to NEC (1.24±0.25°C; P=0.01) and MEN (1.22±0.19°C; P=0.05) but not CON (1.12±0.22°C; P=0.31). Changes in T_{sk} were smaller with ABD (0.41±0.35°C)

compared to CON (0.82±0.41°C; P=0.04), NEC (0.71±0.29°C; P=0.09) and MEN (0.71±0.23°C; P=0.09). Mean TS_{wb} was cooler with MEN (122±38 mm) compared to CON (154±8mm; P=0.04), ABD (147±23mm P<0.01) and NEC (137±32; P=0.05). TS_{neck} was cooler (P<0.05) in MEN (41±48 mm) and NEC (66±28 mm) compared to CON (142±20 mm) and ABD (145±24 mm).

CONCLUSIONS: The lowest thermal strain occurred with ABD, but the coolest whole-body and neck thermal sensation occurred with MEN; however none of these differences yielded performance benefits in the heat.

1741 Board #5 June 1 1:00 PM - 3:00 PM

Cold Saline Infusion and Reduced Severity of Exertional Heat Illness

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(No relationships reported)

The standard of care for initial cooling of a suspected exertional heat illness (EHI) in military training environments is application of ‘ice sheets’ to a casualty. Beginning in 2011 Ft Benning emergency medical services implemented cold (4°C) saline infusion to the pre-hospital transport protocol. **PURPOSE:** To determine the effects of en-route cold saline infusion on biomarkers of EHI severity and length of hospitalization.

METHODS: A retrospective cohort chart review of 290 hospitalized EHI casualties was conducted. Casualties that occurred in 2009-10 (N=153) were the control (CON) group; those in 2011-12 (N=137) received cold saline infusion (CSI) en route to the hospital and were the experimental group. Admission and discharge dates were recorded and length of stay (LOS) was calculated. Biomarkers of organ and tissue damage, including peak creatinine (Cr), creatine kinase (CK), alanine aminotransferase (ALT) and aspartate aminotransferase (AST) concentrations were recorded. Data were not normally distributed and were analyzed using the Mann-Whitney-Wilcoxon (MWW) Ranked Sum Test; median and inter-quartile range (IQR) are reported.

RESULTS: The 290 cases examined represent ~29% of all EHI at Ft Benning and ~6% of all EHI Army-wide during the study period. There were 284 men and 6 women, age 25±5 years.

Variable	CON: 2009-10		CWI: 2011-12		p-value
	Median	IQC	Median	IQC	
LOS, days	3	2	2	1	<0.01
ALT, U/L	84	170	51	56	<0.01
AST, U/L	105	203	87	116	0.13
CK, U/L	2335	5598	1530	4088	0.12
Cr, mg/dL	1.80	0.7	1.4	0.6	<0.01

CONCLUSIONS: These data suggest that the initiation of cold (4°C) saline infusion while en route to a medical treatment facility results in reduced length of stay and lessened severity, as indicated by significantly lower peak ALT and Cr concentrations. Body core temperature data were not available and the effect of CSI on cooling rate remains to be determined.

D-10 Thematic Poster - High Intensity Exercise and Blood Marker Responses

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 404

1742 **Chair:** Rebecca D. Larson. *Univeristy of Oklahoma, Norman, OK.*
(No relationships reported)

1743 Board #1 June 1 1:00 PM - 3:00 PM

An Exploratory Investigation of Inflammation-Associated Circulating MicroRNAs Following Acute High-Intensity Interval Exercise

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(No relationships reported)

PURPOSE: The expression of inflammation-associated circulating microRNAs (ci-miRNAs) has been shown to be upregulated following acute aerobic exercise in both obese and normal-weight individuals. Research has recently discovered that acute high-intensity interval exercise (HIIE) promotes the release of specific ci-miRNAs as regulators of skeletal myogenesis; however, no study has examined the effects of acute HIIE on inflammation-associated ci-miRNAs. Therefore, this study attempted to conduct an exploratory investigation on serum expression of inflammation-associated ci-miRNAs (miR-21, -126, -130b, and -221) after acute HIIE in healthy young males. **METHODS:** Eight males were recruited to participate in HIIE on a cycle ergometer, which consisted of 10 bouts of 1 min cycling at 90% maximum power output, separated by 2 minutes of active rest. Blood samples were collected prior to, immediately after exercise, 30, and 60 minutes into recovery. **RESULTS:** Acute HIIE did not elicit significant alteration on the expression of miR-21, -126, -130b, and -221 across the four time points. **CONCLUSION:** Unlike aerobic exercise, acute HIIE may not regulate the expression of inflammation-associated ci-miRNAs in healthy young males. Further investigation is warranted to recruit individuals with inflammatory conditions (e.g., obesity), as well as modify the work-to-rest ratio of HIIE protocol, to gain a better understanding of the potential role of these inflammation-associated ci-miRNAs in response to exercise.

1744 Board #2 June 1 1:00 PM - 3:00 PM

The Comparison Of High-intensity Interval Exercise-Vs. Continuous Moderate-intensity Exercise-mediated Calprotectin And Inflammatory Mediators

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PURPOSE: Calprotectin is an antimicrobial peptide primarily released from neutrophils and monocytes/macrophages and acts as an immune cell activator during initial stage of innate immune responses. In addition, calprotectin promotes the release of inflammatory mediators (e.g., monocyte chemoattractant protein-1 [MCP-1] and myeloperoxidase [MPO]) to augment chemotaxis and phagocytosis. High-intensity interval exercise (HIIE) has been demonstrated to be more time effective to provide a similar improvement of cardiovascular health in cardiac patients compared to traditional continuous moderate-intensity exercise (CME). Therefore, the purpose of this study was to compare plasma calprotectin, MCP-1 and MPO between acute CME vs. HIIE.

METHODS: Nine healthy males (25±3 yrs) were recruited to participate in HIIE and CME on a cycle ergometer. HIIE consisted of 10 repeated 60 seconds of cycling at 90% max watts (W_{max}) separated by 2 minutes of cycling without resistance, while CME was 28 minutes of cycling at 60% W_{max}. Blood samples were collected prior to, immediately post, and 30 and 60 minutes into recovery following exercise. A linear mixed model for repeated measures was conducted to control for total work output (kilojoules).

RESULTS: A significant condition by time interaction was found for calprotectin (p < 0.001) and MPO (p = 0.007) with a greater elevation in CME. Furthermore, an increase in MCP-1 (p < 0.001) was observed across time in both exercise protocols.

CONCLUSIONS: Our findings indicate that acute HIIE may potentially attenuate the expression of inflammatory mediators (calprotectin and MPO) compared to CME.

1745 Board #3 June 1 1:00 PM - 3:00 PM
Differences In Plasma And Serum BDNF In Response To Acute HIIE

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 (No relationships reported)

PURPOSE: Circulating concentrations of brain-derived neurotrophic factor (BDNF) are reported to increase with acute exercise in a dose-dependent manner; however, the sources of elevated plasma and serum BDNF may differ as workload increases. Elevated plasma BDNF concentrations are believed to reflect release by the brain, which can indicate positive adaptations in brain health, whereas elevations in serum may reflect increased platelet release by the spleen. The popularity and documented benefits of high intensity interval exercise (HIIE), prompted the aim of this study to clarify the acute effects of low-volume, supramaximal HIIE on circulating BDNF. Furthermore, to examine a possible explanation for the changes in plasma BDNF, irisin, a protein involved in the mechanism linking muscle contraction and hippocampal BDNF release, was measured in plasma. **METHODS:** Healthy, sedentary males (N=11) participated in HIIE on a cycle ergometer (10 x 20 seconds of maximal pedaling against 5.5% of the subject's body weight x 10 seconds of rest). Whole blood samples were collected from the antecubital vein prior to, immediately after (POST), and 15 minutes after (15POST) HIIE for BDNF and irisin analyses. **RESULTS:** At rest, serum BDNF concentrations were nearly 40-fold greater compared to plasma. Although no changes in plasma BDNF were observed after HIIE, serum BDNF increased at POST and 15POST ($F_{(2,40)} = 7.277, p = 0.002$). Plasma irisin concentrations significantly decreased at POST ($p = 0.029$). In addition, a positive association between the total change in irisin and total change in plasma BDNF approached significance ($r = 0.501, p = 0.097$). **CONCLUSIONS:** These findings demonstrated that this low-volume, supramaximal HIIE protocol was sufficient for elevating serum BDNF, but not adequate for increasing circulating plasma BDNF in sedentary males. These results may suggest that the intensity of physical activity can differentially affect plasma and serum levels of BDNF. Additional research on HIIE volume and the mechanisms underlying BDNF responses (e.g. irisin) is warranted.

1746 Board #4 June 1 1:00 PM - 3:00 PM
The Response of Leukemia Inhibitory Factor to High-Intensity and High-Volume Resistance Training in Trained Men

David D. Church¹, Jay R. Hoffman, FACSM¹, Gerald T. Mangine², Adam R. Jajtner³, Jeremy R. Townsend⁴, Adam M. Gonzalez⁵, Kyle S. Beyer¹, Ran Wang¹, Carleigh H. Boone¹, Michael B. La Monica¹, Amelia A. Miramonti⁶, Adam, J. Wells¹, David H. Fukuda¹, Jeffrey R. Stout, FACSM¹. ¹University of Central Florida, Orlando, FL. ²Kennesaw State University, Kennesaw, GA. ³Kent State University, Kent, OH. ⁴Lipscomb University, Nashville, TN. ⁵Hofstra University, Hempstead, NY. ⁶University of Nebraska, Lincoln, NE. (Sponsor: Jay R. Hoffman, FACSM)
 (No relationships reported)

PURPOSE: Leukemia inhibitory factor (LIF) and Follistatin like-1 (FSTL1) are myokines involved in the inflammatory response, and have been suggested to be involved in muscle adaptation. The purpose of this study was to characterize the LIF and FSTL1 response to a high intensity (HI) and high volume (HV) bout of resistance exercise (RE) before (PRE) and after (POST) 7 weeks of HI and HV resistance training (RT).

METHODS: Twenty resistance trained men (23.5±2.6 y, 1.79±0.05 m, 75.7±13.75) volunteered for this study. Following a 2-week preparatory phase, participants were randomized into either a HV (n = 10, 4 x 10-12RM, 1-min rest) or HI (n = 10, 4 x 3-5RM, 3-min rest) training protocol for 7 weeks (4 d-week⁻¹). Blood draws were obtained prior to (BL), immediately (IP), 30 min (30P), and 60 min (60P) post-exercise at PRE and POST. Plasma LIF and FSTL1 concentrations were determined using a multiplex signaling assay kit and analyzed with MAGPIX® technology. Area under the curve (AUC) for each myokine was calculated via the trapezoidal method. Data were analyzed using a repeated measures ANOVA. When appropriate, post-hoc analysis using unpaired t-tests were conducted with Bonferroni corrections. In addition, bivariate relationships were examined using Pearson product-moment correlations. **RESULTS:** A significant (p=0.021) training x time interaction was observed for LIF. No main effect of time (p=0.262) was observed at PRE, but was at POST (p=0.025). LIF concentrations at 60P (13.29 pg·mL⁻¹) trended (p=0.083) towards an attenuation from BL concentrations (32.67 pg·mL⁻¹). A significant main effect of time was also observed for FSTL1. FSTL1 concentrations at 60P (6693 pg·mL⁻¹) were significantly (p=0.013) lower compared to IP (7542 pg·mL⁻¹) when collapsed across PRE and POST. Significant correlations were noted between ΔBLIF and ΔBLFSTL1 (r=0.834, p=0.01), and between ΔAUCLIF and ΔAUCFSTL1 (r=0.809, p=0.01).

CONCLUSIONS: LIF concentrations were attenuated at 60P in response to an acute bout of RE after 7-weeks of training. Similarly, FSTL1 concentrations, collapsed across groups, were attenuated after exercise. Changes in LIF were highly correlated to changes in FSTL1 suggesting that adaptations regulating these myokines may be linked.

1747 Board #5 June 1 1:00 PM - 3:00 PM
High Intensity Interval Training Improves Disease Activity and Immune Function in Patients with Rheumatoid Arthritis

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PURPOSE: Rheumatoid arthritis (RA) is a chronic inflammatory disease characterized by a dysfunctional immune system which contributes to disease pathology. Exercise training has many anti-inflammatory and immune enhancing properties. Although exercise training is encouraged in those with RA, adherence is problematic. Adherence to higher intensity interval training is better in deconditioned adults and may offer a means to improve health of those with RA. The aim of this study was to determine if fitness, disease activity and immune dysfunction were modified by ten-weeks of a high intensity interval walking program in older adults with RA.

METHODS: Twelve older (64±7 years) sedentary participants with confirmed RA completed 10-weeks of an ambulatory high intensity interval training program with ten ≥60 second intervals of high intensity (80-90% heart rate reserve (HRR)) separated with bouts of lower intensity intervals (50-60% HRR). Aerobic capacity, DAS-28 ESR, neutrophil and monocyte functions were assessed before and after the intervention. **RESULTS:** Relative peak VO₂ (↑8%; p<.001) and absolute peak VO₂ (↑8%; p<.001) improved, with no change in BMI (p=.170) or body fat % (p=.294). Resting mean arterial blood pressure and heart rate were both reduced (both p<.05). Medication use was stable and as compared to baseline, disease activity (DAS-28 ESR) was reduced by 38% (p=.001) which was primarily through reduced systemic inflammation (ESR; p=.03). This was accompanied by improved neutrophil migration (p=.01) and bacterial phagocytosis (p=.002), while CD14+ monocyte expression of CD16 and TLR-4 expression was reduced (both p<.05) but not monocyte phagocytosis of *E. Coli* (p=.187).

CONCLUSIONS: Ten-weeks of interval training in older individuals with RA rapidly improved aerobic fitness with no change in body composition. Systemic inflammation was changed concordantly with reduced disease activity (from moderate- to low-activity). Immune enhancements imply a reduced risk of infection and systemic inflammation. In sum, high intensity interval training in patients with RA was tolerable, improved cardiorespiratory fitness and favorably modified disease activity in RA, consistent with improved quality of life and infection risk. Funding: EU Marie Curie Outgoing Fellowship Grant (PIOF-GA-2013-629981).

1748 Board #6 June 1 1:00 PM - 3:00 PM
Effect of Interval vs Continuous Exercise Training on Acylated Ghrelin and Appetite in Prediabetic Adults

Emily M. Heiston, Natalie ZM Eichner, Nicole M. Gilbertson, Zhenqi Liu, Eugene J. Barrett, Arthur Weltman, FACSM, Steven K. Malin. *University of Virginia, Charlottesville, VA.* (Sponsor: Arthur Weltman, FACSM)
 (No relationships reported)

Obese individuals are characterized by blunted acylated ghrelin (AG) and increased appetite in response to fasting and feeding. Although exercise may improve weight regulation, few exercise intensity data exist in obese adults with prediabetes in relation to appetite.

Purpose: To determine the effects of short-term interval (INT) vs. continuous (CONT) training on appetite regulation in this clinical population. **Methods:** Thirteen obese adults (Age: 57.8±2.2y, BMI: 34.5±2.2kg/m²) were screened for prediabetes based upon American Diabetes Association criteria (75g OGTT and HbA_{1c}). Subjects were randomized to work-matched INT (n=7, 90% HRmax for 3 min and 50% HRmax for 3 min) or CONT (n=6, 70% HR_{max}) training for 12 supervised sessions over 2 weeks for 60 min/d. Plasma AG was measured at 0, 30 and 60 min of a 75g OGTT before and after training. Visual Analog Scales (VAS) were also administered at 0 and 120 min of the OGTT to examine appetite. Two-day food logs were collected pre- and post-testing to assess ad-libitum diet. Data were analyzed using repeated measures ANOVA and Spearman correlations. **Results:** Fasting AG was not significantly different following INT (64.8±19.7 vs. 75.1±23.5 pg/ml, P=0.31, n=6) or CONT training (71.1±21.6 vs. 70.4±25.8 pg/ml, P=0.94, n=5). Likewise, tAUC was not altered following either exercise intensity intervention (P=0.89). INT and CONT exercise also had no statistical effect on total caloric or macronutrient intake. However, fasting fullness tended to increase following INT exercise only (4.1±5.2 vs. 24.1±27.9 mm, P=0.11).

Conclusion: Despite seemingly divergent responses between AG and fullness, these preliminary data suggest that exercise intensity favorably influences appetite in adults with prediabetes. Further work is required to determine how exercise intensity impacts appetite to optimize weight loss for cardiometabolic health.

D-11 Thematic Poster - Wearables: Applications in Research and Practice

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 304

1749 **Chair:** Patty Freedson, FACSM. *University of Mass Department of Kinesiology, Amherst, MA.*
(No relationships reported)

Board #1 June 1 1:00 PM - 3:00 PM
A Consumer Activity Tracker is Sensitive to Changes in Steps during Simulated Free-Living

Greg J. Petrucci, Jr, Brittany R. Masterler, Melanna F. Cox, John W. Staudenmayer, John R. Sirard, Patty S. Freedson, FACSM. *University of Massachusetts Amherst, Amherst, MA.*
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Reported Relationships: G.J. Petrucci: Contracted Research - Including Principle Investigator; This research was funded by: UMass Institute for Life Sciences Seed Grant and Misfit/Fossil Contract.

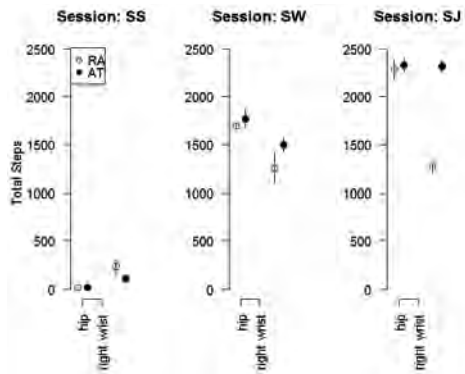
Noted as the top fitness trend for 2016 and 2017, activity trackers are expected to continue to increase in popularity. Forecasts predict that by the end of 2021 over 560 million units will ship, compared with 82 million units that were shipped in 2015. Moreover, there have been inclinations toward adopting consumer activity trackers in intervention research, despite limited validation efforts.

PURPOSE: To determine the sensitivity of a consumer activity tracker (AT) to detect changes in step counts using a research grade accelerometer (RA) to assess concurrent validity.

METHODS: Twenty participants wore the AT and RA, on the right and left wrist, and hip, during three one-hour lab sessions: sedentary session (SS), sedentary plus walking (SW), and sedentary plus jogging (SJ) session. For the SW and SJ sessions, participants performed 30-minutes of sitting and 30 consecutive minutes of walking or jogging at 5.15 and 8.0 kph, respectively. Presentation of sessions was balanced among subjects to eliminate the order effect.

RESULTS: Displayed in figure are total step means and 95% CI's for the 3 sessions and monitor locations. Across all sessions, no significant differences were observed between hip AT and RA estimates of total steps. There were significant changes in total steps across conditions, indicating the AT step measure can detect change as activity dose increased. However, during activity conditions, wrist-worn AT devices yielded significantly greater estimates of steps than the RA.

CONCLUSIONS: While these results are promising, the sensitivity of the AT in detecting changes in usual physical activity volume should be examined under free-living conditions.



1751 Board #2 June 1 1:00 PM - 3:00 PM
Move More, Sit Less? Analysis of an Employer Activity Tracker Workplace Wellness Program

Peter B. Kiessling II, Carol Kennedy-Armbruster, FACSM, Mariah Deinhart, Mary Kerby, Rachel Ryder, Katherine Zukerman, Samantha Schaefer. *Indiana University, Bloomington, IN.* (Sponsor: Carol Kennedy-Armbruster, FACSM)
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(No relationships reported)

Little research exists on behavioral outcomes utilizing wrist-worn activity trackers (AT's). Recent information from Endeavour Partners wearable research shows that sales of AT's have tripled. An estimated 33% of the US population are predicted to own a wearable AT by 2017. Therefore, it's important to conduct behavioral evaluations exploring wrist-worn AT use in combination with physical activity (PA) programming.

PURPOSE: This three-year university community engagement study revealed how student coaching in combination with wrist-worn AT's impacted participant's perceptions of PA and self-reported sitting time. **METHODS:** Quantitative questions regarding sitting time, importance of PA, and confidence in sustaining PA were utilized pre/post 10 week Ready to Move (RTM) program intervention. Six separate groups of employee participants (n=173) received student coaches (n=100) and wrist-worn AT's. Intervention included AT's being distributed to participants along with a student coach to provide instructions on use of AT's. **RESULTS:** PA Importance, pre-survey results showed that participants placed an importance of 8.2/10. Post results showed that participant's importance of PA significantly (p<.001) increased to 8.92/10. Confidence in PA showed pre-results of 7.55/10 and significantly (p<.001) increased in post-results to 8.24/10. 82% of participants self-reporting sitting 3/4 of the time or greater. Post-RTM results demonstrated a self-reported significant (p<.001) decrease in general sitting time with 73.7% of participants reporting sitting 3/4 of the time or greater. The BRFS sitting at work question revealed that 93.75% of participants' pre-RTM reported mostly sitting while at work. Post-RTM results of 92.1% of participants indicated that sitting at work was not impacted. **CONCLUSION:** Overall, the RTM survey results revealed that a combination of coaching and wrist-worn AT usage increased the importance of regular PA for participants, their confidence in sustaining PA and movement, and success in reducing general sitting time. Further policy changes in the workplace are necessary to allow employees to move more while at work.

1752 Board #3 June 1 1:00 PM - 3:00 PM
Adding An Activity Tracker To An Ongoing Community-based Weight-loss Program: Preliminary Results Of An RCT

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Web- and community-based programs effectively promote weight loss, and individuals who use program features more often are more likely to lose a clinically meaningful amount of weight. Many such programs allow participants to synchronize commercially available physical activity (PA) trackers, but the degree to which the provision of such a device would improve participant engagement and weight loss is unclear. **Purpose:** To determine the reach and effectiveness of offering a PA tracker to program participants with the goal of improving program engagement and weight-loss outcomes. **Methods:** A sample of 525 obese (37±6.2 kg/m²) females (44+12.6 yrs) newly enrolled in a web- and community-based weight-loss program were randomized into either an experimental or control group. The experimental group was offered a free PA tracker and asked to provide size and color preferences. Devices were sent to experimental participants who accepted the offer. Program engagement, device use, and weight (lbs) were tracked for three months after program enrollment. **Results:** Of the 266 participants in the experimental sample, 134 (50%) accepted the offer, and 62 (23%) synced the device to their program account. Twenty-two (9%) of the control participants independently obtained and synced a PA tracker. At 3-month follow-up, the experimental group demonstrated greater program engagement than the control group, but only with regard to their likelihood of completing online journal entries (OR(95%CI)= 2.08(1.29,3.37)). There were no significant differences in weight-loss outcomes. Secondary analyses revealed that those who accepted the offer weighed more at baseline (231 vs. 214 lbs; t(df)= 3.40(264); p=.001), and lost more weight (4.71 vs. 1.90 lbs; t(df)= -2.73(264); p=.007) than those who did not accept the offer, and they were more likely to lose 3% body-weight (OR(95%CI)= 2.30(1.21,4.37)) and less likely to drop-out (OR(95%CI)= 2.60(1.58, 4.28)). **Conclusions:** Offering a free PA tracker for use in a web- and community-based weight-loss program reaches a greater proportion of the sample than would independently use this feature. Whether this translates into improved weight-loss outcomes remains unclear. Data collected at 6 and 12 months will be used to determine longer-term effectiveness.

1753 Board #4 June 1 1:00 PM - 3:00 PM
Does Wearable Movement Detection Device Promote Better Exercise Compliance?

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 (No relationships reported)

Information technology (IT) provides efficiency and convenience, however it also reinforces physical inactivity. To provide a remedy the IT industry has designed products that combine mobile apps, websites, and movement detection device for encouraging active lifestyle. Limited studies have examined its' effectiveness.

Purpose: To examine exercise compliance of a 7-min exercise programme through the provision of combining exercise website, mobile apps and movement detection technologies in Hong Kong School Students.

Methods: A total of 185 primary and 178 secondary students were recruited and randomly assigned (by schools & grades) into either an intervention group (n=189) or control group (n=174). The intervention group engaged in a 3-month 7-min moderate intensity interval exercise training (MIIT) program (at least 3 time a week) that incorporated the use of an instructor-led video demonstration website, mobile apps and a wearable movement device (wrist-band); whereas the control group engaged in the same exercise training but without movement detection devices. Major outcome measures were the exercise compliance and health-related fitness before and after intervention.

Results: Two-way repeated measured MANCOVA revealed that, all students regardless of group assignment, improved fitness significantly ($p<.05$). However, the intervention group indicated higher fitness improvement ($p<.05$). The intervention group demonstrated higher ($P<0.05$) exercise compliance (80.53±59.42%) than the control group (65.32±57.20%).

Conclusion: With the inclusion of a wearable movement detection devices (e.g. mobile apps + wrist bands) in an exercise training program, exercise compliance and physical fitness could be better improved, and may be considered when planning health and fitness promotion for school students.

1754 Board #5 June 1 1:00 PM - 3:00 PM
Fit Physician - An Interdisciplinary Approach To Promoting Physical Activity In Medical Students Utilizing Activity Trackers

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 (No relationships reported)

Healthy people 2020 and the American College of Sports Medicine's (ACSM) program, "Exercise is Medicine" have called for an increase in the amount of physician office visits that include discussions on physical activity and health promotion. However, physicians are not counseling their patients on physical activity at sufficient rates. It has been shown that physicians who are more physically active and who have positive health habits are more likely to counsel their patients. Currently under 20% of Canadian and US medical schools offer any kind of health promotion and education to medical students.

PURPOSE: To develop a physical activity and health promotion program among first year osteopathic medical students.

METHODS: 80 first year medical students were randomized into 2 groups. Both groups were given activity trackers. Group 1 (n=40) participated in educational seminars on nutrition and healthy lifestyle habits. In addition, Group 1 attended weekly mentored walks or runs along with fitness challenges were given weekly updates on their activity level. Group 2 (n=40) was given activity trackers with no other intervention. Data was collected on a dashboard that records each subject's daily activity and sleep duration. Academic test scores were obtained from subjects first comprehensive examination within the first 8 weeks of this program. A two way t-test was used to analyze daily steps taken, sleep duration, and academic performance for 10 weeks between groups. Statistical significance was set at $p<0.05$.

RESULTS: After 8 weeks of our FIT-PHYSICIAN program demonstrated that the intervention group (Group 1) had significantly more steps taken compared to Group 2 ($p=0.001$). There were no statistically significant differences in sleep duration ($p=0.16$) or in average composite test scores ($p=0.30$).

CONCLUSIONS: Utilizing activity trackers in conjunction with health education and weekly activity interventions in the first 8 weeks of medical school yielded an increased step count compared to wearing an activity tracker alone. Physical activity and educational intervention did have an effect on composite test scores and sleep duration between groups.

1755 Board #6 June 1 1:00 PM - 3:00 PM
Comparison of Smartphone Pedometer Apps on a Treadmill versus Outdoors

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 (No relationships reported)

Previous research has focused on the accuracy of smartphone pedometer apps in laboratory settings, however less information is available in outdoor (free living) environments.

PURPOSE: To determine the accuracy of 5 smartphone apps at recording steps at a walking speed in a laboratory versus an outdoor setting.

METHODS: Twenty-three healthy college students consented (11 Male; Mean±SD; 22±3.8yrs; BMI 24.9±4.13kg/m²) to participate in 2 separate visits. During the first visit participants walked 500 steps at 3mph on a treadmill while wearing a pedometer and a smartphone placed in the pocket using 5 pedometer apps concurrently (Moves, Google Fit (G-Fit), Runtastic, Accupedo, S-Health). During the second visit, participants walked 400 meters at 3mph on a sidewalk outside. Actual steps for each visit were recorded using a hand tally counter device. Zero and negative values were replaced with the mean value for that trial. Statistical analyses were performed using IBM SPSS 23.0. Mean bias scores were calculated between the step count for each app and the respective tally count for each trial. Mean bias scores were correlated between trials for each app using Pearson correlations and significance was set at $p<0.05$. Mean Absolute Percent Error (MAPE) values were also calculated for each app for both trials.

RESULTS: G-Fit recorded 2 zero values and 2 negative values and Moves recorded 1 zero value. Mean bias scores were significantly correlated between the indoor and outdoor protocols for the pedometer ($r=0.67$, $p<0.01$) and S-Health ($r=0.46$, $p<0.5$). The remaining apps were not correlated between protocols. The outdoor protocol producing a greater mean bias for the outdoor protocol for G-Fit, Runtastic, and Accupedo (mean bias ± SD indoor, outdoor; -4.3±53.1, -19.3±120.0; -10.7±63.3, -33.4±118.7; 16.0±143.6, 79.0±75.0; respectively) and a greater mean bias for the indoor protocol for the pedometer, Moves, and S-Health (mean bias indoor, outdoor; -1.4±41.5, 0.0±34.1; -117.4±196.7, -42.2±209.6; 11.3±28.4, 0.0±58.7; respectively). MAPE was below 5% for the pedometer and S-Health for both trials.

CONCLUSIONS: Apps with the lowest error in a controlled setting may be less affected when used in other settings, while apps with greater variation in a controlled setting may be affected when used in a different environment.

1756 Board #7 June 1 1:00 PM - 3:00 PM
Comparison Of Step Estimates Between A Consumer Activity Tracker And Research Accelerometer On The Dominant And Non-dominant Wrist

Brittany Masteller, 01002, Melanna Cox, Greg Petrucci, John Staudenmayer, John Sirard, Patty Freedson, FACSM. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: Patty Freedson, FACSM)
 (No relationships reported)

Many consumer activity trackers (AT) can be worn at different locations such as the hip, shoe, or wrist. The versatility of wear locations makes these devices attractive to the consumer. However, there is limited data on the differences between wear locations of the dominant (D) and non-dominant (ND) wrist location when estimating steps, a common metric produced by many AT.

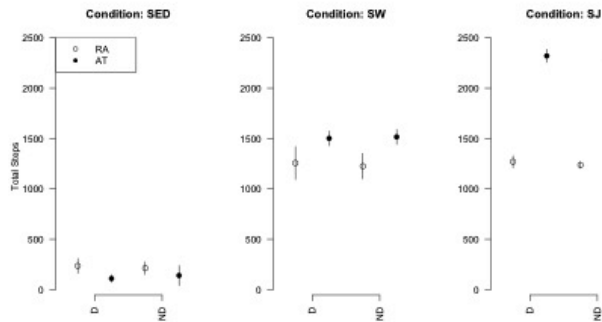
Purpose: To compare estimates of total steps (TS) obtained from a consumer AT and a research accelerometer (RA) worn simultaneously on the dominant (D) and non-dominant (ND) wrist during three simulated free-living conditions.

Methods: Twenty healthy adults wore an AT and RA on the D and ND wrist and completed three 1-hour laboratory conditions: 1) sedentary (SED), 2) sedentary plus walking (SW), and sedentary plus jogging (SJ). During the SED condition, participants completed 60 minutes of sitting. During the SW and SJ conditions, participants completed 30 minutes of sitting plus 30 minutes of continuous walking or jogging at 3.0 or 5.0 mph, respectively. Means and 95% confidence intervals were used to assess differences of TS between the D and ND wrist locations for the AT and RA among all three conditions.

Results: Within devices, similar TS estimates were produced from the D and ND wrist across all three conditions. Between devices, the AT and RA placed at the D and ND wrist produced similar estimates of TS during the SED and SW conditions. For the SJ condition, the AT produced significantly higher TS estimates, compared with the RA, which was less sensitive to TS detection with increasing intensity.

Conclusions: Researchers should use caution when using TS detected from a wrist-worn RA. An additional criterion measure, such as manual step counting, would more clearly identify under- and over-reporting of TS output from AT and RA during controlled laboratory settings.

Supported by: Seed Grant from the Institute of Applied Life Sciences at University of Massachusetts, Amherst and by Fossil Inc.



1757 Board #8 June 1 1:00 PM - 3:00 PM

Physical Activity Trackers in Combination with Motivational Interviewing to Increase Activity

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(No relationships reported)

Evidence is equivocal regarding the benefits of wearable technology for increasing physical activity. Use of these devices in combination with health coaching strategies like motivational interviewing (MI) may be more effective. **PURPOSE:** The study examined if physical activity trackers increase activity levels in healthy adults and if the addition of MI results in greater benefits. A secondary purpose was to examine characteristics of those who were successful in increasing physical activity versus those who were not in order to determine who is more likely to benefit from this type of intervention. **METHODS:** Ninety-four healthy men and women (mean age 41 ± 9 years) were randomly assigned to one of two groups for a 12-week intervention. Groups received either 1) a physical activity tracker (PAT) alone, or 2) a physical activity tracker and three sessions of MI (PAT+MI). Physical activity was assessed pre and post-intervention with accelerometers. Average steps per day were compared within and between groups pre- and post-intervention using paired and independent sample t-tests. Participants were then split into two groups based on whether they increased their mean daily step count from baseline. These post-hoc groups were then compared on demographic and baseline physical activity characteristics. **RESULTS:** Complete data were collected on 84 individuals. Physical activity measured in average steps per day did not increase significantly for either group (PAT+MI – pre: 7496 ± 2895 steps/day, post: 7624 ± 3557 steps/day; PAT – pre: 7519 ± 2259 steps/day, post: 7097 ± 2179 steps/day; p>0.05); further, no group differences were observed (p>0.05). When comparing those who improved over the intervention to those who did not, there were no differences in demographic characteristics including age, gender, income, or education level. However, those who improved over the intervention accumulated significantly fewer steps at baseline (6650 ± 2056 vs. 8522 ± 2871, p < 0.0001). **CONCLUSION:** The provision of a physical activity tracker (with or without brief MI sessions) was not sufficient to increase physical activity in this sample; however, individuals with low baseline activity achieved more significant benefits.

D-12 Free Communication/Slide - Biomechanics after ACL Reconstruction

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 104

1758 **Chair:** Susan M. Sigward. *University of Southern California, Los Angeles, CA.*

(No relationships reported)

1759 June 1 1:00 PM - 1:15 PM

Limb Asymmetry During Anterior Cruciate Ligament Reconstruction Recovery

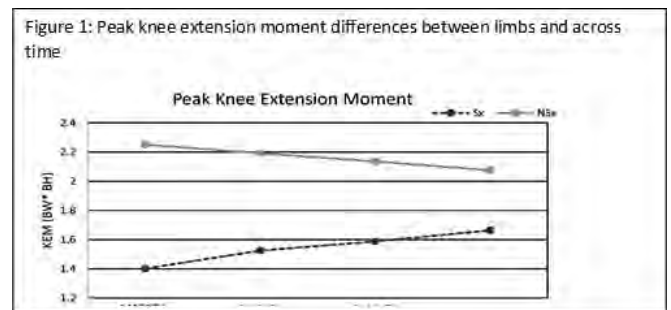
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(No relationships reported)

Limb asymmetries in loading and movement patterns persist up to 2 years after anterior cruciate ligament reconstruction (ACL) and are related to re-injury risk. **PURPOSE:** To determine changes in limb asymmetry across the first year following ACLR. **METHODS:** 23 adolescent ACLR athletes participated in the study (14 female, 9 male). Movement and loading mechanics were collected using an 8 camera motion capture system (120Hz) and 2 embedded force plates (2400Hz) during five vertical stop-jump trials. All analyses were completed using the MIXED models ANOVA procedure in SAS (version 9.3, Cary, NC), with a type I error rate of α=0.05. **RESULTS:** An interaction between time and surgical limb was observed for the peak knee extension moment (KEM) (p=0.041) with the surgical (Sx) and non-surgical (NSx) limbs converging across time (Figure 1). When examining side-to-side symmetry, there were no differences in frontal plane knee range of motion (ROM), sagittal plane hip ROM, and sagittal plane knee angle at contact independent of time. For the peak vertical ground reaction force (GRF) (p<0.001), impulse (p<0.001), limb stiffness (p<0.001), peak posterior GRF (p<0.001), and peak knee flexion angle (p=0.049) the NSx side demonstrated an increased value when compared to the Sx side. The peak vertical GRF and impulse were asymmetric up to 12 months after ACLR. However, loading rate and peak posterior GRF demonstrated asymmetry up to 6 months after ACLR, while limb stiffness asymmetry perpetuated until 5 months after ACLR. **CONCLUSIONS:** Movement and load asymmetry remain up to 12 months following surgery indicating that these patients are at risk for subsequent injuries even after being released to return to sports. Additional therapeutic interventions need to be implemented to restore symmetry and improve landing mechanics prior to athletes being return to sports.

Figure 1: Peak knee extension moment differences between limbs and across time



1760 June 1 1:15 PM - 1:30 PM

Biomechanical Asymmetries in Drop Jump Improve During Rehabilitation Following ACL Reconstruction in Adolescents

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(No relationships reported)

PURPOSE: This study examined 3D motion during drop jump landing between early and late stages of rehabilitation in young athletes following anterior cruciate ligament reconstruction (ACL). **METHODS:** 21 athletes (14 female; age range 10.7-17.7 years) with unilateral ACLR underwent motion testing 3-6 months and again 6-10 months post-operatively. 3D motion was analyzed during the landing phase of a 41 cm vertical drop jump, and differences were compared between visits and operative

THURSDAY, JUNE 1, 2017

and contralateral limbs using paired t-tests. **RESULTS:** At the first visit, operative limbs exhibited less knee flexion (94 vs. 98°, $p=0.002$) and ankle dorsiflexion (28 vs. 30°, $p=0.02$), lower vertical ground reaction force (vGRF) (1.5 vs. 2.1 body weights, $p=0.0005$), lower knee and ankle sagittal moments (knee 0.71 vs. 0.97 Nm/kg, $p=0.002$; ankle 0.70 vs. 0.86 Nm/kg, $p=0.001$) and power absorption (knee 0.83 vs. 1.4 Nm/kg, $p<0.0001$; ankle 0.56 vs. 0.77 Nm/kg, $p=0.03$) compared with the contralateral side. Between visits, hip and knee flexion increased on the operative (hip 10.4° change, $p=0.007$; knee 9.5°, $p=0.005$) and contralateral (hip 10.4°, $p=0.007$; knee 7.6°, $p=0.01$) sides, as well as hip flexion moments and power absorption ($p<0.01$). Power absorption at the knee increased on the operative side only (0.18 Nm/kg, $p=0.01$), with a trend of increased vGRF ($p=0.08$), but remained lower than the contralateral side. No significant changes between visits were observed at the ankle, and only minor differences were observed in the frontal and transverse planes. **CONCLUSION:** During early rehabilitation pediatric and adolescent athletes with ACLR reduce flexion and loading of the knee and ankle on their operative limb, possibly representing an avoidance mechanism. Motion and loading at the knee increase over time but remain reduced relative to the contralateral side 6-10 months post-operatively. Increased hip flexion motion, moments, and power absorption may indicate improvements in proximal control as rehabilitation progresses, which may aid in compensation for persistent deficiencies at the knee. Motion analysis appears to provide valuable insight into resolution of this avoidance mechanism and improvements in proximal control which may be used as a valuable marker for readiness to return to play after ACLR.

1761 June 1 1:30 PM - 1:45 PM

Hip-Dominant Landing Strategy During the Second Landing of a Drop Vertical Jump After ACL Reconstruction

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(No relationships reported)

Drop vertical jump (DVJ) performance is often used to aid in the decision to return to sport after anterior cruciate ligament reconstruction (ACLR). In healthy subjects, the 2nd landing from a DVJ imposes greater demand in the sagittal plane. Deficits in sagittal plane angle and moments at the knee and hip are commonly seen in gait after an ACLR and are linked to poor return-to-sport outcomes. However, how this propagates to tasks such as the 2nd landing of a DVJ has not been well characterized. Furthermore, whether sagittal plane mechanics of the ACLR limb are restored to be similar to a matched control group during the 2nd landing of a DVJ is unknown. **PURPOSE:** To compare sagittal plane mechanics between the ACLR limb and a control group during the 2nd landing of a DVJ.

METHODS: Twenty-two subjects (10 F, age 20.6 ± 5 y, H 1.74 ± 0.1 m, M 71.4 ± 12.5 kg) 6 months post ACLR and 12 controls (5 F, age 21 ± 3 y, H 1.7 ± 0.1 m, M 65 ± 12 kg) performed a DVJ. Three-dimensional motion analysis was conducted while subjects performed a DVJ by stepping off a 30.5 cm box, landing on two feet (1st landing), immediately transitioning into a maximal vertical jump, and landing on two feet a second time (2nd landing). Visual 3D was used to analyze sagittal plane hip and knee mechanics at initial contact. Independent sample t-tests were used to compare groups.

RESULTS: The ACLR limb had significantly greater knee and hip flexion angles than the control group (Knee: -31 ± 9.4 vs -22 ± 5.1°, $p=0.004$, Hip: 27.2 ± 12.9 vs 17.2 ± 14.5°, $p=0.04$). Additionally, the ACLR limb demonstrated less knee extensor moment, but greater hip extensor moment compared to the control group (Knee: -0.22 ± 0.21 vs 0.03 ± 0.21 Nm/kg²m, $p=0.002$, Hip: -0.32 ± 0.2 vs -0.13 ± 0.24 Nm/kg²m, $p=0.01$).

CONCLUSIONS: The combination of greater knee flexion angles with a reduced knee extensor moment suggests the ACLR limb is unable to control the increased sagittal plane demands of the 2nd landing. Additionally, increased hip extensor moment in the ACLR group indicates an altered landing strategy to transfer load absorption from the knee to the hip musculature. Future work should explore the relationship between altered landing strategies to hip and knee muscle strength to identify possible interventions to restore knee neuromuscular control after an ACLR.

1762 June 1 1:45 PM - 2:00 PM

The Effect Of Fear Of Re injury On Biomechanics During A Jump Landing Following ACL Reconstruction

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(No relationships reported)

Fear of reinjury has been identified as a barrier patients must overcome in order to return to sports after ACL reconstruction (ACLR), but may also affect movement patterns during functional tasks. **PURPOSE:** To compare kinematics and kinetics during jump landing between individuals who have undergone ACLR with high, moderate, and low fear of reinjury. **METHODS:** An electromagnetic tracking system interfaced with non-conductive force plates was used to capture joint motion and

force during landing in 59 females (age: 18.8±1.4 yr; time from surgery 25.5±11.9 mo) with a history of unilateral ACLR that were cleared to return to sport. Participants performed 5 trials of a standardized jump landing. Fear was assessed using the Tampa Scale of Kinesiophobia -11 (TSK-11) with higher scores indicating greater fear. Groups were created based on tertile cut-points of TSK-11 scores (High (HIGH): TSK > 21, n=21; Moderate (MOD): TSK 17-20, n=20; Low (LOW): < 17, n=18). Primary variables were peak hip and knee kinematics and kinetics of the reconstructed limb. One-way ANOVAs were used for between group comparisons with post-hoc analysis of least significant differences (LSD) when necessary (*a-priori* $\alpha<0.05$). **RESULTS:** Demographics did not differ between groups ($p>0.05$) (height, weight, age, or time from surgery). TSK-11 was significantly different between all groups ($p<0.001$) indicating our grouping was successful. Peak hip flexion angles on the were lower in HIGH (80.4±16.4°) compared to MOD (93.5±11.6°; $p=0.006$) and LOW (95.6±15.0°; $p=0.002$). Peak knee flexion in HIGH (90.8±14.0°) was significantly lower than in MOD (102.2±14.3°; $p=0.013$). Peak hip abduction angle LOW (7.4±6.1°) was greater than MOD (5.6±6.0°; $p=0.001$) and HIGH (1.0±6.9°; $p=0.003$). Hip extension moment was significantly higher in LOW (2.3±1.0 Nm/kg) compared to MOD (1.7±.6Nm/kg; $p=0.01$) and HIGH (1.8±.6 Nm/kg; $p=0.03$). Finally, LOW (7.3 Nm/kg) had a greater hip adduction moment compared to MOD (5.2 Nm/kg; $p=0.01$). **CONCLUSIONS:** High fear of reinjury was associated with "stiffening" hip and knee motion during a jump landing. Fear of reinjury is a barrier that must be overcome for successful return to sport, but might not be fully addressed during current rehabilitation protocols. This important factor may influence movement patterns for years following reconstruction.

1763 June 1 2:00 PM - 2:15 PM

Reduced Rate of Quadriceps Activation during Running and Jumping in Collegiate Athletes post-ACL Reconstruction

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Running, jumping, and most sports activities involve sequences of rapid muscle activation and relaxation, or rapid increases and decreases in force production. Rapid quadriceps activation and force development (typically assessed with isolated, isometric methods) are reduced after anterior cruciate ligament reconstruction (ACLR). Rate of neuromuscular activation during sports activities after ACLR has not been examined.

Purpose: To investigate side-to-side asymmetries in rate of neuromuscular activation of the thigh and hip muscles during jumping and running in collegiate athletes post-ACLR.

Methods: Twelve Division I athletes (age 20.6 ± 1.8, BMI 25.5 ± 2.8, 7.0 ± 3.1 months post-surgery) performed maximal counter movement jumps (CMJ) and treadmill running at preferred speed (2.88 ± 0.27 m/s) while surface electromyography (EMG) of the bilateral rectus femoris (RF), vastus lateralis (VL), medial hamstrings (MH), biceps femoris (BF), and gluteus maximus (GMX) was recorded. Root mean square values of the EMG signal from 0-50 ms were computed from the initiation of the eccentric (ECC), concentric (CONC), and landing (LAND) phases of the CMJ (e.g., RF_{0-50}). During running, rate of EMG rise (e.g., RF_{RR}) was averaged over 18.8 ± 1.3 strides. Limb asymmetries were computed and compared for each muscle and condition using Wilcoxon Signed-Ranks tests.

Results: VL_{0-50} was significantly lower in the INV limb in all CMJ phases (ECC: INV 24.3 ± 17.8%, UN 36.1 ± 22.5%; CONC: INV 59.3 ± 26.2%, UN 76.2 ± 22.1%; LAND: INV 34.1 ± 12.2%, UN 58.9 ± 27.5%). RF_{0-50} was significantly lower in the INV limb at initiation of the CONC (INV 46.0 ± 25.0%, UN 70.1 ± 23.4%) and LAND (INV 45.1 ± 19.3%, UN 57.8 ± 27.6%) phases. INV limb BF_{0-50} was significantly reduced in the CONC phase (INV 46.6 ± 28.5%, UN 64.8 ± 31.3%). During running, VL_{RR} and RF_{RR} were significantly lower in the INV limb (79.9 ± 41.7% and 78.2 ± 27.2% of UN limb values). There were no between-limb differences in MH or GMX rate of activation in either task.

Conclusion: Collegiate athletes demonstrated reduced INV limb rate of quadriceps activation during jumping and running 7 months post-ACLR. These findings have important clinical implications as sports activities require rapid muscle activation. Rehabilitation efforts to improve fast activation of the quadriceps should be explored.

1764 June 1 2:15 PM - 2:30 PM

3D Hip And Knee Mechanics During Hop Tests After ACL Reconstruction Measured With Inertial Sensors

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Hop testing after an Anterior Cruciate Ligament reconstruction (ACLR) is a common functional test to determine return to play status. Due to the difficulty in capturing knee and hip mechanics over a large area while hopping little is known of differences in kinematics that may persist. Advancements in inertial sensor technology allow for assessment of hip and knee mechanics outside the laboratory setting and could provide significant insights into how these functional tests are performed.

Purpose

To investigate hip and knee mechanics in ACLR patients and healthy controls in the sagittal and frontal plane during hop tests, using inertial magnetic measurement units (IMMUs).

Methods

5 ACLR patients (2 male, 3 female, 20.4 ± 2.1 yrs, 164.2 ± 10.7 cm, 69.1 ± 23.5 kg) one year post reconstruction, and 10 healthy controls (7 male, 3 female, 21.8 ± 2.0 yrs, 178.3 ± 10.2 cm, 73.5 ± 14.3 kg) performed a single leg hop and a triple hop for distance with the reconstructed or dominant leg while wearing a suit equipped with 8 IMMUs at the feet, tibia, upper legs, sacrum and sternum. Sagittal and frontal plane hip and knee angles (flexion, abduction) at initial contact (IC) were calculated. Independent Mann-Whitney U-tests were used to statistically compare the data.

Results

Significant differences (p<0.05) in knee and hip flexion and knee abduction were observed at IC for the single leg hop and triple hop between groups (table 1).

Table 1: Knee and hip mechanics (±SD) during single leg and each landing from triple hop at IC; an asterisk denotes a statistical significant difference at p<0.05.

		Single leg hop			Triple Hop								
		IC			IC 1			IC 2			IC 3		
		ACLR	Control		ACLR	Control	ACLR	Control	ACLR	Control	ACLR	Control	
Knee	Flexion	10.1 (9.9)	* 20.2 (7.4)		16.7 (9.3)	* 34.1 (14.1)	13.7 (9.0)	* 32.7 (17.4)	11.0 (6.6)	* 22.9 (20.7*)			
	Abduction	0.2 (3.5)	* 4.0 (3.3)		0.9 (4.0)	6.1 (6.1)	0.8 (3.4)	5.0 (5.1)	-0.3 (5.8)	3.5 (7.0)			
Hip	Flexion	29.3 (9.1)	* 44.1 (9.5)		33.3 (4.8)	* 42.2 (8.5)	32.1 (5.5)	* 43.4 (5.8)	28.8 (8.1)	* 40.5 (12.9)			
	Abduction	7.8 (6.0)	6.0 (7.7)		0.8 (5.8)	2.4 (5.5)	1.5 (2.9)	0.5 (4.5)	7.1 (7.7)	10.0 (6.2)			

Conclusions

Subjects who have had an ACLR employ landing strategy of less hip and knee flexion and abduction when performing a single leg and triple hop as compared to the mechanics of healthy control subjects. This results in a stiffer landing strategy that may predispose them to secondary injuries if not fully addressed.

Supported by a grant from the Dutch Fulbright Centre.

1765 June 1 2:30 PM - 2:45 PM

Relationship Between Quadriceps Function and Patient Reported Outcomes in ACL-R Patients With and Without Osteoarthritis

Grant Norte¹, Jay Hertel, FACSM², Susan Saliba², David Diduch², Joe Hart, FACSM². ¹University of Toledo, Toledo, OH. ²University of Virginia, Charlottesville, VA. (Sponsor: Joe Hart, FACSM)
(No relationships reported)

The relationship between quadriceps muscle function and patient-reported outcomes over time after ACL reconstruction (ACLR) may help clinicians better understand which factors may be affecting quality of life. **PURPOSE:** To identify the relationship between objective measures of quadriceps function and patient-reported outcomes early (< 1 year) and late (> 2 years) after ACLR, including patients who experienced post-traumatic knee osteoarthritis. **METHODS:** This was a cross sectional study of 72 ACLR patients, categorized as early (n = 34, age = 22.5 ± 6.3, height = 174.1 ± 11.0 cm, mass = 73.9 ± 16.9 kg, time from surgery = 9.0 ± 4.3 months), late (n = 30, age = 24.9 ± 5.9, height = 171.7 ± 11.8 cm, mass = 74.9 ± 16.2 kg, time from surgery = 70.5 ± 41.6 months), or diagnosed with knee osteoarthritis (n = 8, age = 45.4 ± 7.4, height = 170.0 ± 9.7 cm, mass = 85.2 ± 24.8 kg, time from surgery = 115.9 ± 110.0 months). Quadriceps isokinetic strength (peak torque, total work, average power), maximum voluntary isometric contraction (MVIC) torque, fatigue index, central activation ratio, spinal reflex excitability (Hoffmann [H] reflex), and corticospinal excitability (active motor threshold [AMT]) were measured bilaterally. The Knee Osteoarthritis Outcome Score (KOOS) and Veteran's Rand 12-Item Health Survey (VR-12) were

used to quantify regional knee function and global health. Multiple linear (stepwise) regression analyses were used to predict patient reported outcomes using measures of quadriceps function and patient demographics (pain, activity level, time since surgery, and age) in each group. **RESULTS:** In patients early after ACLR, knee extensor work, AMT symmetry, pain, and activity level explained 67.8% of variance in KOOS (p < .001); whereas, knee extensor work, activity level, and pain explained 53.0% variance in VR-12 (p < .001). In patients late after ACLR, age and isokinetic torque symmetry explained 28.9% of variance in KOOS (p = .004), and did not explain variance in VR-12. In patients with osteoarthritis, kinesiophobia and isokinetic torque explained 77.8% of variance in KOOS score (p = .010); whereas, activity level explained 86.4% variance in VR-12 (p = .001). **CONCLUSION:** Factors that predict patient reported outcomes are different for patients early and late after ACLR, and in those with diagnosed knee osteoarthritis.

1766 June 1 2:45 PM - 3:00 PM

The Long Term Effect Of Quadriceps Strength On Patient Reported Outcomes After An ACL Reconstruction

Molly Lex, Darren Johnson, FACSM, Mary Lloyd Ireland, FACSM, Brian Noehren, FACSM. University of Kentucky, Lexington, KY.
(No relationships reported)

Reductions in quadriceps strength following an anterior cruciate ligament (ACL) reconstruction have been hypothesized to reduce quality of life in as little as five years. While commonly speculated upon, the relationship between quadriceps strength and patient reported outcomes (PRO's) has not been formally tested. We hypothesized that greater quadriceps strength and better performance on the timed step down test (TSDT) would predict patient reported outcomes.

Purpose: To determine if quadriceps strength and the 60 second TSDT were able to predict patient reported outcomes at an average of an eight year follow up after ACL reconstruction.

Methods: 40 subjects (29 F, 34 ± 11 years old, H 1.71 ± 0.1 m, M 73 ± 12 kg, Tegner 5.7 ± 1.3) at least 5 years from an ACL reconstruction completed the study. Five maximum voluntary isometric contractions were measured using the Biodex dynamometer and normalized to body weight. The subjects also performed the TSDT, where they completed as many single leg step downs as possible in 60 seconds off of a box of standard height, touching their heel to a scale with less than 10% of their body weight. Patient reported outcomes were recorded on the International Knee Documentation Committee (IKDC) and Lysholm Knee Questionnaire. Multiple linear regressions were performed to assess the relationship between strength and PRO's. **Results:** Mean values for knee extension strength was 2.5 ± 0.50 N/kg, IKDC 82.0 ± 16.1, Lysholm 87.8 ± 11.6, TSDT 31.7 ± 13.2 stepdowns. We found that quadriceps strength, 60 second TSDT, and the interaction between quadriceps strength and Tegner activity levels explained 55% of the variance in the IKDC (F=9.816, p<0.0001) and 45% of the variance in the Lysholm scale (F=7.034, p=0.0003).

Conclusion: Quadriceps strength, TSDT, and Tegner activity levels explained almost half of the variance in self-reported knee functioning long term after an ACL reconstruction. These results suggest that modifiable factors such as muscle strength and endurance could have a significant impact on improving long term outcomes for patients following an ACL reconstruction. Additional studies are needed to assess the effect of maximizing quadriceps strength on the improvements in patient's quality of life.

D-13 Free Communication/Slide - Mechanisms of Muscle Atrophy and Hypertrophy

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 504

1767 **Chair:** Brian Ferguson. University of Illinois - Chicago, Chicago, IL.
(No relationships reported)

1768 June 1 1:00 PM - 1:15 PM
Development of a Risk Index for Predicting Older Adults' Sarcopenia

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(No relationships reported)

Muscle attenuation well exists in adults especially in old adults. Decay rate of muscles in old adults was a key symbol of aging. Delaying sarcopenia is an important focal

point. Identifying people who suffer from the sarcopenia using physical fitness/function measures earlier could play a key role in the early prevention of sarcopenia among the older adults.

PURPOSE: To develop a risk index to predict older adults' sarcopenia using a set of physical fitness and function measures.

METHODS: We administered a set of physical fitness and function tests to 1320 volunteered old Chinese adults (75.03±6.83 yr.; height: 159.16±8.28 cm; mass: 63.30±1.55 kg; male: 28.9%), including vital capacity, hand grip, back muscle strength measured by pull sensor, 30 seconds Chair Stand (30sCS), standing toes, seated body flexion, hands back hook, standing on one foot with eyes closed, reaction time, Timed Up and Go (TUG) and 6-M Gait Speed (GS). Their muscle mass of body was measured using Magnetic Resonance Imaging. The Appendicular Skeletal Muscle Index (ASMI) was calculated by the muscle mass of limbs and prevalence rates of the sarcopenia were computed. Using the logistic regression analysis and ROC curve methods, a risk index to predict older adults' sarcopenia was then derived using the physical fitness and function measures.

RESULTS: According to the ASMI reference values recommended by the Asian Work Group of Sarcopenia, the prevalence rates of sarcopenia in males and females, which ranged from 0.15 to 6.84%. The logistic regression prediction model derived was: Sarcopenia rate = $\exp(21.950 - 2.816 \times \text{ASMI} - 0.190 \times \text{Grip} + 0.770 \times \text{GS} - 0.156 \times 30\text{sCS}) / [1 + \exp(21.950 - 2.816 \times \text{ASMI} - 0.190 \times \text{Grip} + 0.770 \times \text{GS} - 0.156 \times 30\text{sCS})] \times 100\%$. The accuracy of the prediction was supported by ROC (the area under the ROC curve is 0.95), with the sensitivity of 87.90% and the specificity of 95.00%.

CONCLUSIONS: A simple and easy-to-use risk index for older adults' sarcopenia was derived by this study and the accuracy of the prediction was supported. In addition, like commonly used individual measure of sarcopenia such as ASMI, hand grip and GS, 30sCS was found a useful single measure for determining the sarcopenia.

Corresponding author: Chunmei Cao

Study was supported by Independent scientific research plan of Ministry of Education (20121088023)

1769 June 1 1:15 PM - 1:30 PM

Heat Treatment Regulates Autophagy in C2C12 Myotubes

Corey M. Summers, Rudy J. Valentine. *Iowa State University, Ames, IA.*

(No relationships reported)

Autophagy is a cellular process that allows for recycling of intracellular macromolecules and organelles. This process has been shown to be regulated by nutrient availability, with an upregulation in nutrient depleted conditions and a downregulation during nutrient excess. Prolonged heat stress has been shown to dysregulate autophagic signaling in skeletal muscle, leading to deleterious consequences. In contrast, exposure to short durations of heat (heat treatment) appears to have therapeutic effects. However, the impact of heat treatment on autophagy remains unknown.

PURPOSE: To investigate the effects of an acute bout of heat treatment on autophagic signaling in skeletal muscle cells. **METHODS:** C2C12 myoblasts were grown and differentiated into myotubes. Following differentiation, cells were maintained at 37°C (thermal neutral; TN) or heated at 40°C (heat treatment; HT) for 1 or 2h. Heated cells were harvested immediately, 2h post-heating (recovery), or 24h recovery. Bafilomycin A₁ (Baf, 100 nM), an autophagy inhibitor, was added to a subset of cells 3h prior to harvest. During recovery all cells were returned to 37°C. Cell lysates were analyzed via Western blot and densitometry. Statistical analysis of the data was performed by one-way analysis of variance (ANOVA) or an unpaired t-test, with $\alpha=0.05$. **RESULTS:** One hour of HT increased the phosphorylation of AMPK^{T172} (64%, $p<0.05$) and the levels of LC3 II (29%, $p<0.01$) compared to TN cells. AMPK phosphorylation returned to baseline by 2h of recovery, while LC3 II remained elevated until 24h of recovery. When heat was extended to 2h, there was a similar increase in AMPK phosphorylation (56%, $p<0.05$), and a reduction in the phosphorylation of mTOR^{S2448} (15%, $p<0.01$), without altering LC3 II. In the presence of Baf, 2h of HT increased p62 (62%, $p<0.001$) and LC3 II (75%, $p<0.01$) beyond HT alone. However, in 2h HT vs TN, the addition of Baf led to a reduction in LC3 II (24%, $p<0.05$) and a trend for increased phosphorylation of ULK1^{S555} (15%, $p=0.08$). **CONCLUSION:** Heat treatment of C2C12 cells increases signaling associated with the initiation of autophagy (increased p-AMPK, decreased p-mTOR) and phagophore formation (increased LC3 II). Additionally, we provide insight into the protective effect of heat treatment against the inhibition of autophagy.

1770 June 1 1:30 PM - 1:45 PM

Impact of Downhill Running on Proteasome Content in Mouse Skeletal Muscle

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(No relationships reported)

PURPOSE: The proteasome consists of two main forms, the standard proteasome and its inducible counterpart, the immunoproteasome. In skeletal muscle, the standard proteasome is responsible for myofibrillar protein degradation while the immunoproteasome generates antigenic peptides for immune surveillance. The standard proteasome and immunoproteasome both increase in content and activity following catabolic conditions, such as aging and denervation. However, little is known about how the proteasome responds to stressful conditions that do not promote large perturbations in skeletal muscle proteolysis. Therefore, the purpose of this study was to assess proteasome content following a single session of acute muscular stress.

METHODS: Male C57BL/6 wild type (WT) and immunoproteasome knockout *lmp7^{-/-mecl-1}* (*L7M1*) mice ran on a motorized treadmill at a 22 degree decline for 70 min. Soleus muscles were then excised one and three days post-exercise and compared to muscle that did not exercise (baseline). Whole muscle *ex vivo* physiology, histology and biochemical analyses were used to assess the effects of immunoproteasome knockout and downhill running. TNF- α and MCP-1 levels were evaluated with ELISAs while immunoblots were used to quantify standard proteasome (19S, β 1, β 5) and immunoproteasome (11S, LMP7, MECL-1) content, and global levels of protein carbonylation. **RESULTS:** When compared to baseline, the bout of downhill running reduced twitch force one day post-exercise, indicative of low-frequency fatigue. However, it did not significantly depress tetanic force or alter the amount of TNF- α , MCP-1 or carbonylated proteins present in the muscle. Besides *L7M1* muscle lacking LMP7 and MECL-1, no other differences in proteasome content were observed at baseline. In contrast, following the exercise, WT muscle tended to upregulate the catalytic subunits of the immunoproteasome while *L7M1* muscle instead upregulated the catalytic subunits of the standard proteasome. **CONCLUSIONS:** Together, these results suggest that downhill running does not significantly alter tetanic force production or induce a large inflammatory response in mouse soleus muscle. Yet, it appears the stress of downhill running activates the production of specific subunits of the proteasome, of which are influenced by LMP7 and MECL-1.

1771 June 1 1:45 PM - 2:00 PM

The Chemokine Cxcl10 is Not Needed For Normal Skeletal Muscle Regeneration Following a Toxin-induced Injury

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(No relationships reported)

PURPOSE: The CCL2/CCR2 chemokine receptor axis is necessary for successful muscle regeneration following injury. Recently, another chemokine known as CXCL10 (or IP-10) was found to be elevated in human skeletal muscle following muscle-damaging eccentric contractions. This finding may indicate that CXCL10, like CCL2, is important for muscle regeneration.

METHODS: To test this, we measured functional and histological markers of muscle regeneration in mice out to 14 days post muscle injury (DPI) in wild type (WT) mice and CXCL10 knockout (KO) mice ($n = 13$ and 12 , respectively). The muscle injury was induced by cardiotoxin (CTX) injection into the tibialis anterior (TA) muscle of a hind limb of each mouse. The opposite limb was injected with saline to serve as a within-animal sham control. At 2, 7 and 14 DPI muscle function of both the CTX- and saline-injected TA muscles was assessed using an *in situ* contraction preparation. After the functional testing, the TA muscles were excised, weighed, frozen, cut by cross section and mounted on glass slides for histological studies. Mounted muscle samples were stained using hematoxylin and eosin to identify central nucleated fibers and quantify cross sectional area. Samples were also stained immunohistochemically for embryonic myosin heavy chain (eMyHC) to identify the number of fibers undergoing regeneration.

RESULTS: Relative to the saline-injected TA, strength significantly decreased ($p<0.05$) at 2 (WT=46.7±15.9%, KO=44±9.4%) and 7 (WT=65±8.3%, KO=66±15.9%) DPI, and was recovered by 14 DPI. No significant differences in muscle strength were found between genotypes. Compared to the control TA, the CTX-injected TA muscle mass was significantly reduced ($p<0.05$) at 7 DPI (WT=86±3%, KO=91±9%) compared to 14 DPI (WT=105±8.3%, KO=105±11%). No significant differences in muscle mass were found between genotypes. Cross-sectional area of regenerating myofibers was greater at 14 DPI compared to 7 ($p<0.05$), yet again no

significant differences were found between genotypes. The number of myofibers expressing eMyHC was greater at 7 DPI than 14 ($p < 0.05$), with no significant difference between genotypes.

CONCLUSIONS: We conclude that CXCL10 is not necessary for normal muscle regeneration from a toxin-induced muscle injury in mice.

1772 June 1 2:00 PM - 2:15 PM

Blockade Of Mtor And Erk1/2 Resulted In Attenuated Protein Synthesis Rates In Differentiated C2c12 Myoblasts.

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(No relationships reported)

Fractional protein synthesis rates have long been used as an indicator of acute alterations in the anabolic state of various tissues. Through the use of a number of stable and isotopic tracer methodologies, the measurement of fractional synthesis rates (FSR) *in vivo* has become a staple of skeletal muscle physiology. Through the application of a deuterium oxide tracer, this project sought to measure pharmacological perturbations in fractional synthesis rates *in culture* in differentiated C2C12 murine myotubes. **PURPOSE:** To assess myofibrillar protein FSR in differentiated C2C12 murine myotubes following pharmacological inhibition of rapamycin-sensitive (mTOR) or -insensitive (ERK1/2) pathways. Furthermore, how signal transduction through these pathways impact FSR as compared to previous *in vivo* studies of pharmacological inhibition studies in skeletal muscle. **METHODS:** C2C12 murine myoblasts were cultured in collagen coated 6 well culture dishes, and grown to 60-70% confluency using a high glucose DMEM growth media (GM). Cultures were transitioned to a differentiation media (DM) upon reaching target confluency. DM was changed daily for 4 days to allow for complete differentiation to myotubes. Cultures were randomly assigned treatment conditions of cell control (CC), rapamycin inhibition (RAPA), ERK1/2 inhibition (ERK), and electrical stimulation (ESTIM). Cultures underwent treatment conditions for 24 hours with a 4% deuterium oxide GM supplement. Analysis was carried out using a gas chromatography mass spectrometer. **RESULTS:** Fractional rates of protein synthesis were significantly lower in the RAPA ($p=0.028$) and ERK ($p=0.029$) groups as compared to CC, with no differences between RAPA and ERK groups ($p > 0.05$). Although statistics were not applied to the ESTIM group due to low sample size, electrical pulse stimulation shows promise for the stimulation of FSR in cultured myotubes. **CONCLUSION:** Diminished FSR in both RAPA and ERK groups are consistent with previous findings from *in vivo* rodent studies. These results may indicate comparable alterations in skeletal muscle anabolic signaling in cell culture as well as *in vivo* rodent models. Further investigations into anabolic signaling mechanisms related to the control of protein synthesis are needed.

1773 June 1 2:15 PM - 2:30 PM

6 Weeks Of Nrf2-activator And Protein Supplementation Improves Myofibrillar Proteostasis In Men.

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The age-related loss of muscle mass and function are key contributors to the decline in healthspan. Maintenance of protein homeostasis (proteostasis) is critical to maintain muscle quality and function during advancing age. We have previously shown that interventions that slow aging increase the ratio of skeletal muscle protein to DNA synthesis, which we believe are indicative of improved proteostatic mechanisms. Oxidative stress and inflammation blunt the anabolic response to protein feeding, thus supplementation with a nuclear factor, erythroid 2 like 2 (Nrf2) activator could restore the anabolic response to protein feeding in older adults. **PURPOSE:** To test the hypothesis that supplementing with a Nrf2 activator alongside protein feeding would increase muscle subcellular protein synthesis in skeletal muscle of older adults. **METHODS:** In a 6-week double-blind study, older adults ($n=46$, 60-77 years old) were randomized to protein supplementation with placebo (CON) or one of the Nrf2 activators conjugated linoleic acid (CLA) or Protandim (PTD). We used deuterium-labeled water to measure DNA synthesis and protein synthesis in myofibrillar, mitochondrial, and cytosolic enriched fractions of skeletal muscle. **RESULTS:** PTD maintained myofibrillar protein synthesis while mitochondrial and cytoplasmic protein synthesis decreased ($p < 0.05$). There was no change in DNA synthesis with PTD or CLA supplementation compared to CON. PTD tended to

increase the myofibrillar protein: DNA synthesis ratio compared to CON (PTD 5.55 ± 1.364 vs CON 4.691 ± 0.749 ; $p=0.07$). Increased myofibrillar protein:DNA synthesis after PTD was more apparent in men.

CONCLUSIONS: We report that protein supplementation with a Nrf2 activator tended to increase myofibrillar protein:DNA synthesis ratio which was more profound in men versus women. Given that protein:DNA synthesis is a measure of proteostasis, our results demonstrate that protein supplementation with a Nrf2 activator to diminish oxidative stress and inflammation improves proteostasis in older adult men. Additional studies are warranted to determine if maintaining myofibrillar proteostasis with PTD or more potent Nrf2 activators may help maintain muscle mass and function with age in both men and women. Supported by the National Dairy Council.

1774 June 1 2:30 PM - 2:45 PM

Effects of Compression Treatment on Ribosome Biogenesis, Hypertrophy and Inflammation in Subjects Performing Resistance Exercise

Matthew A. Romero, Cody T. Haun, Shelby C. Osburn, Gillis L. Langston, Richard G. Anderson, Michael D. Goodlett, David D. Pascoe, Michael D. Roberts, Jeffrey S. Martin. *Auburn University, Auburn, AL.*
(No relationships reported)

PURPOSE: We sought to determine the effects of external pneumatic compression (EPC) when used concurrently with resistance training on skeletal muscle measures related to ribosome biogenesis, hypertrophy and inflammation.

METHODS: 20 resistance-trained males (aged 21.6 ± 2.4 years) were randomized to balanced sham and EPC intervention groups. The protocol consisted of 3 consecutive days of heavy, voluminous back squat exercise followed by EPC/sham treatment (Days2-4) and 3 consecutive days of recovery (Days5-7) with EPC/sham only on Days5-6. *Vastus lateralis* muscle was biopsied on Day 1 (PRE), 1-h post-EPC/sham treatment on Day2 (POST1) and 24-h post-EPC/sham treatment on Day7 (POST2).

RESULTS: Of all of the assayed ribosome biogenesis mRNAs and rRNAs, only c-myc increased significantly in both groups from PRE to POST1 ($p < 0.001$). No significant main effect of time nor group*time interaction was observed for mechano-growth factor or myostatin mRNAs, although there was an increase in IGF-1 protein levels in both groups ($p < 0.05$). A significant main effect of time was observed for IL-6, IL-10, IL-1 β , and MCP-1 mRNA levels ($p < 0.001$ for all).

CONCLUSIONS: These data suggest that EPC does not modulate select markers of ribosome biogenesis or muscle-specific growth factor expression compared to sham treatment during a one-week voluminous resistance training paradigm.

1775 June 1 2:45 PM - 3:00 PM

Inducible Overexpression of p21Cip1 in Myotubes Promotes Increases in Protein Synthesis and Myotube Hypertrophy

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PURPOSE: p21Cip1 is classically defined as a cyclin-dependent kinase inhibitor that promotes satellite cell differentiation within skeletal muscle. However, sparse literature has demonstrated that mechanical loading can elicit robust (i.e. ~30-50+-fold) increases in skeletal muscle p21Cip1 mRNA expression patterns up to 6 hours post-exercise; this being an event which precedes satellite cell activity. Herein we tested whether the inducible over-expression of p21Cip1 promotes alterations in muscle protein synthesis (MPS) and hypertrophy in post-differentiated myotubes.

METHODS: Briefly, the p21Cip1 gene was cloned into the pINDUCER vector, which is turned on by doxycycline treatment, and a stable C₂C₁₂ p21Cip1-inducible (p21-IND) cell line was established. Empty vector C₂C₁₂ clones (EV) served as the control condition. Following 7 d of differentiation, the p21-IND and EV lines were treated for 4 days with doxycycline. **RESULTS:** An 86% overexpression of p21Cip1 mRNA was confirmed in p21-IND versus EV myotubes with RT-PCR ($p < 0.05$). p21-IND myotubes exhibited 2.5-fold greater MPS rates ($p < 0.05$) and a 2.2-fold greater increase in myotube size ($p < 0.05$) compared to EV myotubes. Select differentiation markers (i.e., MyoD mRNA and myogenin mRNA) did not differ between cell lines. Interestingly, pre-47S rRNA tended to increase in p21-IND myotubes compared to EV myotubes (1.6-fold, $p = 0.09$). **CONCLUSIONS:** These data suggest that p21Cip1 may act in post-mitotic skeletal muscle fibers to increase translational capacity and/or efficiency, thereby promoting skeletal muscle hypertrophy.

D-14 Clinical Case Slide - Elbow

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 401

1776 **Chair:** Jason L. Zaremski, FACSM. *University of Florida, Gainesville, FL.*

(No relationships reported)

1777 **Discussant:** Sean Engel. *University of Minnesota, Minneapolis, MN.*

(No relationships reported)

1778 **Discussant:** Poonam P. Thaker, FACSM. *Presence Resurrection Medical Center, Chicago, IL.*

(No relationships reported)

1779 June 1 1:00 PM - 1:20 PM

Elbow Pain in an Adolescent Baseball Pitcher

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(No relationships reported)

HISTORY: 15 year-old right-hand dominant male baseball pitcher presents with 3 weeks of right posterior elbow pain. The pain started after a weekend of extended pitching. He describes the pain with ball release, extension type movements, and hitting. He denies numbness, tingling, swelling, erythema, medial elbow pain, or shoulder pain. There are no prior injuries and his father states that his son's throwing mechanics are normal.

PHYSICAL EXAMINATION: Right elbow with mild tenderness on the olecranon and triceps insertion. No tenderness over the medial epicondyle, ulnar collateral ligament, flexor pronator mass, radiocapitellar joint, or lateral aspect of his elbow. Full ROM with mild pain on passive extension of the elbow. No significant pain with valgus stress. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: Olecranon stress fracture, avulsion fracture, posterior olecranon impingement, olecranon bursitis

TEST AND RESULTS: 3V XR of right elbow - delayed closure of the olecranon physis with widening and chronic changes when compared to the uninvolved side. No osteochondral injury or other growth plate abnormality. MRI of the right elbow - inflammation and edema near the olecranon growth plate.

FINAL WORKING DIAGNOSIS: Olecranon stress fracture **TREATMENT AND OUTCOMES:**

- Completely shut down from a throwing perspective and referred to physical therapy.
- Physical therapy focused on stretching to increase shoulder mobility as well as scapular and rotator cuff strengthening in an effort to decrease the amount of stress on the elbow. - Referral to an orthopedic surgeon to discuss operative (screw fixation) vs non-operative treatment. The choice was made to pursue a trial of non-operative treatment. - At 6 week follow up, he had minimal pain. - At 3 months, he was pain free with a normal exam. Repeat radiographs at 3 months showed a marked amount of healing around the olecranon physis. Repeat MRI showed very mild persistent olecranon apophysitis. - Released to slowly progress back to play. - Significance: Olecranon stress fracture is a separation of the olecranon secondary ossification center. If left untreated, it can result in an incompletely fused olecranon apophysis. Some orthopedic surgeons recommend internal fixation with a screw for throwing athletes in order to allow early return to sport.

1780 June 1 1:20 PM - 1:40 PM

Elbow Injury - Baseball

Terin Sytsma, Timothy McKenna. *Mayo Clinic, Rochester, MN.* (Sponsor: Dr. Karen Newcomer, FACSM)
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(No relationships reported)

HISTORY: A 13-year-old male baseball player presented with intermittent lateral and posterior right elbow pain that became constant over the last month of travel baseball. The pain worsened in the cocking stage of throwing, and he reported decreased elbow extension. There was no numbness, tingling or weakness in his right upper extremity. Pain was a 4/10 at rest and worse with activity.

PHYSICAL EXAMINATION: Slight right elbow effusion with tenderness over the olecranon and lateral and medial epicondyles. Range of motion was decreased to 15 degrees short of full extension. Range of motion did not elicit snapping of the triceps or ulnar nerve. There was pain with valgus stress of the right elbow but no instability. Strength of the upper extremity was normal with no pain elicited during strength testing. Tinel's at the cubital tunnel was negative.

DIFFERENTIAL DIAGNOSIS:

1. Osteochondritis Dissecans (OCD) of the capitellum
2. Panner's Disease
3. Lateral/medial epicondylitis
4. Lateral/medial epicondyle apophysitis/avulsion fracture
5. Triceps tendinitis
6. Ulnar collateral ligament sprain
7. Olecranon stress fracture/loose body

TEST AND RESULTS:

Right elbow radiographs:

-Small right elbow joint effusion

Right elbow MRI:

-Focal bone marrow signal changes in the anterior capitellum

-Large joint effusion

-Focal tiny subchondral fluid signal abnormality in mid capitellum

-No visualized loose bodies

-Suggestive of Panner disease or early OCD of the elbow

Repeat right elbow MRI for increased pain after three weeks:

-New 9 mm oval cartilaginous defect from the central capitellum, displaced in the medial joint recess posteriorly

-No definite bony component

-Underlying capitellar edema

FINAL/WORKING DIAGNOSIS:

-OCD of the capitellum

TREATMENT AND OUTCOMES:

1. Right elbow arthroscopy with OCD drilling microfracture and loose body removal
2. Adjustable hinge elbow brace locked at 60-90 degrees of flexion for 2 weeks
3. Brace was loosened to 40-120 degrees after 2 weeks
4. Doing well at 5 week postoperative follow up. The brace was removed, and activities were restricted to no throwing activities for an additional 6 weeks. Then he was allowed slow return to throwing.
5. At one year follow up, he was doing well with no pain or symptoms. He was cleared for sports but instructed to refrain from pitching.

1781 June 1 1:40 PM - 2:00 PM

Elbow Pain-Young Baseball Pitcher

Luis A. Sanchez¹, Juan C. Galloza², William Micheo, FACSM¹.

¹University of Puerto Rico, Medical Sciences Campus, San Juan, PR. ²University of Texas Health Science Center at Houston (UTHealth), Houston, TX. (Sponsor: William Micheo, FACSM)
Email: luisalberto721@gmail.com

(No relationships reported)

HISTORY: 15 year-old male pitcher with right elbow pain of 2 weeks of duration. The pain had sudden onset after a long toss during baseball practice. It was localized at the posterior-medial aspect of his right elbow, exacerbated with repetitive elbow extension and relieved with rest. He was unable to pitch/throw after the injury. No previous episodes of elbow pain. Prior history was positive for right knee chondroplasty one year before the evaluation. Sports participation was relevant for year-long baseball participation with less than one month resting period.

PHYSICAL EXAMINATION: Height: 66 inches, Weight: 141 pounds, Body Mass Index (BMI): 22.8 kg/m². Inspection showed protracted shoulders and no medial elbow swelling. The postero-medial aspect of the right elbow was tender to palpation. Range of motion presented full painless flexion, but a painful extension lag of 10 degrees. Strength deficits on rotator cuff. Pain with resisted elbow extension. Negative valgus testing.

DIFFERENTIAL DIAGNOSIS:

1. Ulnar Collateral Ligament Sprain
2. Valgus extension overload (VEO) syndrome
3. Olecranon fracture
4. Medial Epicondylitis
5. Common flexor tendon strain
6. Triceps tendinopathy

TEST AND RESULTS:

1. AP & Lat x-rays: Linear lucent defect at the olecranon process.
2. MRI: Olecranon non-union with associated edematous changes at the level of the growth plate.

FINAL/WORKING DIAGNOSIS:

•Non Union of Olecranon Stress Fracture (Right)

TREATMENT AND OUTCOMES:

1. Conservative treatment
 - a. Kinetic Chain Evaluation i. Weakness of core and pelvic girdle muscles
 - ii. Quadriceps Asymmetry: Isokinetic Tests: Right 29% weaker than Left
 - iii. Scapular dyskinesia
 - iv. GIRD (Glenohumeral Internal Rotation Deficit)
2. Physical therapy i. Physical modalities
 - ii. Stretching and strengthening program for right shoulder, elbow and other components of the kinetic chain (core/hip/legs)
 - iii. Avoid elbow extension exercises until symptoms free

c. Outcome

- i. 6 weeks: No symptoms on palpation.
- ii. 8 weeks: Continued without symptoms. Start throwing program.
- iv. 16 weeks: No symptoms throwing. Completed throwing program. Persisted with core and right lower extremity weakness. Focused on strength deficits to correct kinetic chain.
- v. 20 weeks: Return to sports practice and progress full participation if asymptomatic

1782 June 1 2:00 PM - 2:20 PM

Medial Elbow Pain - Young Baseball Pitcher

Andrew H. Gordon, Arthur J. DeLuigi. *MedStar National Rehabilitation Hospital, Washington, DC.* (Sponsor: Garry Ho, FACSMT)
 Email: Andrew.Gordon@medstar.net
 (No relationships reported)

HISTORY: A 14-year, 2-month old male right-handed baseball pitcher presented with chronic right medial elbow pain over 18 months, with no inciting injury/trauma. Initially he had mild right medial epicondylitis on magnetic resonance imaging (MRI) which resolved with rest and physical therapy. Still his right elbow pain recurred when throwing, ultimately failing conservative measures. Our collaborating orthopaedist then referred him to us for ultrasound and nonsurgical management. At his initial visit with us, he reported no pain at rest. He last had elbow pain one month earlier while doing lighter outfield (non-pitching) throws.

PHYSICAL EXAMINATION: Afebrile with normal blood pressure and pulse. Normal muscle bulk and appearance for his age. Focused right elbow examination showed normal range of motion and no pain with flexion/extension. No locking or swelling. He did have laxity of his right elbow with valgus stress.

DIFFERENTIAL DIAGNOSIS: 1. Valgus extension overload. 2. Osteochondritis dissecans. 3. Olecranon stress fracture. 4. Medial epicondyle avulsion fracture. 5. Medial apophysitis. 6. Medial epicondylitis. 7. Ulnar collateral ligament (UCL) sprain or tear. 8. Ulnar neuritis/subluxation.

TESTS AND RESULTS: Initial MRI 18 months prior showed no UCL injury, but rather fluid at the flexor pronator mass consistent with medial epicondylitis. New MRI showed a partial right UCL tear at the proximal insertion. No full tear, fracture, or other connective tissue injury. Under ultrasound, laxity of the right UCL and pathology consistent with the partial UCL tear was seen, with no fracture, loose bodies, or epicondylitis.

FINAL WORKING DIAGNOSIS: Partial UCL tear at the right elbow.

TREATMENT AND OUTCOMES: We injected platelet rich plasma (PRP) under ultrasound to the pathologic site of the right UCL. The boy then proceeded with our 12-week PRP rehabilitation protocol tailored to throwing athletes. At 8 weeks post-injection, ultrasound showed interval healing with reduced laxity of the right UCL. At 16 weeks post-injection, ultrasound revealed virtually complete healing with no laxity of the right UCL. The boy eventually returned to throwing full pitching distance without pain, emphasizing the potential utility of PRP injection in pediatric/adolescent athletes with musculoskeletal injuries.

1783 June 1 2:20 PM - 2:40 PM

PRP For Treatment Of Lateral Epicondylitis In A Division I Collegiate Pitcher.

Ryan Hudson, D.O., Andrew T. Martin, D.O. *Campbell University School of Osteopathic Medicine, Lillington, NC.* (Sponsor: Pat Leary, FACSMT)
 (No relationships reported)

HISTORY: 19 yo male, right hand dominant pitcher, presents for evaluation of progressively worsening lateral right elbow pain. He has recently increased baseball play over the past 1 year in preparation for matriculation to a D-1 collegiate program. He has been evaluated previously by his primary care. Previous treatment included rest, ice, NSAIDs, home exercise routine and single episode of dry needling prior to moving to college.

Past Surgical Hx: Tommy John surgery to right elbow in 2013

PHYSICAL EXAMINATION: Physical examination is remarkable for tenderness to palpation over the lateral epicondyle with decreased grip strength and pain upon resisted wrist extension. Rest of physical examination is within normal limits.

DIFFERENTIAL DIAGNOSIS:

Osteochondritis Dissecans, Radial Tunnel Syndrome, Posterior Interosseous Nerve Syndrome, Elbow arthritis, Foreign body, Cervical radiculopathy, Lateral epicondylitis, Posterior lateral instability

TEST AND RESULTS:

Office ultrasound showed degenerative changes to the common extensor tendon complex.

FINAL WORKING DIAGNOSIS:

Lateral epicondylitis.

TREATMENT AND OUTCOMES:

Patient was treated with dry needling with STEM in the sports medicine clinic. He was placed on rest and treated with modalities by ATC. He continued to have pain. He was offered PRP and placed in arm sling for a duration of 2 weeks. Repeat evaluation at 2 weeks post PRP showed 80% reduction in pain and he was started on home exercises. Week 4 follow up visit, he was started on low weight with high repetition exercises. Week 5 follow up visit revealed that the patient was able to tolerate light weights and was 95% better. He was released to full weight room and started on RTP throwing protocol. He completed throwing protocol without issue and has been returned to full play.

1784 June 1 2:40 PM - 3:00 PM

Left Elbow Pain- Push Ups

Kamyar Nabegh¹, Jeffrey Anderson², Matthew Hall¹. ¹*UCHC, Farmington, CT.* ²*University of Connecticut, Storrs, CT.*
 (No relationships reported)

HISTORY: 17-year-old female presents complaining of left elbow pain ongoing for 4 years. She has a history of a diagnosed subluxing ulnar nerve on the left. She complains of difficulty playing sports such as softball and doing push-ups. She would like to enlist in the Armed Services and is concerned about the symptoms limiting her from doing so. She mainly complains of symptoms when the nerve is subluxing during flexion of the elbow, including discomfort over the cubital tunnel with numbness and tingling in her 4th and 5th digits. She denies symptoms when the nerve is not subluxing. She is right hand dominant and has never had treatment for this, including physical therapy. She believes the symptoms of subluxation started when she suffered a direct fall to the ground landing on the elbow years ago. No fractures were diagnosed at that time.

PHYSICAL EXAM: Examination of the left upper extremity reveals intact skin without discoloration, atrophy or swelling. Mild tenderness to palpation in the cubital tunnel. Sensation to light touch is intact. AROM with flexion is to 140 degrees. Strength is 5/5 with arm flexion. Tinel's sign is positive at the elbow. There is palpable subluxation of the ulnar nerve over the medial epicondyle when brought into flexion from extension. A second snap is also appreciated when the elbow is brought into further flexion.

DIFFERENTIAL DIAGNOSIS:

- 1. Subluxing Ulnar Nerve
- 2. Snapping Triceps
- 3. Cubital Tunnel Compression

TESTS AND RESULTS:

-EMG shows no cubital tunnel compression at baseline.
 -Dynamic ultrasound evaluation reveals an ulnar nerve in cross section located in the normal position within the cubital tunnel during extension. With the elbow slowly flexed past 90 degrees, a palpable snapping of the ulnar nerve was noted on exam and seen dynamically with ultrasound crossing over the medial epicondyle. As the elbow was brought into further flexion, a second snap was appreciated by palpation and on dynamic ultrasound evaluation as the muscle belly of the triceps was noted snapping over the medial epicondyle.

FINAL WORKING DIAGNOSIS:

- Subluxing Ulnar Nerve
- Snapping triceps muscle

TREATMENT AND OUTCOMES:

- 1. Conservative measures including physical therapy and bracing with no relief.
- 2. Surgical Treatment: Anterior transposition of the ulnar nerve with triceps assessment. Expected rehab is 3-4 months.

D-15 Clinical Case Slide - Foot and Ankle II

Thursday, June 1, 2017, 1:00 PM - 2:40 PM
 Room: 402

1785 **Chair:** Ashley Zapf. *Schwab Rehabilitation Hospital, Chicago, IL.*
 (No relationships reported)

1786 **Discussant:** Michael Fredericson, FACSMT. *Stanford University, Stanford, CA.*
 (No relationships reported)

1787 **Discussant:** David Olson, FACSMT. *University of Minnesota, St. Paul, MN.*
 (No relationships reported)

THURSDAY, JUNE 1, 2017

1788 June 1 1:00 PM - 1:20 PM

Uncommon Cause Of Footpain After Trauma In A Collegiate Rugby Union PlayerPierre L. Viviers, FACSM, Wayne Derman, Jeandre T. Viljoen.
Stellenbosch University, Stellenbosch, South Africa.
Email: plviviers@sun.ac.za*(No relationships reported)*

HISTORY: A 22 year old male rugby union loose head prop received a ball prior to a contact situation. He was tackled from the front with his left foot firmly planted on the surface. He immediately experienced forefoot pain, however not severe enough to cause him to stop. Whilst he could not identify the exact location of the pain he indicated that it was under the foot on the medial aspect. He completed the match in pain and discomfort. Scrummage intensified the pain during loading of the affected foot. He applied RICE after the match. The next morning he experienced severe pain in the medial arch and described difficulty flexing his big toe. Weight bearing during the gait cycle, especially toe-off caused extreme pain. Previous history included two concussions and a right-sided turf toe. He also suffered from lower back pain during pre-season gymnasium training as well as during scrummaging sessions. He described effective relief from his lower back pain following ingestion of NSAID's and physiotherapeutic management. **PHYSICAL EXAMINATION:** Healthy rugby player, unable to bear weight on his left foot. No obvious bruising or any deformity of the left foot. Severe medial arch tenderness of the affected foot to palpation (plantar fascia, sesamoids). No bony tenderness over the whole forefoot or medial arch. Neurovascularly intact. Severe pain during active plantar flexion, as well as pain with passive stretching (dorsiflexion) of the big toe.

DIFFERENTIAL DIAGNOSIS: • Sprain 1st MTP joint (Turf toe) • Collateral ligamentous injury 1st MTP joint • Flexor hallucis longus strain/rupture • Plantar fascia - acute tear • Subluxation/ Dislocation 1st MTP joint • Sesamoid fractures (acute) • 1st Metatarsal avulsion fracture • Metatarsal fracture • Phalangeal fracture • Sesamoiditis • "Undiagnosed" soft tissue injury **TEST AND RESULTS:** X-rays: reported as normal **MRI:** reported partial tears of the left medial and lateral heads of flexor hallucis brevis. No collateral ligament injury. Sesamoids were normal and no avulsion of the plantar plate could be demonstrated

FINAL WORKING DIAGNOSIS: Partial ruptures medial and lateral head of the left flexor hallucis brevis

TREATMENT AND OUTCOMES: • Immobilized non-weight bearing in moonboot for 2 weeks • Physical therapy • Gradually mobilized over next 2 weeks and full return to train and play after 4 weeks

1789 June 1 1:20 PM - 1:40 PM

Dance is PainThomas A. Moran¹, Holly Benjamin, FACSM². ¹University of Chicago-NorthShore, Glenview, IL. ²University of Chicago, Chicago, IL*(No relationships reported)*

HISTORY: 15-year-old female dancer who attends a dance academy and regularly dances 5-6 days/week presented for routine followup regarding a resolving grade I Left MCL sprain. She denied current knee symptoms with dance but stated "Oh by the way, I think I sprained my right ankle" after landing from jump 2 weeks ago. She initially developed nonspecific anterolateral ankle pain with ambulation, 6/10 in severity. She reported initial swelling over dorsum of midfoot extending to the lateral ankle, however, this improved spontaneously within 1 week. Currently she had no complaints of pain with ambulation but she described a "nagging discomfort when dancing en pointe and going down stairs." She continued dance through the pain but limited her jumping and toe work.

PHYSICAL EXAM: Nonantalgic gait. Examination of both ankles revealed bilateral pes planus, no swelling or ecchymosis. Full Active and Passive range of motion, Dorsiflexion 20 degrees, hyper-plantarflexion to 70degrees, inversion 30degrees and eversion to 10degrees. 1+ anterior drawer but equal bilaterally. Tender to palpation over dorsum of midfoot over anterior subtalar joint. Repeat exam at 3 week followup same.

DIFFERENTIAL

Lateral ankle sprain, specifically ATFL injury

Navicular fracture

Osteochondral defect of talar dome

Avascular necrosis talus

Tarsal tunnel capsulitis

TESTS/RESULTS

Xray AP, lateral mortise of ankle unremarkable (foot XRs not obtained)

MRI: Diffuse abnormal marrow signal within navicular bone and cortical irregularity at articulation with talus.

CBC, CMP, Calcium and VitD 25-OH levels within normal limits.

FINAL/WORKING DIAGNOSIS

Navicular stress fracture

TREATMENT/OUTCOMES

1. Short leg cast x 4 weeks

2. NWB with crutches

3. PT for crutch strengthening and Core Strengthening

4. OTC VitD and Ca supplementation

5. F/U at 4 weeks with consideration of walking boot.

6. Anticipate transition to walking boot at 4-6 weeks

7. Anticipate CT foot at 6 weeks

1790 June 1 1:40 PM - 2:00 PM

Chronic Plantar Fasciitis: From Disability To Running!Lindsay Troilo, Irene Davis, FACSM. *Spaulding Outpatient Center Cambridge, Cambridge, MA.**(No relationships reported)*

HISTORY: 27 yr. old male with BIL knee and plantar foot pain R>L. Knee pain developed while running in college. Foot orthotics resulted in no change in symptoms. Thus he stopped running and stopped wearing them. Pt. moved to London 5 yrs ago and increased his daily walking. He also began wearing a flat, less supportive shoe. As a result, he developed heel pain that radiated to the arch and gradually progressed to a burning sensation. He returned to the United States and underwent steroid injections, orthotics, tarsal tunnel release and 4 months of PT without relief. At the time of our assessment, foot pain was 6/10 after 3 minutes of standing/walking. He was unable to take public transportation or care for his young daughter due to this pain. **PHYSICAL EXAMINATION:** Pain in posterior tibialis muscle and tendon, plantar fascia origin, and 1st MTP joint R>L. Posterior tibialis, peroneals, and toe flexors were weak and painful on contraction. A (+) patella compression BIL and (+) Ober's R noted. Weakness noted in hip EXT. and ABD BIL. Pt presented with contralateral hip drop L>R, hip ADD and IR, and midfoot pronation BIL during a brief running assessment. He was a rearfoot striker with mildly elevated vertical load rates. These load rates were markedly reduced when he ran on his forefoot. His knee pain was also reduced when he ran on his forefoot. **WORKING DIAGNOSIS:** 1. BIL plantar fasciitis due to foot weakness and overuse, with associated posterior tibialis and flexor hallucis longus tendinosis. 2. BIL patellofemoral pain due to increased Hip ADD and IR associated with hip weakness. **TREATMENT:** Goal1: Pain-free standing and walking Progressive foot core program performed barefoot Soft tissue and joint mobilization to foot/ankle Fitbit to monitor walking step progressions Wean out of orthotics and into minimal shoes to promote foot strength Gait retraining to promote activation of foot intrinsic muscles during walking Goal 2: Pain-free running Progressive and dynamic hip strengthening Gait retraining to promote activation of hip musculature to improve hip mechanics **OUTCOME:** After 32 visits over 11 mos. pt was walking 1-2 hrs with < 1/10 pain in his feet. Pt. worked on home program of hip strengthening for 8 mos. He then returned for 8 sessions of gait retraining to improve hip mechanics. Pt. discharged running 25 min. pain-free in knees and feet.

1791 June 1 2:00 PM - 2:20 PM

Ankle Injury - FootballPhilip Hoffman, Igor Danelisen, Jonathan Vanadore, Andrew Martin. *Campbell University, Lillington, NC.* (Sponsor: Patrick Leary, FACSM)

Email: mtbdrphil@gmail.com

*(No relationships reported)***History:**

A 17 year old high school football player, free-safety position, blocked a kick by the opposing team, landing on his left foot and falling in obvious distress. Examination on the field revealed injury to the left lower extremity, with his foot being stuck in approximately 75 degrees eversion and the distal tibia protruding anteriorly from ankle joint.

PE

Examination revealed intact neurovascular structures and no break in the skin. There was a step off of his lateral malleolus concerning for fracture. 1 attempt was made at relocation of the ankle joint but was not successful on the field.

Differential

Dislocation of left ankle

Fracture distal left fibula

Test and results

AP X-ray confirmed lateral displacement of ankle and distal fibular fracture

Lateral x-ray showed posterior dislocation of ankle and distal fibular fracture.

Final diagnosis

Closed ankle dislocation with displaced distal fibular fracture

Treatment and outcomes

1.

ER relocation of ankle

2.

Surgical fixation and plating of distal fibular fracture

3.

Aircast boot and non-weight bearing for 6 weeks; anticipated date he may start weight-bearing activity is 11/5/16.

1792 June 1 2:20 PM - 2:40 PM

An Atypical Cause for Posteromedial Ankle Pain in a Runner

Nicole T. Yedlinsky, 22033, Garry W. K. Ho, 22033, FACSM. *VCU - Fairfax Family Practice Sports Medicine Fellowship Program, Fairfax, VA.* (Sponsor: Garry Ho, MD, FACSM) Email: nyedlinsky@ffpcs.org

(No relationships reported)

HISTORY: A 44-year-old female presented with 3 weeks of left posteromedial ankle and foot pain and swelling only occurring with running. It did not bother her while walking and she experienced no injury or trauma.

PHYSICAL EXAMINATION: Normal walking gait with full range-of-motion. Significant tenderness over tarsal tunnel approximating posterior tibial tendon and mild tenderness over the medial retrocalcaneal area. Drawer test, Cotton test, Squeeze test, Talar tilt test, and Thompson test all negative. Too-Many-Toes and Peek-a-Boo heel signs negative, and Rise on Toe exhibited normal heel varus. Dorsolateral compression negative. Strength testing was 5/5 globally with increased pain on resisted inversion. Tinel's sign negative over the tibial nerve. Distal pulses intact.

DIFFERENTIAL DIAGNOSIS:

1. Posterior tibialis or insertional Achilles tendinopathy
2. Stress fracture
3. Cartilage or osteochondral injury
4. Accessory soleus muscle
5. Soft tissue neoplasm

TEST AND RESULTS:

Radiographs negative for fracture or acute bony injury. Patient was prescribed relative rest and activity modification, and was given a home exercise program and referred to physical therapy. MRI of the foot and ankle performed when symptoms failed to improve after 6 weeks of PT. MRI showed a prominent accessory soleus muscle with minimal edema. The tendinous attachment inserted medially at the margins of the posterior calcaneus. The accessory soleus muscle abutted the posterior margins of the tarsal tunnel.

FINAL DIAGNOSIS:

Accessory soleus muscle

TREATMENT AND OUTCOMES:

1. Symptoms improved 80% with continued focus on eccentric rehabilitation of ankle flexors and evertors.
2. Patient able to gradually return to light exercise.

DISCUSSION:

The accessory soleus muscle is a rare anatomical variant that can cause exertional pain and swelling in athletes. Most patients present with swelling and pain. It usually manifests in the late teens. Accessory soleus can also be found as an incidental finding. No treatment is required for asymptomatic patients. Conservative therapy can be attempted but many patients require surgical excision due to persistent symptoms.

D-16 Clinical Case Slide - Hip and Pelvis I

Thursday, June 1, 2017, 1:00 PM - 3:00 PM
Room: 103

1793 **Chair:** John C. Hill, FACSM. *University of Colorado, Denver, CO.*
(No relationships reported)

1794 **Discussant:** Siobhan M. Statuta. *University of Virginia, Charlottesville, VA.*
(No relationships reported)

1795 **Discussant:** Scott A. Paluska, FACSM. *Christie Clinic Sports Medicine, Champaign, IL.*
(No relationships reported)

1796 June 1 1:00 PM - 1:20 PM

Painful Hip Snapping In A 15 Year Old Female Soccer Player: A Case Report

Melissa Roscher, Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.* (Sponsor: Brian A. Davis, FACSM) Email: rigginms@upmc.edu

(No relationships reported)

HISTORY: A 15 y/o girl with history of bilateral iliotibial band (ITB) lengthening was referred to sports medicine clinic for diagnostic ultrasound of the right anterior hip due

to painful snapping in the groin. Pain was exacerbated by kicking a ball. Sonographic examination demonstrated snapping iliopsoas and psoas major tendons with reproduction of groin pain. Physical therapy (PT) focusing on iliopsoas stretch was ineffective; she underwent iliopsoas tendon lengthening and synovectomy with complete resolution of pain. Five months following iliopsoas tendon lengthening, she returned with a new painful grinding sensation in the right buttock. Pain was exacerbated by walking, specifically at toe-off. Pain was sharp, episodic, and debilitating. She denied groin pain or pain with hip flexion. She denied neurologic deficits

PHYSICAL EXAMINATION: Gen: No acute distress
Neuro: Audible clunk with ambulation. Non-focal sensory, motor, and reflex examination of the RLE

MSK: No visible defect of right buttock. Nontender over the gluteal region and ischial tuberosity. Pain reproduced with passive external hip rotation. Negative FABER, FAIR, log roll, Stinchfield, Ober, and scour

DIFFERENTIAL DIAGNOSIS: 1. Ischiofemoral impingement

2. Hip labral/intraarticular pathology
3. Snapping gluteus maximus tendon/muscle
4. Recurrent iliotibial band snapping

TEST AND RESULTS: MRI arthrogram: minimal labral fraying. Minimal symptom improvement with intraarticular steroid. Diagnostic ultrasound: hypertrophy of the right quadratus femoris (QF) (2.51cm right vs 1.54cm left) with dyskinetic motion of the QF between the ischial tuberosity and lesser trochanter during external hip rotation. Dyskinesia was more pronounced with standing and walking. Contralateral QF was void of dyskinetic movement. She underwent injection of lidocaine and triamcinolone into the right QF under sonographic guidance

FINAL WORKING DIAGNOSIS: Ischiofemoral impingement 2/2 hypertrophied QF

TREATMENT AND OUTCOMES: 1. Sonographically guided injection of lidocaine/corticosteroid resulted in diagnostic block from lidocaine component only

2. Discussed repeat injection vs debulking operation vs trial of botulinum toxin injection to the QF
3. Referred to PT for hip stretching and pelvic stabilization exercises

1797 June 1 1:20 PM - 1:40 PM

Pelvis And Hip Injury - Soccer

In-Kyu Choi, 90015. *Kaiser Permanente Fontana Medical Center, Fontana, CA.* (Sponsor: Aaron Rubin, FACSM) Email: inkyu0925@gmail.com

(No relationships reported)

HISTORY:

A 18 year old male soccer player presented with a 2 week history of gradually worsening left sided groin pain without any radiation or radicular symptoms. Pain was initially only with activity such as sprinting and kicking, but now with just walking. Patient is a right leg dominant attacking mid-fielder and reports having similar symptoms about 2 years ago while in Germany. He had negative work up for hernia and the symptoms eventually resolved with rest at the time. He denies any recent history of trauma or change in activity level. No history of urinary or testicular symptoms.

PHYSICAL EXAMINATION: Full range of motion of the left hip. Pain with resisted hip adduction but no pain with resisted flexion, extension and abduction. Tenderness to palpation over the pubis symphysis and medial inguinal region. No testicular/inguinal lumps and negative cough test for hernia. Positive FADIR and FABER. No leg length discrepancy. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: 1. Hip adductor strain 2. Osteitis Pubis 3.

Femoroacetabular impingement 4. Labral tear 5. Inguinal hernia

TEST AND RESULTS: 1. XR Pelvis, AP and lateral - reported normal, but possible CAM lesion and possible degenerative changes at the pubis symphysis. 2. MRI Pelvis - Osteitis Pubis. Stress reaction at the bilateral inferior pubic rami. Possible labral tear. 3. MR Arthrogram of the left hip (obtained 3 weeks after initial MRI) - No evidence of labral tear. Stress reaction at the right inferior pubic ramus resolved; improved on the left. CAM lesion

FINAL WORKING DIAGNOSIS: 1. Stress reaction of the inferior pubic rami 2. Osteitis Pubis 3. Femoroacetabular impingement

TREATMENT AND OUTCOMES:

1. Crutches while having pain with walking for 1-2 weeks 2. NSAIDs as needed for pain 3. Restriction on soccer/running for 8 weeks 4. Plan for gradual return to activity

1798 June 1 1:40 PM - 2:00 PM

Back And Buttocks Pain In An Adolescent Athlete

Andrew Getzin, FACSM. *Cayuga Medical Center, Ithaca, NY.* Email: agetzin@cayugamed.org

(No relationships reported)

History

"I hurt my glut in football, then on and off in basketball, as of one week it seems like a much different injury." LS is a 14-year-old male with right-sided 9/10 lower back and gluteal pain for six months. There was no specific injury. He was able to complete football (linebacker, QB, tight end) and basketball seasons with mild pain and has now

progressed into the start of baseball season. Eight days prior, his pain changed to be first thing in the AM, stabbing pain over his glut and ischial tuberosity- made worse with sudden movement, swinging, throwing, squatting, and lateral bending. Pain was better with not moving but did not disturb his sleep. No relief with stretching nor ibuprofen.

Physical Exam:

Athletic looking adolescent male mildly uncomfortable

Chest: normal respiratory effort

Skin: no visible rashes or lesions

Normal gait

Back: right glut pain on flexion with finger tips to the floor, FROM on extension without pain, -Slump test bilaterally, +R SLR with severe glut pain, -L SLR, dermatomes and Myotomes WNL

Right Hip: mild tenderness over ischial tuberosity, FROM, -FADIR's +FABER's -Ober's, 5/5 strength with mild pain on resisted hip extension

DDx

1. LS strain
2. Axial discogenic pain
3. Spondylolysis
4. Slipped Capital Femoral Epiphysis
5. High hamstring tendinopathy
6. Proximal adductor tendinopathy
7. Piriformis syndrome
8. Juvenile Spondyloarthropathy
9. Pelvic stress fracture

Tests and Results

X-ray LS spine: WNL

X-ray, hip and AP pelvis: WNL

MRI LS spine:

1. Edema within the left L4 pedicle
 2. Small focal protrusion at the L4-L5 level in the right lateral recess, possibly impinging on the L5 nerve root
- Treated with Medrol dose pack and PT for discogenic pain. One morning he felt an explosion of pain in his right glut, 10/10 that kept him out of school for the next few days. Due to exacerbation and chronicity, further imaging was performed.

MR arthrogram R hip:

1. Mild cam FAI
2. Small focus of edema right greater trochanter
3. R unilateral sacroiliitis with erosion of subchondral bone along the iliac margin and iliac margin subchondral marrow edema.

MR LS Spine: WNL

CBC: WNL

ESR: 8

CRP: <0.5

RF: <15

HLA-B27: positive

ANA: positive

Final Dx: Juvenile Spondyloarthropathy

Outcome: He initial did well with Humira injections.

1799 June 1 2:00 PM - 2:20 PM

Hip Pain - Women's Soccer

Shawn D. Felton, Taylor K. Kramer, Jason C. Craddock. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchell L. Cordova, FACSM)

Email: sfelton@fgcu.edu

(No relationships reported)

HISTORY:

Athlete is a 20-year-old NCAA Division II women's soccer player. Athlete's previous medical history includes chronic pelvic instability, Legg-Calve Perthes Disease (LCPD), and chronic exertional compartment syndrome bilaterally.

PHYSICAL EXAMINATION:

Athlete reported to athletic trainer complaining of sharp pain near right proximal hip region. Athlete did not recall a specific mechanism of injury. Initial evaluation revealed right hip bulge at proximal anterior hip. Athlete was point tender over bulge. Full active ROM and strength with hip flexion, extension, abduction, and adduction; decreased ROM with internal and external rotation. (+) Soft tendon bulge present with hip flexion, (-) bulge with extension. Neurological exam revealed reflexes 2/4 bilaterally and sensation grossly intact bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Generalized hip inflammation
2. Hip contusion
3. Hip flexor strain
4. Labral tear
5. Femoroacetabular impingement (FAI),
6. Legg-Calve Perthes Disease LCPD

TEST AND RESULTS:

MRI arthrogram

- revealed late abnormalities of LCPD

- flattening of superior weight bearing surface of femoral head with a shortened femoral neck, coxa magna deformity,

- globular thickening of the acetabular labrum

- chondral thinning along the acetabular margin anterosuperiorly

FINAL/WORKING DIAGNOSIS:

Legg-Calve Perthes Disease with Acetabular Dysplasia

TREATMENT AND OUTCOMES:

Athlete began conservative treatment with rest, soft tissue therapy, and stretching but right hip bulge exacerbated. An MRI arthrogram was ordered and revealed late abnormalities of LCPD. Athlete was further treated conservatively with NSAID's, activity modifications, and light resistive exercises. With ceased sport activity providing incomplete relief of symptoms, through a consultation with a physician, the athlete agreed to undergo a combined right hip surgical dislocation with acetabular rim trim, acetabular labral repair, femoral head and neck junction osteoplasty, relative neck lengthening, trochanteric advancement, and right hip periacetabular osteotomy. Since surgery, athlete has undergone five months of rehabilitation. Athlete is progressing well but her return to full participation has not been determined.

1800 June 1 2:20 PM - 2:40 PM

Pelvic Floor Injury - Gymnastics

Luis J. Soliz, Sheila Dugan, FACSM. *Rush University Medical Center, Chicago, IL.* (Sponsor: Sheila Dugan, MD, FACSM)

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(No relationships reported)

HISTORY: A 16-year-old female gymnast sustained a gymnastic injury resulting in left hip and pelvic pain. She was on the uneven bars and had to straddle in the air and then catch the bar coming from the abducted hip position to an adducted hip position. She felt the outside of her bilateral hips "pop". She rested for 6 weeks and underwent physical therapy. She returned to competition and reinjured the same area 2 weeks later. She underwent additional physical therapy and again returned to gymnastics but subsequently noticed many activities within her sport now caused "stabbing" pain. When landing from a trick she reported a shock up her left leg into her pubic bone. She was referred to a physiatrist for consideration of pelvic floor involvement given limited improvement in her symptoms with previous treatments and therapies.

PHYSICAL EXAMINATION: Bilateral active and passive ROM at the hip was WNL. There was tenderness to palpation (TTP) of the piriformis, glutes, ITB and trochanteric bursa on the left. Special tests including Scour's, FABER's, Ober's and Ely's were negative. There was TTP of the adductors bilaterally. Pelvic floor examination revealed normal labia with external inspection with intact sensation. Palpation revealed no pain in the introitus or urogenital diaphragm. Obturator internus was tender to touch and with resisted motion L>R. Abdominal exam revealed TTP of the psoas bilaterally L>R, pubic symphysis, and at the attachment of the rectus abdominis on the pubic bone bilaterally L>R.

DIFFERENTIAL DIAGNOSIS:

1. High Tone Pelvic Floor Muscle Dysfunction
2. Abdominal Wall Strain
3. Osteitis Pubis

TEST AND RESULTS:

MRI Abdomen Pelvis

-osteitis pubis, questionable pubic symphysis abnormality, and possible sports hernia

FINAL WORKING DIAGNOSIS:

High-Tone Pelvic Floor Muscle Dysfunction

TREATMENT AND OUTCOMES:

1. Manual therapy for pelvic alignment correction
2. Abdominal and pelvic girdle myofascial release
3. Pelvic stability with Kinesio Taping
4. Internal vaginal muscle myofascial release and neuro re-education
5. Padding in leotard to reduce impact at pubic tubercle
6. Trigger point injections of obturator internus muscles
7. Trial of Lyrica
8. Reduction of high-impact & high-speed repetitive sport-related activities
9. Discharge from PT with successful return to gymnastic competition

1801 June 1 2:40 PM - 3:00 PM

Anterior Hip Pain Following A Trampoline Injury

Ashley L. Yelinek, Suzanne Hecht, FACSM, Brad Nelson. *University of Minnesota, Minneapolis, MN.* (Sponsor: Suzanne Hecht, FACSM)

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(No relationships reported)

History: A 13 year old female presented to sports medicine clinic with substantial left anterior hip pain 2 weeks after jumping on a trampoline where she landed awkwardly and heard a loud "pop." She was in immediate pain and unable to bear weight. She was seen at a local emergency department immediately after the incident where she

had x-rays that were negative for fracture. She was admitted overnight for pain control. Orthopaedics was consulted and she was diagnosed with a muscle strain. She was discharged the next day with crutches to use as tolerated. When she presented to clinic she continued to have severe pain. She had spent the last 2 weeks non weight bearing with crutches with minimal improvement. She described her pain as sharp, constant, anterior, and worse with movement especially flexing her hip.

Physical Examination: She was guarded to any movement but in no acute distress. She was tender to palpation over her left ASIS and iliac spine. She had limited range of motion secondary to pain. Pain was elicited with muscle testing for hip flexion and hip abduction. She had a normal motor, vascular, sensory exam distally.

Differential Diagnosis:

1. Rectus femoris strain/ rupture
2. Sartorius strain/ rupture
3. Hip apophyseal avulsion fracture
4. Acetabular fracture

Test and Results:

X-rays. AP Pelvis and frog-leg lateral views of her left hip showed near complete skeletal maturation, no fracture or osseous abnormality. Pelvic MRI. MRI revealed a fluid signal along the left anterior superior iliac crest, consistent with sartorius tendon avulsion. No evidence of displaced bone.

Final Diagnosis: Complete sartorius avulsion off ASIS without bony involvement

Treatment and Outcomes:

-She was referred to Orthopaedic surgery and seen 5 weeks after her initial injury. Her pain was improving and she had been able to weight bear without her crutches for short distances.

-She was treated non operatively and instructed to weight bear as tolerated.

-Formal physical therapy was prescribed for range of motion, core and pelviformal strengthening, as well as neuromuscular re-education with a follow up visit scheduled in eight weeks.

the test a submaximal exercise test in normal clothing was performed to determine a relationship between heart rate and oxygen consumption (Pre-Test). Results: In total 163 exposures were measured. Tolerance time ranged from as low as 20 minutes in the hot-dry condition to 60 minutes (the maximum) in the moderate climate, especially common at the lowest walking speed. An important aspect of the dataset was the large variability between the subjects. Although the average responses seemed predictable, the variability in the high strain conditions ranged from 20 minutes up to 60 minutes. Individual characteristics showed very limited power in predicting individual tolerance times; only age versus final heart rate and the pre-test versus tolerance time showed a significant correlation with tolerance time ($p < 0.05$). Conclusions: Individual variability was much larger than expected, partly due to the inhomogeneous groups used in these experiments. Furthermore, rather than maximum core temperature reaching maximum heart rate was the most important reason for terminating the work. The data show the importance of individual monitoring for these high thermal and physiological strain exposure in the work place.

1830 June 1 4:10 PM - 4:25 PM

Human Wetness Perception: From Skin To Clothing

Margherita Raccuglia, Simon Hodder, George Havenith, FACSM. *Loughborough University, Loughborough, United Kingdom.*

(No relationships reported)

During exercise the increased sweat production causes moisture build-up at the skin-clothing interface. The resultant perception of wetness (WP) triggers the onset of thermal and sensorial discomfort, which can cause reductions in performance and productivity. In absence of skin hygro-receptors, WP occurs through the central integration of thermal and tactile stimulations. When in contact with clothing, especially personal protective ones, a large portion of skin interacts with textile materials, the latter's factors modulating WP. PURPOSE: To identify those textile parameters that trigger cutaneous thermal and tactile inputs underpinning WP. METHODS: A number of textile samples with different thickness, fiber type, and surface texture, were tested in STATIC (upper back) and DYNAMIC (inner forearm) contact with the skin. In both conditions fabric WP was observed at HIGH and LOW fabric-to-skin pressure. WP and stickiness sensation (tactile cue) were measured using ordinal perceptual scales and local skin temperature (thermal cue) by thermocouples. RESULTS: In STATIC, WP was positively related to fabric thickness ($r_2 = 0.87$). In fact, higher thickness resulted in greater fabric water content ($r_2 = 0.98$), the latter related to a diminished local skin temperature ($r_2 = 0.78$). In DYNAMIC, higher WP was associated with greater stickiness sensation ($r_2 = 0.68$), occurring from differences in fabric surface texture; additionally, fabric thickness did not correlate with WP directly, however when combined with stickiness sensation it provided a strong predictive power ($r_2 = 0.86$). In both STATIC and DYNAMIC, greater WP responses ($p < 0.05$) were observed in HIGH compared with LOW pressure condition; furthermore when matching for thickness, fiber type (cotton, polyester, polyester Coolmax) did not affect WP ($p > 0.05$). CONCLUSION: Fabric thickness and surface texture properties trigger thermal and tactile inputs, respectively, underpinning skin WP in static and dynamic clothing applications. Additionally, fabric weight and clothing fit could cause changes in fabric-to-skin pressure, which represents another tactile sensory modality contributing to skin WP. Hence, when wearing protective clothing, discomfort could be attenuated by accounting for these clothing and textile factors which modulates WP.

1831 June 1 4:25 PM - 4:55 PM

Keynote - What Kind of Protection is Needed for the Firefighters' Tasks and How does it Influence the Performance?

Ronald Heus. *Institute for Safety (IFV), 2718 RP Zoetermeer, Netherlands.*

(No relationships reported)

June 1 4:55 PM - 5:15 PM

Overall Discussion

D-31 Highlighted Symposium - Too Hot to Handle: Protective Clothing, Thermoregulation and Performance

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 406

1826 **Co-Chair:** Caroline J. Smith. *Appalachian State University, Boone, NC.*

(No relationships reported)

1827 **Co-Chair:** Robert W. Kenefick, FACSM. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*

(No relationships reported)

1828 June 1 3:25 PM - 3:55 PM

Keynote - How Much Personal Protection is too Much? Conflicts Between Optimal Performance and Protective Obligations

Nigel A.S. Taylor. *University of Wollongong, Wollongong, Australia.*

(No relationships reported)

1829 June 1 3:55 PM - 4:10 PM

Variability in Human Responses when working in Chemical protective Impermeable Suits

Emiel A. DenHartog. *North Carolina State University, Raleigh, NC.*

(No relationships reported)

Purpose: A major concern for responders to hazardous materials (HazMat) incidents is the heat strain that is caused by impermeable (NFPA1991) suits. In a research project, funded by the US Department of Defense, the thermal strain experienced when wearing these suits was studied. One area of interest was determining whether individual or anthropometric factors of age and body mass index could be predictors for individual physiological responses to allow more accurate predictions of work time in HazMat suits. Methods: 40 subjects between the ages of 25 and 50 participated in a protocol approved by the local ethical committee. Six different fully encapsulated impermeable HazMat suits were evaluated in three climates: moderate (24°C, 50% RH, 20°C WBGT), warm-wet (32°C, 60% RH, 30°C WBGT), and hot-dry (45°C, 20% RH, 37°C WBGT, 200 W/m² radiant load) and at three walking speeds: 2.5 km/hr, 4 km/hr, and 5.5 km/hr. The medium speed, 4 km/hr, was tested in all three climates and the other two walking speeds were only tested in the moderate climate. Prior to

THURSDAY, JUNE 1, 2017

D-41 Basic Science World Congress - Thematic Poster - Exercise, Neuroplasticity, and Cognition in Youth

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 101

1880 **Chair:** Dawn P. Coe, FACSM. *University of Tennessee, Knoxville, TN.*

(No relationships reported)

1881 **Board #1** June 1 3:15 PM - 5:15 PM
Cognitive Performance In Young Adulthood Is Associated With Sport Trajectories From Early Childhood Through Adolescence

Erin K. Howie¹, Romola S. Bucks², Joanne A. McVeigh³, Leon M. Straker³. ¹University of Arkansas, Fayetteville, AR. ²University of Western Australia, Perth, Australia. ³Curtin University, Perth, Australia. (Sponsor: Russell Pate, FACSM)
Email: ekhowie@uark.edu

(No relationships reported)

Cognitive functions, especially executive functions, develop across the lifespan into early adulthood. Physical activity has been shown to improve cognitive functions, yet the influence of youth sport, specifically, on cognitive function in later life is unknown. **PURPOSE:** To determine the association between latent class trajectories of organized sports participation and cognitive functions in young adulthood. **METHODS:** Organized sport latent class trajectories were previously developed separately for women and men for the Western Australian Pregnancy Cohort (Raine) Study from reported sports participation at ages 5, 8, 10, 14, and 17. At age 22, participants completed three subtests of the computerized Cogstate battery: card detection (a test of speed of processing), card identification (a test of vigilance and visual attention) and one back (a test of attention and working memory). Performance on these cognitive tasks (reaction times as \log_{10} transformed seconds) was compared using sex-specific MANCOVAs adjusted for the probability of trajectory class membership. Further adjustments were made for highest education level completed and self-reported physical activity assessed by the International Physical Activity Questionnaire at age 22. **RESULTS:** There were significant multivariate effects in cognitive performance between sport trajectories for both women ($p=.046$) and men ($p=.004$). For women, there were differences in performance on the one back test ($n=360$, $F=4.32$, $df=2$, $p=.014$) between the 3 sport trajectories. Women in the non-participator trajectory had slower reaction times, and thus poorer performance, compared to women who consistently participated or dropped-out of sports. For men ($n=356$), there were differences in performance for both the one back ($n=356$, $F=7.1$, $df=2$, $p<.001$) and card detection tasks ($F=3.2$, $df=2$, $p=.038$). Men who dropped out of sport had slower reaction times on both tests compared to those who were in the consistent participator trajectory. These associations remained when adjusted for education and current physical activity. **CONCLUSIONS:** Improved cognitive performance was associated with a trajectory of consistently participating sports compared to never participating or dropping out of sport for women and dropping out of sport for men.

1882 **Board #2** June 1 3:15 PM - 5:15 PM
Activity Intensity and School Readiness in Young Children

Tyler J. Kybartas¹, Jennifer I. Flynn², Jeffery T. Fairbrother¹, Sean R. Durham³, Dawn P. Coe, FACSM¹. ¹University of Tennessee, Knoxville, TN. ²Maryville College, Maryville, TN. ³Auburn University, Auburn, AL.
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(No relationships reported)

Physical activity (PA) is associated with academic achievement in school-aged children. There appears to be a threshold intensity with more intense PA having a stronger association with higher academic achievement. It is not known whether this intensity threshold is present in young children (preschool and kindergarten) since limited research has examined the association between PA and school readiness, a proxy for academic achievement, in this age group.

PURPOSE: To determine whether an association exists between PA intensity and school readiness in young children.

METHODS: Participants were 28 children (5.3+1.3y) enrolled in preschool and kindergarten programs at a university laboratory school. PA was assessed using an ActiGraph GT3x+ accelerometer worn on the right hip for seven days. Data were analyzed using the Pate cut points to calculate minutes of daily PA in each intensity (light, moderate, and vigorous). School readiness was assessed using the Expressive (BE) and Receptive (BR) Bracken Basic Concept Scales. BE requires verbal responses

on items related to colors, numbers, letters, shapes, and sizes/comparisons. The BR includes non-verbal responses (e.g., pointing) to the same items. Spearman correlations were used to examine the associations between PA intensities and the two Bracken subtests.

RESULTS: Children accumulated 309.5+72.1 min of daily total PA. Significant correlations were identified between moderate PA and BR ($r=0.39$; $p<0.05$) and between vigorous PA and both BE ($r=0.51$; $p<0.01$) and BR ($r=0.47$; $p<0.05$). Correlations were not significant between light PA and both Bracken subtests (BE: $r=0.29$; $p=0.13$; BR: $r=0.33$; $p=0.08$) and between moderate PA and BE ($r=0.21$; $p=0.28$).

CONCLUSIONS: Results suggest the existence of an intensity threshold influencing the PA and school readiness association such that only moderate or vigorous levels were associated with higher levels of readiness. The promotion of PA of varying intensities in early childhood programs may be beneficial for school readiness.

1883 **Board #3** June 1 3:15 PM - 5:15 PM
Effects Of Playing Soccer On Executive Function In Children

Shota Sakamoto, Masamitsu Ito, Yuta Uematsu, Masahiro Katagiri, Takeru Gushiken, Kazuhiro Suzukawa. *Nippon Sport Science University, Tokyo, Japan.*
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(No relationships reported)

Recent studies have shown the positive influence of physical activity on brain function in children. However, there is a lack of studies focusing on the qualitative aspects in type of exercise. Soccer requires sophisticated levels of thinking. Players are asked to decide quickly and accurately using optimum skill during the game. Because of this, it is implied that soccer stimulates cognitive functions. **PURPOSE:** The purpose of this study was to examine executive functions, especially, planning, cognitive flexibility, and fluency in generating visual patterns, between a group of non-physically active children and the group of young soccer players. The test results of the levels of performance of the group of young soccer players were compared between the two groups to reveal important findings in executive functions in soccer.

METHODS: The participants were 171 children, aged 10-12 years. They were divided into 2 groups. The group of young soccer players (GS) comprised of 63 children in a soccer team and the group of non-physically active (GN) candidates comprised of 108 sedentary children. Following that the group of young soccer players was divided into 2 groups according to level of performance. Group1 (G1) was comprised of 29 soccer players from the highest level of national youth soccer league. Group2 (G2) was comprised of 34 soccer players from the third national division in the same location. The test used was Design Fluency Test, which measures planning, cognitive flexibility, and fluency in generating visual patterns, above and beyond contributions from motor speed. The results were compared between GS and GN, and G1 and G2.

RESULTS: The group of young soccer player performed much better in the executive tests than the group of non-physically active (GS: mean-score: 8.0, SD: 3.31, GN: mean-score: 10.02, SD: 3.37; $t=3.793$, $df=169$, $p<.001$). The soccer players in the G1 had significantly better results than soccer players in the G2. (G1: mean-score: 11.21, SD: 3.45, G2: mean-score: 9.0, SD: 2.94; $t=2.694$, $df=61$, $p<.01$).

CONCLUSION: This study suggests that playing soccer influences the executive functions, especially, planning and cognitive flexibility for children and suggests that even the slightest improvement in executive functioning might be important for soccer performance in youth soccer players.

1884 **Board #4** June 1 3:15 PM - 5:15 PM
Obesity, Visceral Adipose Tissue, And Cognition In Childhood

Lauren Raine¹, Naiman Khan², Eric Drollette², Matthew Pontifex³, Arthur Kramer¹, Charles Hillman¹. ¹Northeastern University, Boston, MA. ²University of Illinois, Urbana, IL. ³Michigan State University, Lansing, MI.

(No relationships reported)

Purpose: There is an increasing prevalence of physical inactivity during childhood, concurrent with a rise in obesity rates, which are associated with a myriad of health complications. Independent of weight status, central adiposity has been linked to decrements in both metabolic health and cognitive function in children. However, the effect of central adiposity on childhood brain health and cognition warrants further study. Specifically, the effects of daily physical activity on concomitant changes in adiposity and childhood cognition function are unclear. Further, the extent to which pre-existing or baseline weight status predicts physical activity derived effects on children's cognition remain unknown. Accordingly, the aim of this investigation was to examine the effect of a 9-month physical activity intervention on changes in adiposity and cognition based on baseline weight status (i.e., healthy weight vs. obese) in children. **Methods:** Participants included obese ($n=77$) and matched healthy weight ($n=77$) preadolescents (8-9-year-olds) who participated in a 9-month physical activity randomized controlled trial. Cognitive function was assessed using

an inhibitory control task (modified flanker task). **Results:** Following the 9-month physical activity intervention, children intervention participants exhibited reduction in adiposity. In contrast, children in the waitlist-control condition, particularly obese children, gained visceral adipose tissue (95% confidence interval (CI) -58.58, -9.14; $p=0.008$). Furthermore, changes in visceral adipose tissue were related to changes in cognitive performance, such that the degree of reduction in visceral adipose tissue directly related to greater positive gains in inhibitory control, particularly among obese intervention participants (CI -0.14, -0.04; $p=0.001$). **Conclusions:** These findings demonstrate that participation in a daily physical activity program not only reduces adiposity but also concomitantly improves children's cognitive function. Further, this work reveals that the benefits of physical activity on improvements in cognitive function are particularly evident among obese children.

1885 Board #5 June 1 3:15 PM - 5:15 PM

An 8 Week Aerobic Exercise Training Intervention Improved Executive Functions in Adolescents

Kimberley Lakes, Fadia Haddad, Kim Lu, Dan Cooper, FACSM, Shlomit Aizik. *University of California, Irvine, Irvine, CA.*

(Sponsor: Dr. Dan Cooper, FACSM)

Email: klakes@uci.edu

(No relationships reported)

A recent meta-analysis examining the impact of 28 physical activity (PA) interventions on executive function (EF) outcomes in healthy children reported a significant, small to moderate positive effect on EF, though effects varied widely across qualitatively different programs, and none of the programs utilized individual, controlled exercise prescriptions. **Purpose.** To evaluate the impact of personalized exercise intervention on EF in adolescents. **Methods.** 32 normal weight adolescents (14-17 y/o, 20 girls) participated in an 8 week supervised, personalized exercise program, 3 times/week, 60 min/session (24 sessions total). VO_2 peak was assessed, before and after the program by ramp-type progressive cycle ergometer until exhaustion. EFs were measured before and after intervention using a computerized test of executive function, with three trials (congruent, incongruent, mixed) that yielded six scores each time - three response times (RTs) and three accuracy scores. Changes were examined using paired samples *t*-tests with pre- and post-test scores for each of the six variables. **Results.** Peak VO_2 was improved ($12.6 \pm 1.6\%$, $p=4.8E-08$) in 31 out of 32 participants. The means for Congruent Accuracy, which measures primarily attention, were similar at pre- and post-test (93% and 94% correct), and this difference was not statistically significant, $t(30) = -0.61$, $p = .55$, $d = .11$. Congruent RT taps into attention and processing speed and was significantly improved, $t(30) = 3.21$, $p = .00$, $d = .58$. Incongruent Accuracy measures primarily inhibitory control and changes were not statistically significant, $t(28) = -1.41$, $p = .17$, $d = .19$. Incongruent RT requires attention, processing speed, and inhibition and significantly improved, $t(29) = 2.44$, $p = .02$, $d = .45$. Accuracy on the Mixed Trial, which measures inhibitory control and shifting, improved significantly, $t(30) = -3.63$, $p = .00$, $d = .50$. Mixed RT requires attention, processing speed, and shifting and significantly improved, $t(30) = 2.31$, $p = .03$, $d = .41$. **Conclusions.** Results suggest a positive impact of an individualized exercise program on attention, processing speed, inhibitory control, and shifting in adolescents. Further research is needed to identify the underlying mechanisms involved. Supported by NIH Grant P01HD-048721 and PERC System Biology Fund

1886 Board #6 June 1 3:15 PM - 5:15 PM

Prospective Associations Of Cardiorespiratory Fitness, Motor Performance, And Adiposity With Cognition In Children

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Reported Relationships: E.A. Haapala: Consulting Fee; Fazer Group.

Cardiorespiratory fitness and motor performance have been associated directly and adiposity has been associated inversely with cognition among children in cross-sectional studies. However, little is known about their longitudinal relationships to cognition in children. **PURPOSE:** To investigate the associations of cardiorespiratory fitness, motor performance, and body fat percentage among children aged 6-8 years and changes in these parameters during 2-year follow-up with cognition at the age of 8-10 years. **METHODS:** A total of 391 children (195 boys, 196 girls) participated in the study. Cardiorespiratory fitness (CRF) was assessed using a maximal exercise test on a bicycle ergometer and was defined as peak workload per lean body mass. Motor performance score was computed from the z-scores of 50-meter shuttle run test time, errors in the static balance test, and results of the Box and block test. Body fat percentage was measured using dual-energy X-ray absorptiometry. Cognition was measured using Raven's Coloured Progressive Matrices (RCPM). The data were analyzed separately for boys and girls by linear regression analyses and ANCOVA with repeated measures adjusted for age. **RESULTS:** In boys, motor performance was

directly associated with RCPM score ($\beta=0.237$, 95% CI=0.083 to 0.392, $p=0.003$) at baseline and better motor performance at baseline was related to a higher RCPM score at the 2-year follow-up ($\beta=0.180$, 95% CI=-0.021 to 0.388, $p=0.026$), but this association weakened after adjustment for baseline RCPM score ($p=0.569$). Changes in CRF, motor performance, or body fat percentage were not associated with RCPM score at 2-year follow-up in boys. Boys in the highest third (mean difference=2.545, 95% CI for difference=0.705 to 4.386, $p=0.003$) and in the middle third (mean difference=1.813, 95% CI for difference=0.068 to 3.558, $p=0.039$) of motor performance at baseline had higher Raven CPM scores across 2 years compared to boys in the lowest third. CRF, motor performance, body fat percentage, or their changes were not associated with RCPM score among girls. **CONCLUSIONS:** Poor motor performance at baseline was associated with poorer cognition through 2-year follow-up period in boys. No associations of CRF, motor performance, or body fat percentage with cognition were found in girls.

1887 Board #7 June 1 3:15 PM - 5:15 PM

A Novel Approach To Look At The Brain: Fitness And Shape Of Subcortical Structures In Children

Francisco B. Ortega, Daniel Campos, Cadenas-Sanchez Cristina, Signe Altnae, Cristina Martinez-Zaldivar, Miguel Martin-Matillas, Andres Catena, Cristina Campoy. *University of Granada, Granada, Spain.*

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(No relationships reported)

A few studies have recently reported that higher cardiorespiratory fitness is associated with higher volumes of subcortical brain structures in children. It is known however that not only the whole volume of the structure but also the shape of the brain structures influence brain functioning. To the best of our knowledge, the association between fitness and shape of subcortical brain structures has not been studied in any age group.

PURPOSE: We aimed to examine the association of the main health-related physical fitness components with shape of subcortical brain structures in children.

METHODS: The study sample comprised 44 Spanish children aged 9.7 ± 0.2 years. Cardiorespiratory fitness, muscular strength and speed-agility were assessed using valid and reliable tests (ALPHA-fitness test battery). Shape of the subcortical brain structures was assessed by magnetic resonance imaging, and its relationship with fitness was examined after controlling for a set of potential confounders using a partial correlation permutation approach.

RESULTS: All physical fitness components studied were significantly related to shape of subcortical brain nuclei. These associations were both positive and negative, indicating that a higher level of fitness in childhood is related to both expansions and contractions in certain regions of Accumbens, Amygdala, Caudate, Hippocampus, Pallidum, Putamen and Thalamus. Cardiorespiratory fitness was mainly associated with expansions, whereas handgrip was mostly associated with contractions in the structures studied.

CONCLUSIONS: Our observational data provide preliminary evidence supporting that physical fitness could play a role in brain shaping. These findings should be confirmed or contrasted by future randomized controlled trials, demonstrating whether changes in fitness modify the shape of brain structures and the extent to which those changes influence cognitive function.

1888 Board #8 June 1 3:15 PM - 5:15 PM

Physical Fitness Components And Cortical And Subcortical Brain Volume In Overweight/obese Children: The Activebrains Project

Irene Esteban-Cornejo¹, Cristina Cadenas-Sánchez¹, Oren Contreras-Rodriguez², Juan Verdejo-Roman¹, Jose Mora-González¹, Jairo H. Migueles¹, Pontus Henriksson¹, Catherine L. Davis³, Antonio Verdejo-García⁴, Andrés Catena¹, Francisco B. Ortega¹. ¹University of Granada, Granada, Spain. ²Bellvitge Biomedical Research Institute-IDIBELL, Barcelona, Spain. ³Augusta University, Augusta, GA. ⁴Monash University, Melbourne, Australia.

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(No relationships reported)

PURPOSE: To examine the association between the key components of physical fitness (i.e. cardiorespiratory fitness, speed-agility and muscular fitness) and brain structural volume in overweight/obese children.

METHODS: A total of 101 overweight/obese children aged 8-11 years were recruited from Granada, Spain. The physical fitness components were assessed following the ALPHA health-related fitness test battery. T1-weighted images were acquired with a 3.0 Tesla Siemens Magnetom Tim Trio system. Gray matter tissue was calculated using Diffeomorphic Anatomical Registration Through Exponentiated Lie algebra (DARTEL). All analyses were controlled for sex, peak high velocity offset, parent

education, body mass index and total brain volume. The statistical threshold was calculated with AlphaSim and further Hayasaka adjusted to account for the non-isotropic smoothness of structural images.

RESULTS: Cardiorespiratory fitness was related to greater gray matter volumes ($P < 0.001$, $k=58$) in 9 out of all regions with β ranging from 0.493 to 0.584; specifically in frontal regions (i.e. premotor cortex and medial primary motor cortex), superior parietal cortex, subcortical regions (i.e. hippocampus and caudate), temporal regions (i.e. middle and inferior temporal gyri and parahippocampal gyrus) and calcarine cortex. Speed-agility was associated with greater gray matter volumes ($P < 0.001$, $k=54$) in 2 regions (i.e. the inferior frontal gyrus and the superior temporal gyrus) with β ranging from 0.564 to 0.611. Muscular fitness was not independently associated with greater gray matter volume in any brain regions. No brain regions showed statistically significant negative associations between components of physical fitness and gray matter volume.

CONCLUSIONS: Cardiorespiratory fitness and speed-agility, but not muscular fitness, might independently be associated with greater volume of numerous cortical and subcortical brain structures. Importantly, those associated brain structures are different for each fitness component. These findings suggest that the development of cardiorespiratory fitness and speed-agility might positively affect development of distinctive brain regions and contribute to counteract the harmful effect of overweight and obesity on brain structure during childhood.

D-42 Thematic Poster - Biomechanical Effects of Fatigue

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 403

1889 **Chair:** Rod Harter, FACSM. *Texas State University, San Marcos, TX.*

(No relationships reported)

1890 **Board #1** June 1 3:15 PM - 5:15 PM
The Effect Of Compression Tights On Muscle Vibration And Fatigue From A High-intensity Run

Margaret E. Raabe, 43212, Michael P. McNally, Ajit M.W. Chaudhari, FACSM. *The Ohio State University, Columbus, OH.* (Sponsor: Ajit Chaudhari, FACSM)
Email: margaret.e.raabe@gmail.com

(No relationships reported)

BACKGROUND: It has been hypothesized that compression garments may enhance performance by reducing muscle vibrations during running and jumping. Muscles naturally contract to dampen vibration, which could lead to accelerated fatigue. Therefore, wearing compression garments may result in reduced muscular fatigue.

PURPOSE: To investigate the effect of compression tights on muscle vibration and fatigue from a high-intensity run.

METHODS: Twenty healthy experienced male runners ran overground at estimated 80% $\dot{V}O_2$ max speed. Vibration data was collected using an optical motion capture system. The peak amplitude of muscle vibrations (axial direction) were calculated during the first 150ms after foot strike for the quadriceps, hamstrings, gastrocnemius, and tibialis anterior muscles. A high-intensity run was then performed on a treadmill at the same speed for 30 minutes or until voluntary exhaustion. Participants performed 3 countermovement jumps (CMJ) and isometric strength measurements of the 4 leg muscle groups before and after the run. This protocol was repeated on three separate days, one with running shorts (S) and the others with low (L) or high (H) compression tights (10-15 mmHg; 20-25 mmHg). The order of conditions was randomly assigned. Measures of fatigue analyzed included: percent change in jump height, muscle strength, and landing loading rate during the CMJ.

RESULTS: Linear mixed models revealed a significant effect of the tights on muscle vibration for all muscles except the hamstrings (hamstrings: $S=7.6 \pm 3.6$ mm, $L=7.4 \pm 2.0$ mm, $H=7.2 \pm 2.2$ mm, $p=0.89$), with significantly less vibration in both tights conditions compared to the shorts (quads: $S=15.9 \pm 5.1$ mm, $L=8.4 \pm 2.3$ mm, $H=7.6 \pm 2.5$ mm, $p < 0.0001$). However, the tights had no significant effect on the fatigue measures analyzed (% change in quad strength: $S=-2.6 \pm 12.1$ %, $L=-2.6 \pm 10.4$ %, $H=-0.7 \pm 14.6$ %, $p=0.85$; % change in CMJ landing loading rate: $S=+11.7 \pm 38.2$ %, $L=+24.9 \pm 41.9$ %, $H=+23.4 \pm 29.6$ %, $p=0.39$; % change in CMJ height: $S=+6.1 \pm 8.3$ %, $L=+8.4 \pm 9.4$ %, $H=+8.8 \pm 8.1$ %, $p=0.43$).

CONCLUSION: Compression tights significantly reduced muscle vibration during running but had no effect on muscle fatigue as measured by change in jump height, jump landing loading rate, or strength following a 30-minute high-intensity run. Supported by a research grant from Nike, Inc.

1891 **Board #2** June 1 3:15 PM - 5:15 PM
The Influence of Fatigue on Vertical Free Moment and Vertical Moments around the COM in Female Runners With a History of Stress Fractures
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The free moment (FM) is a torque around a vertical axis that is the result of the friction between the foot and ground. The FM has been shown to be greater in runners with a history of stress fractures (SF) and is associated with changes in step width, length, pronation, hip and knee kinematics, arm swing, and fatigue. Since the FM acts in conjunction with moments due to horizontal ground reaction forces (GRFs) to determine whole body axial acceleration, a history of SF may be associated with a difference in controlling axial rotation. **PURPOSE:** Evaluate the influence of progressive fatigue on FM and vertical moments around the body COM in female runners with and without a history of SF. **METHODS:** 9 Females with a history of SF and 11 healthy females ran on an instrumented treadmill at their estimated 5k pace until voluntary exhaustion. 3D kinematics for 13 segments identified whole body COM. The product of the horizontal GRFs and the difference between COP and the projected COM determined the axial moment from medio-lateral force (M_{ml}), antero-posterior force (M_{ap}) and their sum (M_{grfnet}). Peak internal (PKINT) and external (PKEXT) values and values at peak braking (PKBRK) of the moments were evaluated between groups and time with a RMANOVA. **RESULTS:** In most cases, M_{grfnet} was dominated by M_{ml} in the first half of stance and by M_{ap} in the latter half and FM directly opposed M_{grfnet} . No group by time interactions were found. PKINT- M_{grfnet} ($.184 \pm .07$ to $.223 \pm .09$ Nm/kg, $p=.0005$) and PKINT-FM ($.163 \pm .08$ to $.203 \pm .12$ Nm/kg, $p=.0007$) increased with time with no change in PKEXT-FM. Group differences indicated greater PKEXT- M_{ap} in the SF group ($.113 \pm .03$ vs $.092 \pm .02$ Nm/kg, $p=.014$) along with lower internal PKBRK-FM ($.018 \pm .12$ to $.110 \pm .10$ Nm/kg, $p=.015$). **CONCLUSIONS:** Runners with a history of SF respond to fatigue similarly as healthy runners. Differences in PKBRK-FM and PKEXT- M_{ap} suggest whole body axial rotation is controlled differently when there is a history of SF. The opposing relationship between Fm and M_{grfnet} suggests that FM acts to modify the influence of M_{grfnet} on the COM during the first half of stance. The increase in PKINT-FM and PKINT- M_{grfnet} with fatigue indicates changes in the requirements to control whole body axial rotation during stance in both groups.

1892 **Board #3** June 1 3:15 PM - 5:15 PM
The Effect of Fatigue on Tibial Acceleration During an Incremental Run
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(No relationships reported)

Background: Tibial acceleration is one of the most important mechanical factors associated with high risk of injuries, such as tibial stress fracture and other related musculoskeletal pathologies. Increased tibial acceleration is linked to increased bone-to-bone stress and may exceed the repair and remodeling process of the bone structure over time. Running through fatigue also exacerbates this phenomenon. **Purpose:** To investigate the effects of a high-intensity fatiguing run on tibial acceleration while running at various speeds to identify a change in speed-acceleration relationship. **Methods:** Five male college students (age = 20.8 ± 1 yr; weight = 76.7 ± 4 kg; height = 181.2 ± 4 cm) visited the Creighton University Biomechanics laboratory on two occasions. During the first visit, subjects underwent an incremental test of 3-min stages to determine their lactate threshold speed (LTS) by collecting blood samples ($LTS=7.6 \pm 1$ mph). During the second visit, subjects were asked to complete an incremental run of seven 30-second stages at speeds that ranged from 20% below to 40% above the LTS. Subsequently, they performed a 5k run at their LTS followed by another incremental run. A wireless accelerometer that was placed at each subject's dominant tibial plateau recorded acceleration before and after the 5k run. **Results:** A two way repeated ANOVA (2 states x 7 speeds) showed that there was a main effect of speed and a main effect of fatigue ($p < 0.05$). Post hoc analysis revealed that tibial acceleration was significantly greater at speeds larger than 10% above LTS. **Conclusion:** Current findings showed that tibial acceleration – a previously identified risk factor for impact-related injuries – is affected by fatigue and speed. Therefore, it is of paramount importance that recreational runners that run through fatigue should not run at speeds much faster than their LTS to avoid increasing their risk of injury due to reduced tolerance for impact.

1893 Board #4 June 1 3:15 PM - 5:15 PM

Effect of Fatigue on Landing Biomechanics in Soccer Players with an Anterior Cruciate Ligament Reconstruction

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Fatigue has been shown to influence landing biomechanics in individuals with an anterior cruciate ligament reconstruction (ACLR). However, no study has evaluated the effect of fatigue on landing biomechanics during a soccer-specific landing task in soccer players with an ACLR.

PURPOSE: To evaluate the effect of fatigue on landing biomechanics during an unplanned landing task in soccer players following ACLR compared with healthy non-injured soccer players.

METHODS: Eighteen soccer players with an ACLR (age, 26.11 ± 3.95 years; height, 1.70 ± 0.09 m; weight, 68.15 ± 9.64 kg, BMI, 23.52 ± 2.69 kg/m², time since surgery, 5 ± 3.30 years) and 18 healthy non-injured soccer players (age, 25.83 ± 3.51 years; height, 1.66 ± 0.05 m; weight, 66.88 ± 10.37 kg, BMI, 24.09 ± 3.73 kg/m²) participated in the study. Subjects were assessed during an unplanned landing task before and after completing a Wingate fatigue protocol. The landing task included jumping forward to head a soccer ball and landing on the force plates. An accumulation of 4mmol of lactate was indicative of fatigue. The outcome measures were peak flexion angles and extension moments of the hip, knee and ankle joints, peak pressure and electromyography activity of gluteus maximus, quadriceps, hamstrings and gastrocnemius muscles. A 2x2 ANOVA (fatigue×group) was performed for each outcome measure.

RESULTS: There were no significant fatigue×group interactions for any of the outcome measures. There were significant main effects of fatigue (as compared to the non-fatigued landing) regardless of group. The fatigued landing showed greater hip flexion ($F_{1,34} = 7.24, p = 0.01$), greater knee flexion ($F_{1,34} = 12.16, p = 0.001$), and greater ankle dorsiflexion ($F_{1,34} = 10.97, p = 0.002$). Also, the fatigued landing demonstrated significantly greater hip extension moments ($F_{1,34} = 7.71, p = 0.009$), greater knee extension moments ($F_{1,34} = 7.04, p = 0.012$), greater ankle plantarflexion moments ($F_{1,34} = 10.38, p = 0.003$), and decreased quadriceps activity ($F_{1,34} = 8.18, p = 0.007$).

CONCLUSION: Fatigue caused changes in landing biomechanics; however, these changes were not significantly different when the groups were compared. These results indicate that having an ACLR (at least 1 year post-surgery) does not appear to lead to sustained changes in landing biomechanics induced by fatigue.

1894 Board #5 June 1 3:15 PM - 5:15 PM

The Influence of Hamstrings Fatigue on Knee Biomechanics During a Drop Vertical Jump

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(No relationships reported)

Anterior cruciate ligament (ACL) injuries are more prevalent in females vs. males, and are associated with significant morbidity as a result of prolonged symptoms. One mechanism thought to underlie this gender disparity is relative weakness of the hamstrings muscles, particularly the medial hamstrings, which are ACL protective. Neuromuscular fatigue may exacerbate hamstrings weakness, resulting in increases in injury risk factors such as valgus knee angles and moments during landing, cutting, and pivoting. **PURPOSE:** To examine the influence of hamstrings fatigue on female knee biomechanics. **METHODS:** Twelve female athletes performed six drop vertical jump (DVJ) tasks before and after a fatiguing protocol utilizing a glute-ham bench. Knee kinematics and kinetics were recorded during the contact phase of the DVJ, including knee abduction angle, knee abduction moment, knee flexion angle, and vertical ground reaction force (vGRF). These parameters were grouped based on leg dominance and analyzed by paired t-tests. **RESULTS:** Between baseline and the fatigued state, there was a significant decrease in the dominant limb knee abduction angle (but not in the non-dominant limb) across the contact phase (initial contact: 10.5 ± 5.3° vs. 6.4 ± 3.2°; toe-off: 10.1 ± 4.8° vs. 5.9 ± 1.6°; maximum: 13.5 ± 5.0° vs. 9.1 ± 2.2°; peak vGRF: 8.3 ± 4.6° vs. 4.7 ± 2.6°; for each $P \leq 0.05$). Knee flexion angle did not differ between baseline and fatigue in either limb. Knee abduction moment in the non-dominant limb was significantly lower with fatigue at toe-off (0.2 ± 0.2 vs. 0.1 ± 0.3 Nm/Kg), but at no other point during contact. Knee abduction moment was not affected in the dominant limb. Peak vGRF was significantly lower with fatigue compared to baseline in both limbs (dominant: 1.5 ± 0.3 vs. 1.2 ± 0.2 x BW; non-dominant: 1.4 ± 0.3 vs. 1.1 ± 0.2 x BW). **CONCLUSION:** The results were unexpected: post-fatigue knee abduction angle and moment were (partially) reduced and in theory, less risky. This may relate to the glute-ham exercises preferentially fatiguing biceps femoris, which has a valgus moment arm, vs. the medial hamstrings which have varus moment arms.

If the protocol led to greater relative medial hamstrings force production, it may have reduced knee abduction angle via a varus net hamstrings moment. Further research is required to test this explanation.

1895 Board #6 June 1 3:15 PM - 5:15 PM

Effect of Fatigue on Lower Extremity Biomechanics during Repeated Vertical Jumps in College-Aged Females

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Anterior cruciate ligament (ACL) injuries are common in females, and most non-contact ACL injuries occur during landing or cutting movements. Also, fatigue has been linked to an increased risk of injury. Accordingly, significantly more injuries occur during the latter portions of game performance, according to several epidemiological studies. However, a scarce amount of research exists regarding the effects of neuromuscular fatigue on landing biomechanics. We surmised that FL would cause abnormal lower extremity biomechanics.

PURPOSE: To determine if a 60-second continuous bout of jumping affects lower extremity landing biomechanics in females. **METHODS:** Recreational female athletes (n=10; 63.9±6.5kg, 170.5±3.1cm) participated in this study. Participants performed established fatigue protocol: double leg vertical jumps every three seconds for 60 seconds. Participants were required to touch a suspended horizontal bar during each jump, with the bar height set by having participants hang from the bar and adjusting it until the height from the midpoint of the lateral malleolus to the ground was 0.4 m. The first three consecutive jumps from the first and last 10 seconds were chosen for data analysis. Reflective marker coordinates were reconstructed from locations captured from 7 cameras (240 Hz). Dominant-side lower extremity angular joint kinematics and ground reaction forces (GRF: 1,200 Hz) were compared between the non-fatigue landings (NFL) and fatigue landings (FL) using paired t-tests ($p < .05$). **RESULTS:** FL, compared to NFL, resulted in increased knee abduction angle (1.6±3.9° and 0.6±2.8°) and decreased knee flexion angle (2.7±5.2° and 4.0±6.3°) at initial contact (IC). An increased trunk maximum flexion angle (15.5±7.6° and 10.0±5.2°) and knee flexion displacement (58.7±12.8° and 55.6±13.6°) also occurred. Additionally, FL also resulted in a reduction in vertical GRF peak magnitude (1.47±0.24 N·kg⁻¹ and 1.75±0.26 N·kg⁻¹). **CONCLUSION:** At IC, both an extended knee position and greater knee abduction angle have been associated with an increase in ACL injury risk and loading. However, a decrease in peak vertical GRF and increased trunk flexion angle and knee flexion displacement are factors that decrease ACL injury risk and loading and may be adaptation strategies to protect the knee when fatigued.

1896 Board #7 June 1 3:15 PM - 5:15 PM

The Effects of Different Fatigue Protocols on Lower Extremity Kinematics and Impact Forces during Landings

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(No relationships reported)

Neuromuscular fatigue probably contribute to the increased incidence of ACL injuries. Previous studies have demonstrated that a more erect landing posture combined with increased impact characteristics commonly occurred in fatigue condition. However, the inconsistency of fatigue protocols lead to contradictory results of kinematics and impact forces.

PURPOSE: To examine the changes in the lower extremity sagittal plane kinematics, impact forces between two fatigue protocols during drop landings. **METHODS:** 15 trained male athletes participated in the study. Two fatigue protocols were randomly used to induce fatigue. The running fatigue protocol (R) required participants to run at 4.0 m/s. The running + jumping fatigue protocol (R + J) required participants to first perform five countermovement jumps within a height above 70% of their maximal vertical jump height then completing a group of shuttle running. Before and after the fatigue protocols, each participant was required to execute five successful trials of drop landing from a 60 cm platform. Kinematics and kinetics data was collected using Vicon and Kistler force plates. The variables included sagittal joint angle of the hip, knee, and ankle; peak impact forces/loading rate. **RESULTS:** 1) For kinematics, the minimum angle of hip joint (R + J: 87.8 ± 20.5° vs. 80.4 ± 21.5°; R: 93.9 ± 26.0° vs. 85.0 ± 28.0°), knee joint (R + J: 83.3 ± 16.9° vs. 75.5 ± 17.6°; R: 85.6 ± 19.8° vs. 80.4 ± 22.0°) in post-fatigue condition was lower than those in pre-fatigue condition and the range of motion of hip joint (R + J: 50.4 ± 14.2° vs. 58.6 ± 15.8°; R: 48.5 ± 17.9° vs. 53.7

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$\pm 17.5^\circ$), knee joint (R + J: $73.6 \pm 13.4^\circ$ vs. $83.7 \pm 13.5^\circ$; R: $73.8 \pm 14.9^\circ$ vs. $78.9 \pm 15.9^\circ$) in post-fatigue condition was higher than those in pre-fatigue condition for both fatigue protocols ($P < .05$); Post-tests using R + J showed an increase in the range of motion of ankle joint ($37.9 \pm 9.8^\circ$ vs. $40.4 \pm 9.6^\circ$) comparing with pre-tests ($P < .05$); 2) No changes were found in the impact characteristics between pre- and post-tests for both fatigue protocols. **CONCLUSION:** Both fatigue protocols can induce a more flexed landing posture of lower extremities during the impact of landing. However, whether it is an intentionally or unintentionally protection of potential ACL injury still needs further considering.
Supported by NSFC grant (81302131).

1897 Board #8 June 1 3:15 PM - 5:15 PM
Improved Drop Landing Kinematics and Resistance to Fatigue Following Participation in Two Neuromuscular Training Programs

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PURPOSE: Hip abductor weakness and acute fatigue are thought to negatively influence the amount of dynamic knee valgus and increase the risk of ACL injury. The Landing Error Scoring System (LESS) is a validated, low-tech drop landing field test commonly used to screen athletes en masse for ACL injury risk. We compared the effects of two 4-week lower extremity neuromuscular training (NMT) programs on acute hip abductor muscular fatigue and LESS scores in women. **METHODS:** 32 physically-active women (age, 21.0 ± 1.4 yrs; height, 1.63 ± 0.06 m; mass, 61.3 ± 8.6 kg) were randomly assigned to one of two 4-week NMT programs, Traditional ($n = 17$) or Plyometric ($n = 15$), and performed their respective NMT exercises 4 days per week for 4 weeks. We induced fatigue with a standing hip abduction protocol that employed an isokinetic dynamometer (Thomas et al., 2010). Key outcome measures were obtained pre- and post-fatigue at Week 0 and Week 4, and included concentric/eccentric hip abductor peak torque at $120^\circ/s$, closed chain leg press peak force at $60^\circ/s$, and the 17-point LESS test score. **RESULTS:** Compliance with both NMT programs was excellent, with 27 of 32 participants (84%) recording perfect attendance. Concentric hip abduction peak torque increased 27.9% in the Plyometric group and 19.9% in the Traditional group after 4 weeks ($p < 0.001$), but there were no significant between group differences ($p > 0.05$). Our 3-way mixed ANOVA—Group (2) x Time (2) x Fatigue Condition (2)—revealed significant differences on the LESS test for Group ($p < 0.05$), and Time and Fatigue Condition ($p < 0.001$). At entry into the study, mean post-fatigue LESS scores were $9.06 + 1.49$ for the Plyometric group and $6.89 + 1.69$ for the Traditional group ($p > 0.05$). The Plyometric NMT protocol improved LESS scores at Week 4 in both the pre-fatigue (16.7%) and post-fatigue drop landings (11.6%), while participation in the Traditional NMT program improved LESS test scores at Week 4 by 9.0% pre-fatigue and 7.9% post-fatigue when compared to Week 0 ($p < 0.05$). **CONCLUSION:** Both of the 4-week lower extremity NMT programs were successful in improving hip abductor and leg press strength. More importantly, the Plyometric protocol produced significantly greater improvements in LESS test scores than the Traditional program, possibly further reducing ACL injury risk in this population.

D-43 Thematic Poster - Measurement and Modeling

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 505

1898 **Chair:** Stella L. Volpe, FACSM. Drexel University, Philadelphia, PA.
(No relationships reported)

1899 Board #1 June 1 3:15 PM - 5:15 PM
Performance Modeling Applied to On Ice Measures of NCAA Div. III Collegiate Ice Hockey Players

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Performance modeling has been used in numerous sports to predict performance based on the interaction of the positive (i.e. fitness) and the negative (i.e. fatigue) effects of training that results in optimal performance. **PURPOSE:** i) To use accelerometry to

quantify daily training load of on-ice sessions among collegiate ice-hockey players, ii) to use this training load as inputs for an impulse-response performance model & iii) to compare model parameters to on-ice performance metrics. **METHODS:** 7 NCAA Div. III hockey players (22.0 ± 0.6 yr; 185.4 ± 3.7 cm; 87.9 ± 6.6 kg) consented to procedures approved by the Adrian College Human Subjects Committee whereby triaxial accelerometry (Zephyr, MD) was collected during each practice and game of the 2014/15 season. Accelerations (g 's) were used to generate a Training Stress Scores (TSS). TSS was entered into a performance modeling algorithm to yield a Training Stress Balance (TSB) resulting from Chronic Training Loads (CTL) (i.e. "fitness"), & daily Acute Training Loads (ATL) (i.e. "fatigue"). Data were divided into quartiles, & quartile Top 10 anaerobic (5 - 60 sec) & aerobic (20, 45 min) efforts were analyzed. MANOVA & Regressions were performed using SPSS 21.0 (IBM, NY). **RESULTS:** Compared to quartile 1 (Q1), TSS was significantly lower during Q4 (57.1 ± 3.18 v. 65.0 ± 2.24 ; $p < 0.05$); TSB was significantly higher during Q2, Q3, & Q4 (-2.30 ± 0.67 , -1.49 ± 0.55 , 1.88 ± 0.74 v. -12.4 ± 0.52 ; $p < 0.001$); CTL was significantly higher during Q3 & Q4 (32.5 ± 0.27 , 33.5 ± 0.37 v. 29.9 ± 0.26 ; $p < 0.001$); whereas ATL was significantly lower during Q4 (34.7 ± 0.95 v. 44.8 ± 0.67 ; $p < 0.001$). Anaerobic accelerations for all time increments were lower during Q4 ($p < 0.05$), while aerobic acceleration outputs were non-significantly higher. Strong relationships were observed between 30 and 60 sec accelerations and TSS ($r = 0.63$, 0.68 , respectively), while not as strong with TSB ($r = 0.33$, 0.35 , respectively). Aerobic efforts were generally weaker in relation to model parameters. **CONCLUSION:** Training load was reduced in 2nd half of the season, as a result ATL declined in 2nd half of season; while CTL remained relatively high. Predicted increased CTL matched a nonsignificant increase in long-duration (aerobic) on-ice metrics. Although TSB increased significantly, short-duration (anaerobic) metrics decreased.

1900 Board #2 June 1 3:15 PM - 5:15 PM
Assessing Physical Fitness In PReschool Children: Fitness Reference Standards From The PREFIT Project

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Physical fitness is a powerful marker of health in children and adolescents, and there is no reason to believe that fitness is less important in younger children, i.e., preschoolers. Our group has recently published a systematic review and methodological studies on fitness in preschoolers and has proposed the PREFIT (Assessing levels of FITness in PReschoolers) battery for preschoolers aged 3-5 years, providing information about its feasibility, reliability and practical recommendations. References, manual of operations, videos about the tests, etc. are freely available at <http://profith.ugr.es>. Currently, there are no fitness reference standards available to interpret fitness levels in preschoolers.

PURPOSE: To provide fitness reference standards for preschool children. **METHODS:** A total of 3179 preschoolers aged 3-5 years from 10 cities geographically distributed across Spain participated in the PREFIT project. Cardiorespiratory fitness, muscular strength, speed-agility and balance were assessed using the PREFIT 20m shuttle run (an adapted version of the original test proposed by Leger in 1988), handgrip strength and standing long jump, 4x10m shuttle run and one-leg stance tests, respectively. We applied the Generalized Additive Model for Location, Scale and Shape method to obtain reference standards based on percentile curves. **RESULTS:** Reference standards for each fitness component by sex and age each 0.25 year are provided. Boys performed better than girls in cardiorespiratory fitness, muscular strength and speed-agility in all age groups and over the different percentiles (all $P_s \leq 0.01$). However, girls performed slightly better than boys in balance ($P < 0.001$). Older children had better performance in all fitness tests than their younger counterparts ($P < 0.001$). **CONCLUSION:** Our study provides age- and sex-specific fitness reference standards in preschool children. This work complement the reference standards already published in children and adolescents. These findings can help professionals to identify preschool children with very low fitness level and also as screening element of poor cardiometabolic health levels in order to implement new public health strategies from very early ages.
Supported by RYC-2011-09011, BES-2014-068829.

1901 Board #3 June 1 3:15 PM - 5:15 PM
Fitness And Health Assessment And Monitoring Practices Of Fitness Trainers

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PURPOSE: This study examined the health and fitness assessment and monitoring practices among a large sample of registered Australian fitness professionals.
METHODS: In 2014, 9,100 fitness trainers were invited to complete an online survey. Respondents were asked to report their frequency of assessment and monitoring of eight separate health and fitness constructs (e.g. body composition, aerobic fitness). The prevalence of those classified: (i) 'high' (regularly assessing/monitoring ≤ 5 constructs); (ii) 'medium' (1-4 constructs) and (iii) 'low' (0 constructs) are reported by sociodemographic variables (age, gender) and fitness industry-related characteristics (role, setting, qualification). Potential social ecological correlates of assessment and monitoring were also examined. A multivariate adjusted logistic regression model assessed the odds of being classified as a 'high assessor and monitor' according to potential social ecological correlates.
RESULTS: Out of 1,206 fitness trainers (response rate = 13.2%), aged 17-72 years, 39.1% (95% CI: 36.4%-41.9%) were classified as 'low', 45.0% (95% CI: 42.2%-47.8%) as 'medium' and 15.8% (95% CI: 13.7%-17.9%) as 'high' assessor and monitor. Body composition (47.7%; 95% CI: 45.0%-50.1%) and aerobic fitness (42.5%; 95% CI: 39.6%-45.3%) were the most regularly assessed constructs. In contrast, the least regularly assessed constructs were balance (24.0%; 95% CI: 24.7%-26.5%) and mental health (20.2%; 95% CI: 18.1%-29.6%). In the adjusted analysis, a perceived lack of client interest, not considering assessing their responsibility and lack of time to assess and monitor were all associated with lower odds of being classified as a 'high assessor and monitor'.
CONCLUSIONS: Our findings show that most fitness trainers do not regularly assess and monitor client fitness and health. In Australia, efforts should be made to increase the prevalence of assessment and monitoring among fitness trainers.

1902 Board #4 June 1 3:15 PM - 5:15 PM
Player Mounted Sensors To Identify Fatigue During Games At USA 15 National Hockey Development Camp

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 (No relationships reported)

Recently, there has been a great increase in the use of player mounted sensors (PMS) for performance assessment in various sports. In contrast to many other sports that involve running, ice-hockey presents a particular challenge to performance assessment due to the unique nature of ice-skating. Selection camps for elite level national ice-hockey teams consist of several intense on-ice sessions over several days and fatigue may be a factor to consider when selecting players in this setting. **PURPOSE:** To use PMS to monitor accelerations (ACC) and heart rate (HR) during an ice-hockey national team development camp to i) identify fatigue, as manifested by reduced on-ice ACC and/or HR and ii) determine if two-a-day on-ice sessions affect ACC or HR in games later on the same day.
METHODS: 22 members (15 yr; 177.5 \pm 7.8 cm; 73.7 \pm 12.1 kg) of the USA Hockey 15 national development camp participated in procedures approved by the Eastern Michigan University Human Subjects Committee. Players wore PMS that measured tri-axial ACC and HR (Zephyr, MD) for each on-ice session (n=7) during the 5-day camp. Three games (G1, G2 and G3) were played on days 2, 4 and 5. G1 and G2 were preceded by a morning training session (TS). Peak ACC (g's) were divided into neuromuscular (NM) (5, 10 sec), anaerobic (AN) (20, 30, 45 and 60 sec) and aerobic (AE) (5, 10, 20, 40 min) timing domains for purposes of determining relevant physiological fatigue factors.
 Peak HR (bpm) was divided into AN and AE domain time points identical to the ACC. MANOVAs with time and previous TS as main effects were performed by SPSS 21.0 (IBM, NY). **RESULTS:** No significant differences were observed for ACC in the NM, AN or AE domains. There were small effects ($\eta_p^2 = 0.017 - 0.075$) for reduced ACC in the AN (20 to 60 sec) and AE domains (10 and 40 min) from G1 to G3. Interestingly, no effects ($\eta_p^2 < 0.01$) were observed for accelerations in the NM domain (< 20 sec) or 5 min. No significant differences were observed for HR in any domain, but small effects ($\eta_p^2 = 0.019$) for elevated HR at 40 min were observed from G1 to G3.
CONCLUSION: Small effects for reduced ACC from G1 to G3 indicates fatigue was present over the course of the camp. Prior TS did not appear to affect later games on the same day. ACC may be superior to HR for identification of fatigue among 15 yr old national caliber hockey players.

1903 Board #5 June 1 3:15 PM - 5:15 PM
Submaximal Yo-Yo Test Reliability and Sensitivity in National 7-a-side Squad Preparing for Rio 2016 Paralympics

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 (No relationships reported)

7-a-side football is a game played by football players with cerebral palsy (CP). The Dutch 7-a-side team prepared for the Paralympic games at Rio 2016 at our national training centre. We monitored the physical performance monthly using a submaximal Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo). However, the Yo-Yo test has been developed specifically to measure physical performance in team-sports for able-bodied athletes [1] with determined reliability and sensitivity [2]. **PURPOSE:** Therefore, to use the Yo-Yo test as a monitoring tool appropriately, the aim of this study was to determine its reliability and sensitivity in CP athletes. **METHODS:** A subgroup (n=13) of the Dutch 7-a-side team participated in this data-collection. The Yo-Yo tests were executed as previously described [2]. Two submaximal tests (up to step 14.8) were carried out 2 days apart, aiming to elicit a heartrate (Hr) of 86-93% of the Hr achieved during a maximal Yo-Yo test (Hr_{max}), as this range has proven to show the least variability in submaximal tests [3]. **RESULTS:** The day-to-day variation, calculated as the TEM, and the SWC were found to be 2.6 and 1.6b·min⁻¹ respectively, while the CV was 5.1%. A significant correlation between submax 1 and 2 was observed ($r=0.93$, $P < 0.05$). Different heartrate recovery's (HRR) (calculated as the average of 15sec) were calculated and it was found that HRR at 75sec showed the highest correlation with the distance completed during the maximal Yo-Yo ($r=0.59$, $P < 0.05$). In addition, this test can discriminate between different classifications (athletes are classed according to the magnitude of the disability; cl. 5/6: 97 \pm 1.8%, cl. 7: 93 \pm 4.0% and cl. 8: 88 \pm 2.9% Hr_{max}). **CONCLUSIONS:** Submax Yo-Yo tests performed with CP football players showed a high reproducibility and strong sensitivity. Therefore, submaximal Yo-Yo tests can be used to monitor physical performance in CP football players.

Age (yrs)	22.8 \pm 3.2
Hr _{max} (b·min ⁻¹)	187.2 \pm 7.0
% Hr _{max}	93.6 \pm 4.0
HRR _{75sec} (b·min ⁻¹)	34.8 \pm 9.7
Hr _{submax 1} (b·min ⁻¹)	175.4 \pm 9.9
Hr _{submax 2} (b·min ⁻¹)	175.2 \pm 8.0
Δ (beats·min ⁻¹)	-0.2 \pm 3.9
R ² (submax 1 vs. 2)	0.86

1904 Board #6 June 1 3:15 PM - 5:15 PM
Validation Of The 3-min All-out Exercise Test For Shuttle Running Prescription

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 (No relationships reported)

A 3-min all-out exercise test (3MT) for running has been developed to determine critical speed (CS) and finite capacity for running speeds >CS (D') to predict time limits (T_{LIM}) and it can be utilized for prescribing interval training; however, the 3MT has not been validated for shuttle running, which is required in most team sports. **PURPOSE:** To examine the efficacy of shuttle running 3MT to determine CS and D'. **METHODS:** A total of 12 subjects were tested using an all-out 3MT along with three separate all-out distance time-trials (600, 810 and 1020 m) in a 30 m distance shuttle. Average speed during the 3MT for each 10 m distance and times for each time-trial was recorded. 3MT was used to calculate predicted CS, D' and T_{LIM}. The 3 time-trials were used to determine true CS and D' using D-t, and 1/t models. Within-group analyses of CS and D' from the 3MT, D-t, and 1/t models were evaluated using a series of one-way analyses of variance (ANOVA) with repeated measures. Actual and predicted times for the 3 distances were evaluated with a 2 X 3 ANOVA with repeated measures.
RESULTS: The 3MT (2.94 \pm 0.39 m·s⁻¹) and the true CS (3.00 \pm 0.36 m·s⁻¹) for shuttle running did not differ (p = 0.71) and had a coefficient of variation (CV) of 7.7%. Conversely, D' from the 3MT exceeded true D' by 42 m (p = 0.04, CV = 36%). The T_{LIM} estimated for the 3 different distances were within ~2 to 6% (p = 0.60).
CONCLUSIONS: The shuttle run 3MT may offer a suitable method for predicting CS and T_{LIM} and prescribing shuttle running interval training.

THURSDAY, JUNE 1, 2017

1905 Board #7 June 1 3:15 PM - 5:15 PM
Maximal Oxygen Consumption Predicts Skeletal and Heart Muscle Biomarkers Changes after a Full Distance Ironman
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 (No relationships reported)

Strenuous exercise like marathon or triathlon leads to disturbances of several biomarkers, not at least markers of skeletal and heart muscle damage. Different predictors of biomarker changes, e.g. sex, age and training experience have been discussed in the literature with contradictory results. To our best knowledge, maximal oxygen consumption (VO_2 max) has not been investigated in this setting. **PURPOSE:** To evaluate predictors of biomarker changes in an Ironman triathlon. **METHODS:** In 39 non-elite athletes (10 female, 29 male; age 41.1 ± 9.7 , range 24-70 years) who had performed a 20 m shuttle run test to predict VO_2 max, biomarkers (cardiac troponin T (cTnT; reference < 14 ng/L), creatine kinase (CK; ref. < 1.9 $\mu\text{kat/L}$), myoglobin (MG; ref. < 72 $\mu\text{g/L}$), and N-terminal prohormone of brain natriuretic peptide (NT-proBNP; ref. < 300 ng/L) were measured by standard laboratory methods 7 days before, directly after, and day 1, and 6 after the race. **RESULTS:** VO_2 max was on average 49.9 ± 6.4 O_2 ml/kg/minute (range 36.5-63.9). Three biomarkers measured directly after the race were predicted by VO_2 max: CK (53 ± 50 $\mu\text{kat/L}$; $R = -0.44$; $p = 0.005$), MG (2137 ± 2614 $\mu\text{g/L}$; $R = -0.31$; $p = 0.056$) and NT-proBNP (772 ± 2614 ng/L; $R = -0.35$; $p = 0.027$). cTnT (75 ± 89) was not significantly predicted by VO_2 max but cTnT leakage was, in contrast to the other biomarkers, higher with higher VO_2 max ($R = 0.10$; $p = 0.55$) and return to normal appeared to be faster with higher VO_2 max. **CONCLUSION:** Earlier research into predictors of biomarker changes after strenuous exercise has found contradictory results concerning age, sex and training experience. In the present Kalmar IronWoMan study VO_2 max was found to be a good predictor of biomarker changes with higher VO_2 max values being correlated to lower values for CK, NT-proBNP and MG.

1906 Board #8 June 1 3:15 PM - 5:15 PM
Validity And Reliability Of A Low-cost System To Measure Oxygen Uptake During Submaximal Exercise
 Christen J. Mendonca, Jillian L. Hawkins, Sinclair A. Smith. *Drexel University, Philadelphia, PA.* (Sponsor: Dr. Stella Volpe, FACSMM)
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 (No relationships reported)

Measuring oxygen uptake (VO_2) is the gold standard method for assessing cardiorespiratory fitness. Metabolic systems that assess VO_2 require a significant financial investment. A low-cost VO_2 system would increase the availability to measure cardiorespiratory fitness. **Purpose:** To assess the validity and reliability of a low-cost VO_2 system consisting of a Vernier O_2 sensor, CO_2 sensor, spirometer, and a modified 2L BioChamber 2000 versus the Vmax Encore metabolic system (Care Fusion). **Methods:** One healthy adult (55 years, 70.5kg) completed a submaximal graded exercise test on a cycle ergometer that began at a 50-Watt workload and increased by 25 Watts every 3 minutes to a maximum of 175 Watts. The participant's expired air was captured simultaneously by the low-cost VO_2 system and Vmax system. Both instruments measured flow rate (L/s), O_2 (%), and CO_2 (%) and were used to calculate ventilation (VE) and relative VO_2 . For the low-cost VO_2 system, VO_2 was calculated as the difference between the inspired and expired O_2 fraction multiplied by VE (L/min). VE was corrected to Standard Temperature and Pressure, Dry. An independent t-test was used to test validity and an Intraclass Correlation Coefficient (ICC 3,2) was used to test reliability between the low-cost VO_2 system and Vmax system. Significance was set at $p < 0.05$. A Bland-Altman plot was used to illustrate the individual difference scores between the low-cost VO_2 system and Vmax system. **Results:** There was no significant difference between low-cost VO_2 system VO_2 (21.1 ± 10.3 ml/kg/min) and Vmax system (19.61 ± 9.5 ml/kg/min) $p = 0.388$, 95% CI [-4.72, 1.85]. The low-cost VO_2 system demonstrated excellent reliability across 71 measures with an average measures ICC=0.986, 95% CI [0.941, 0.994] $p < 0.01$. **Conclusion:** Findings support that a low-cost system provides valid and reliable measures of VO_2 at rest and submaximal exercise conditions compared to the Vmax system. This project was not funded.

D-44 Thematic Poster - Move More, Sit Less, What's Best?

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
 Room: 304

1907 Chair: Alpa V. Patel. *American Cancer Society, Atlanta, GA.*
 (No relationships reported)

1908 Board #1 June 1 3:15 PM - 5:15 PM
Isotemporal Substitution of Sedentary Behavior and Physical Activity on Functional Performance in Older Adults

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Age-related progressive increases in sedentary behavior (SB) and decreases in physical activity (PA) have been independently linked to deficits in functional capacity in older adults. The independent relationship of PA and SB on functionality and the lack of evidence for PA interventions to alter SB have led to an interest in joint interventions to displace SB with a PA. **PURPOSE:** To examine the relationship of substituting 30 minutes of SB with light (LPA) and moderate-to-vigorous physical activity (MVPA) on functional performance in community dwelling older adults. **METHODS:** A hip-worn accelerometer (ACC, Actigraph GT3X+) was worn for seven consecutive days to collect human movement. Freedson cut-points and Choi algorithm for wear-time were used to determine SB, LPA, and MVPA. Functional measures included 400m walk test (400W; m/sec), usual gait speed (UGS; m/sec), and 5-time sit-to-stand (STS; sec). Isotemporal substitution modeling was used to predict the relationship of substituting 30 minutes spent in SB, LPA, and MVPA while adjusting for age and gender. **RESULTS:** Ninety-one older adults (60% female) aged 50-90 years with an average ACC wear time of 13.99 ± 0.13 hr/day spent approximately 63% of waking hours in SB. LPA was a significant predictor of 400W [$\beta = 0.032$ m/sec (95% CI: 0.006, 0.056)] and MVPA for 400W [0.204 m/sec (0.110, 0.297)], UGS [-0.618 sec (-0.178, -0.1059)], and STS [-2.276 sec (-3.714, -0.759)]. Directly substituting 30 minutes of SB time with LPA resulted in a significant improvement in 400W [0.027 m/sec (0.000, 0.053)]. MVPA significantly improved 400W [0.193 m/sec (0.099, 0.286)], UGS [0.575 sec (0.123, 1.020)], and STS [-2.176 sec (-3.734, -0.753)]. Aside from a strict 1:1 reallocation of SB to LPA or MVPA, significant improvements in all functional measures were observed with a combination of 5 minutes MVPA and 25 minutes LPA. **CONCLUSIONS:** While MVPA had the greatest impact when displacing SB, the practical implications of introducing a LPA to displace SB may be of particular importance among public health practitioners. Specifically, a goal of redirecting 5-10% of SB time (27-54 minutes/day) toward LPA, and not exclusively MPVA, may result in beneficial changes in functional health in older adults.

1909 Board #2 June 1 3:15 PM - 5:15 PM
Longitudinal Association Between Screen Time And Clustered Metabolic Risk Factors From Adolescence To Young Adulthood

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The prevalence of metabolic syndrome (MetS) in young adults is on the rise. Excessive screen-based media use during adolescence may increase the risk of developing MetS in adulthood. **PURPOSE:** To examine screen time in adolescence and its longitudinal association with metabolic risk factors that are related to MetS in young adulthood. We hypothesized that the amount of screen time and its change through adolescence would be significantly associated with metabolic risk in young adulthood. **METHODS:** This study included 5098 participants (age=29±1.8 yrs) from wave I (baseline) through IV of the National Longitudinal Study of Adolescent Health. Using the wave IV data, a latent variable for clustered metabolic risk factors was constructed consisting of blood pressure, waist circumference, HbA1c, triglycerides, and high-density lipoprotein cholesterol. The self-reported weekly screen time hours during adolescence (wave I in 1994-95, wave II in 1996, and III in 2001-02) were calculated by summing the screen-based media time variables (i.e., watching TV, watching videos, and computer use) at each wave. The latent trajectory of screen time during adolescence was analyzed using latent growth modeling and the latent variable for the metabolic risk factors was treated as distal outcome of the growth model. **RESULTS:**

Mean screen times were 22.5 (\pm 19.0) hrs/wk, 20.4 (\pm 17.7) hrs/wk and 21.6 (\pm 17.3) hrs/wk at wave I, II and III, respectively, indicating that the prevalence of excessive screen time was high. The structural model showed a good fit of the data ($\chi^2=126.12$; $df=25$; $p<0.0001$; CFI=0.952; TLI=0.931; RMSEA=0.025; 90% CI [0.021, 0.029]; SRMR=0.025). The results suggest that individuals who reported a high level of screen time at baseline or increased their screen time during adolescence had an increased metabolic risk in young adulthood, respectively ($\beta=0.305$; $p<0.001$; $\beta=0.191$, $p=0.002$). The model accounted for approximately 10% of the explained variance in the latent variable of the clustered metabolic risk factors. **CONCLUSIONS:** Our findings suggest that screen-based sedentary behavior during adolescence may predict increased risk for developing MetS in young adulthood. Longitudinal intervention research is warranted to investigate the causal pattern between sedentary behaviors and MetS.

1910 Board #3 June 1 3:15 PM - 5:15 PM
Physical Activity And Sedentary Behavior During The Retirement Transition: The Multi-ethnic Study Of Atherosclerosis (MESA)

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INTRODUCTION: Physical activity and sedentary behavior are major risk factors for chronic disease. These behaviors may change at retirement due to shifts in daily routine, social networks, and access to resources, with implications for health in later life.

PURPOSE: To describe longitudinal trajectories in moderate to vigorous physical activity (MVPA) and TV watching among adults transitioning to retirement compared to continuing to work.

METHODS: Participants in the MESA (N=6,814) were recruited from six United States communities, had no history of cardiovascular disease, and were aged 45-84 at baseline. Employment status, overall MVPA (metabolic equivalent (MET)-minutes/week), and TV watching (minutes/week) were self-reported at four study exams from 2000 to 2012. Multivariable mixed-effect linear regression models were used to describe longitudinal trajectories in MVPA and TV watching by retirement status. Models were adjusted for age, gender, race/ethnicity, education, income, time since retirement, occupational physical activity, self-rated health, and study site.

RESULTS: Of 4,212 MESA participants not retired at baseline, 57% were female, 51% had a college degree, and 40% were non-Hispanic white. A total of 955 (23%) retired during follow-up (median follow-up time: 8.0 years). Retirees engaged in less MVPA (median 3585 vs. 4005 MET-minutes/week) and more TV watching (median 900 vs. 750 minutes/week) compared to workers. Over time, average MVPA decreased (-44 MET-min/week per year, 95% confidence interval (CI): -67, -22) and average TV watching increased (18 minutes/week per year, 95% CI: 15, 21). Retirement was associated with a slower rate of decline in MVPA (average difference: 108 MET-minutes/week per year, 95% CI: 19, 197) and faster rate of increase in TV watching (10 minutes/week per year difference, 95% CI: -1, 22).

CONCLUSION: Retirement was associated with unfavorable decreased MVPA and increased TV watching compared to continuing to work. Exploring domain specific changes in physical activity (e.g., exercise, care giving) and identifying determinants of physical activity and sedentary behavior change at retirement may inform physical activity promotion efforts targeted at the growing population of American retirees. Supported by the NIH/NHLBI and Royster Society of Fellows.

1911 Board #4 June 1 3:15 PM - 5:15 PM
Physical Activity And Sitting Time In Relation To Colorectal Cancer Risk. The HUNT-study, Norway

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Sedentary behavior such as sitting is becoming increasingly prevalent in the modern society, and it is distinctly different from physical inactivity. Colorectal cancer (CRC) is one of the most common cancers, and physical activity consistently reduces the risk for CRC. It is still unclear whether increased sitting time influences colorectal cancer risk. **PURPOSE:** In a prospective longitudinal design, we examined sitting time and physical activity in relation to colorectal cancer risk. **METHODS:** Data were from the Nord-Trøndelag Health Study (HUNT2, 1995-97), Norway. In the present study 65,229 (69%) adults \geq 20 years participated. CRC incidence was obtained (1 January 1995 to 31 December 2014). The primary exposures were physical activity and sitting time, and the endpoint were incident CRC identified using ICD-10 codes, C18-C21. Based on meta-analytic evidence, we categorized sitting time as: 0 < 8 hr/day (low risk) and \geq 8 hr/day (at risk). The PA estimate was recalculated in metabolic equivalent of task (MET)- hours per week (MET-hr/wk), and categorized as low PA (0 thru 8.3

MET-hr/wk), moderate PA (> 8.3 thru 16.6 MET-hr/wk) and high PA levels (> 16.6 MET-hr/wk). Cox proportional-hazard models were used to examine associations between sitting time and PA with CRC, with the combined low risk group as the reference (Low sitting and/or vigorous PA). **RESULTS:** In total, there was included 626,761 person-years and 709 incident CRC cases during the 16-year (average) follow-up. Men who reported moderate or low PA had a 32% and 34% higher risk for CRC respectively, compared to those who were in the high active category. In analyses of the joint association of sitting time and physical activity with CRC incidence, it was found that men who reported low physical activity combined with sitting more than 8 hours per day had a 60 % increased risk (95% CI 1.11, 1.27) and those sitting less than 8 hours per day had a 44 % increased risk (95% CI 1.06, 1.96) compared to those who were highly active. **CONCLUSIONS:** Low physical activity is a risk factor for CRC in men. Vigorous physical activity is independently protective against CRC cancer in men, but this was not found in women.

1912 Board #5 June 1 3:15 PM - 5:15 PM
Sedentary Behaviors and Cardiometabolic Risk, an Isotemporal Substitution Analysis

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Evidence suggests that time spent in sedentary behaviors is associated with a greater risk of adverse cardiometabolic outcomes. However, existing research has focused on broad measures of sedentary time or television viewing, and less is known about the association between other types of sedentary activities and cardiometabolic risk.

Purpose: To investigate the cross-sectional associations of six distinct sedentary activities with cardiometabolic risk factors, and compare replacing one type of sedentary behavior with another in relation to cardiometabolic risk. **Methods:** Participants were 3,314 Black and White adults, aged 42-59 years, from the Coronary Artery Risk Development in Young Adults (CARDIA) study who reported average hours/day sitting in six distinct activities (television, computing, paperwork, reading, phone, and car). A composite cardiometabolic risk score was calculated by standardizing and summing waist circumference, blood pressure, fasting glucose, insulin, triglycerides, and negative HDL-cholesterol. Linear regression models examined the independent and joint associations of the sedentary activities with the cardiometabolic risk score. Isotemporal substitution models were then used to estimate the "substitution effect" of replacing sedentary time from one activity for an equal amount of sedentary time from another activity. All models adjusted for age, sex, race, education, smoking status, alcohol consumption, fast food frequency, sugar-sweetened beverage consumption, physical activity and BMI. **Results:** Time spent in each of the sedentary activities, with the exception of car time, was independently and positively associated with the cardiometabolic risk score ($p<0.04$). When all sedentary activities were entered simultaneously in the model, television viewing was the only variable that remained significantly associated with the cardiometabolic risk score ($p<0.001$). Replacing television time with time spent in any other sedentary activity was associated with a 0.06 to 0.09 standard deviation lower cardiometabolic risk score (all $p<0.007$). **Conclusion:** Television viewing has a more adverse association with cardiometabolic risk factors than other types of sedentary behaviors.

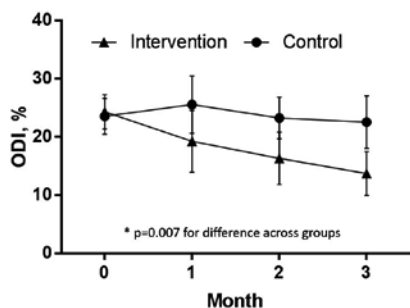
1913 Board #6 June 1 3:15 PM - 5:15 PM
Reducing Sedentary Behavior to Decrease Low Back Pain: 3-month Results of the Stand Back trial

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Reported Relationships: B. Barone Gibbs: Contracted Research - Including Principle Investigator; Humanscale.

Low back pain (LBP) is a major public health problem. Preliminary data suggest that LBP increases throughout the workday for sedentary, desk-bound employees. **PURPOSE:** The Stand Back randomized trial evaluated whether an intervention targeting reduced prolonged sitting could decrease pain in desk workers with chronic LBP. **METHODS:** The study recruited individuals with chronic LBP, Oswestry Disability Index (ODI) > 10%, and desk jobs (sitting \geq 20 hr/wk). Participants in the intervention received behavioral counselling with an initial in-person visit followed by monthly telephone calls. They also received a sit-stand desk attachment with a goal to stand for 2 hr each day and an activity-prompting device set to vibrate after 30 min of inactivity. Goals were individually tailored and progressed during monthly contacts

based on participant response. LBP was measured using the ODI. Sitting time (work and all day) was assessed by self-report. Outcomes were compared across intervention groups using paired *t* tests and linear mixed models. **RESULTS:** In completers (n=25 of n=27 enrolled), baseline mean (SD) age was 49 (11) years, 76% were female, and ODI was 23.9 (2.1) %. Sitting time at baseline was 6.9 (1.1) hr during work and 10.2 (1.6) hr all day. At 3 months, sitting time significantly decreased in intervention (n=13) vs. control (n=12) both during work [-2.0 (1.3) vs. -0.5 (1.2) hr, *p*=0.007] and all day [-2.5 (1.7) vs. -1.1 (1.6) hr, *p*=0.045]. Across months 1-3, the average decrease in ODI from baseline was significantly greater in intervention vs. control (difference between groups of -7.9 %, of *p*=0.007) (Figure). At 3 months, the decrease in ODI was -10.6 (8.7) % in intervention vs. -1.0 (10.4) % in control (*p*=0.020). **CONCLUSION:** An intervention targeting sedentary behavior in desk-bound employees with chronic LBP was effective in reducing sitting time and low back pain/disability. Studies are needed to examine longer term effects of sedentary behavior interventions in chronic LBP.

3-month Changes in Oswestry Disability Index (ODI)



1914 Board #7 June 1 3:15 PM - 5:15 PM

A Comparison Between Two Different Conditions Of Breaking Up Sedentary Behaviour On Glucose Metabolism

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INTRODUCTION: Sedentary behaviour is suggested a risk factor for various health outcomes, independent of the amount of subcomponents of physical activity. There is currently paucity of experimental studies comparing frequent breaks of sedentary time with one single long bout of exercise in an iso-caloric design. **PURPOSE:** to examine if breaking up sedentary behaviour with short five minutes' bouts or one continuous 30-minute bout of vigorous intensity activity differentially affects metabolic risk markers compared with a control condition of prolonged sitting. **METHODS:** 12 healthy adults participated in a randomized cross-over design as follows: 1) six hours of quiet sitting; 2) six hours of sitting, including five minutes exercise bouts (treadmill running) at 70 % of maximal oxygen uptake (VO_{2max}) each hour; 3) continuous exercise at 70 % of VO_{2max} for 30 minutes followed by five hours and 30 minutes of sitting. Prior to each test, a fasting blood sample was collected and followed by a standardized meal consisting of 646 kilocalories. Blood samples were thereafter collected every hour. Maximal aerobic capacity was measured using indirect calorimetry and the running speed equivalent to 70 % of VO_{2max} was determined by extrapolation following a submaximal steady state exercise test prior to the experiment. Each condition was separated by a 6-day wash-out period. **RESULTS:** There were no differences in insulin (mean (95 % CI); 1) 60704.8 (36352.4-79412.1) pmol · L⁻¹ · 360 min; 2) 53375.7 (28787.8-71847.5) pmol · L⁻¹ · 360 min; 3) 44827.3 (24853-67912.7) pmol · L⁻¹ · 360 min), glucose (mean (95 % CI); 1) 105 (27.6-150) mmol · L⁻¹ · 360 min; 2) 48.4 (-88.6-113.5) mmol · L⁻¹ · 360 min; 3) 105.8 (49.3-171.6) mmol · L⁻¹ · 360 min) and triglycerides (mean (95 % CI); 1) 41 (10.4-72.1) mmol · L⁻¹ · 360 min; 2) 60.63 (30-91.5) mmol · L⁻¹ · 360 min; 3) 38.22 (9.4-71.1) mmol · L⁻¹ · 360 min) incremental area under curve between conditions. **CONCLUSION:** There is no effect of either breaking up sedentary behaviour each hour or performing 30 minutes of vigorous physical activity in one bout compared with prolonged sitting for six hours on glucose and lipid metabolism.

1915 Board #8 June 1 3:15 PM - 5:15 PM

Individual and Joint Associations of Sedentary Time and Sedentary Bouts with Glycemic Biomarkers: Hispanic Community Health Study/Study of Latinos

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 (No relationships reported)

Excessive sedentary time is ubiquitous in Westernized societies and is associated with deleterious health outcomes. Few studies have examined whether the manner in which sedentary time is accrued (in short or long bouts) carries clinical relevance that is separate from or jointly related to total sedentary time. **PURPOSE:** The purpose of this study was to examine the individual and joint associations of total sedentary time and prolonged, uninterrupted sedentary bouts with glycemic biomarkers in Hispanic/Latino adults. **METHODS:** We studied 12,083 adult participants from the population-based Hispanic Community Health Study/Study of Latinos. Homeostatic model assessment of insulin resistance (HOMA-IR) was measured from a fasting blood sample and 2-hour glucose was measured following an oral glucose challenge. Sedentary time was measured via hip-mounted accelerometer. Prolonged, uninterrupted sedentariness was expressed as mean sedentary bout length. Participants were classified into four categories: low total sedentary time (quartiles 1-3 of total sedentary time) and low sedentary bout duration (quartiles 1-3 of mean sedentary bout duration), low total sedentary time and high sedentary bout duration (quartile 4), high total sedentary time (quartile 4) and low sedentary bout duration, or high total sedentary time and high sedentary bout duration. **RESULTS:** Adjusted for confounders and moderate-vigorous physical activity, participants in the upper quartile for both sedentary characteristics (e.g. high total sedentary time and high sedentary bout duration) had the highest levels of HOMA-IR (4.96 [95% CI: 4.59, 5.33] vs 4.49 [95% CI: 4.10, 4.89] for low/low group; *p*<0.001) and 2-hour glucose (138.9 mg/dl [95% CI: 123.0, 154.8] vs 134.2 mg/dl [95% CI: 118.3, 150.1] for low/low group; *p*=0.002). High total sedentary time or high sedentary bout duration alone were not associated with differences in any of the glycemic biomarkers. **CONCLUSIONS:** High total sedentary time and high sedentary bout duration were deleteriously associated with glycemic biomarkers together (e.g. high total sedentary time and high sedentary bout duration) but not individually. These findings support the concept that reducing and regularly breaking up sedentary time may be an important adjunct to existing physical activity guidelines.

D-45 Thematic Poster - Neuromechanics of Ankle Instability

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
 Room: 404

1916 Chair: Robin Queen, FACSM. Virginia Tech, Blacksburg, VA.

(No relationships reported)

1917 Board #1 June 1 3:15 PM - 5:15 PM

Altered Ankle Neuromechanics During Walking In Patients With Chronic Ankle Instability

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 (No relationships reported)

Lateral ankle sprains are common sport-related injuries which often lead to chronic ankle instability (CAI). CAI has been shown to impair neuromuscular control as well as dynamic stability of the ankle joint. **PURPOSE:** To examine if CAI subjects demonstrate different ankle neuromechanic patterns during walking when compared to controls. **METHODS:** 100 CAI patients (22±2 yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.5±2.6 ankle sprains) and 100 controls (22±3 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports, no previous sprains) participated. Subjects performed five walking trials over a force plate while ankle joint angles, moments and muscle activation were collected during the stance phase (0-25%: initial stance, 25-50%: loading response, 50-75%: midstance, and 75-100%:

terminal stance). Functional analyses ($p < .05$) were used to compare the entire gait cycle between groups. Functions of each group as well as 95% confidence interval (CI) were plotted to determine significant differences. **RESULTS:** Figure 1. The CAI group increased plantarflexion, likely a result of greater plantarflexion moments and gastrocnemius activation. Decreased eversion was also observed, accompanied by decreased inversion moments tied to decreased peroneus longus activation. **CONCLUSION:** Relative to the leg, CAI subjects demonstrated a potentially high-risk gait patterns by positioning the foot in a less closed-pack position and a more inverted position. CAI subjects appear to alter lower extremity biomechanics in a way that could increase injury risk during walking.

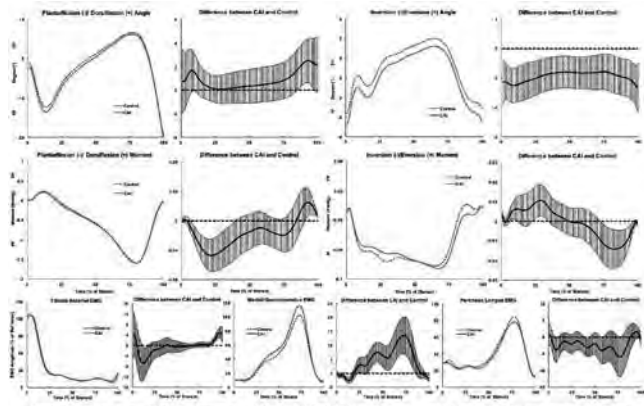


Figure 1. Plantarflexion/eversion (PE) and inversion/eversion (VE) angles, PE/EP and VE/VE moments, and EMG amplitude for tibi anterior (TA), medial gastrocnemius (MG) and peroneus longus (PL) during stance phase of walking tasks. Mean differences (solid line) and corresponding 95% CI (shaded area) are plotted as a function of time. When the shaded area does not overlap with the zero line (dotted horizontal line), a significant difference ($p < 0.05$) is indicated between groups.

1918 Board #2 June 1 3:15 PM - 5:15 PM
Ankle Muscles Reaction Time During Sudden Inversion in Individuals With Or Without Functional Ankle Instability

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 (No relationships reported)

Muscle reaction time (RT) represent the time lag from event to muscle activation. Person with functional ankle instability (FAI) often experiences “giving way” during activities. Whether this is because of muscle activation delay is still unclear. **PURPOSE:** To compare RT of ankle muscles using a sudden ankle inversion (30 degrees) apparatus in individuals with or without FAI. **METHODS:** A total of eight subjects volunteered to participate for this study including two subjects with FAI (FAI group, 25.5 ± 2.1 yrs, 171.5 ± 0.7 cm, 76.5 ± 17.7 kg, CAIT score: 18.5 ± 3.5) and six control subjects without FAI (control group, 23.7 ± 0.5 yrs, 175.3 ± 4.7 cm, 78.7 ± 11.6 kg, CAIT score: 28.3 ± 1.4). Using Cumberland ankle instability tool questionnaire (CAIT) to identify whether subjects were with FAI. Scores of ≤ 23 indicate FAI. Subjects were asked to stand on the two platforms for each legs of sudden ankle inversion apparatus. The platforms were initial locked by electromagnetic force. After unlocking, one of them inclined downward to 30 degrees ankle inversion. During the test, RT of tibialis anterior (TA), peroneus longus (PL) and peroneus brevis (PB) were assessed through surface electromyography (EMG). The RT of the muscles was determined as the time between the unlocking of the platform and the increase to 5 SDs higher than the mean resting activity during stance. EMG data were collected at 1000Hz and band-pass filtered at 10 and 450 Hz and low-pass filtered at 10 Hz. Data were analyzed using independent t-test. **RESULTS:** The RT of TA, PL and PB in FAI group were 46.3 ± 1.4 ms, 45 ± 4.2 ms and 42.7 ± 5.7 ms. PB activated first and TA activated last in FAI group. The RT of TA, PL and PB in control group were 43.3 ± 6.4 ms, 50.4 ± 9 ms and 44.4 ± 14.7 ms. TA activated first and PL activated last in FAI group. There were no significant difference in RT for TA ($p=0.277$), PL ($p=0.229$) and PB ($p=0.439$) between groups. **CONCLUSION:** The RT of TA, PL and PB induced by sudden ankle inversion (30 degrees) in individuals with and without FAI were not different. But the sequences of activation were different. The activations of PL and PB in individuals with FAI were not delayed compared with individuals without FAI. The activation of TA might be also an important factor for ankle stability. Further studies are needed to clarify the function of TA during sudden inversion in subjects with FAI.

1919 Board #3 June 1 3:15 PM - 5:15 PM
Examining Postural Control without Feedback in Individuals with and without Chronic Ankle Instability

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Lateral ankle sprains are common orthopedic injuries that often result in chronic ankle instability (CAI). CAI is characterized by many residual symptoms, including pain, episodes of giving way, recurrent injury, impaired postural control and gait, decrease in strength, structural laxity, and decreased physical activity. Impairments in postural control have been identified using both static balance tests like the single leg test on Biodex Stability System and dynamic balance tests, like the star excursion balance test. However, it is not known if there are differences in postural control between individuals with and without a history of ankle sprain when tested without feedback. **PURPOSE:** To examine postural control and stability characteristics of persons with and without CAI during the Athlete Single Leg Stability Test on the Biodex Balance System (BBS). **METHODS:** 18 persons with CAI, 15 Copers, and 18 healthy controls (mean age: 22 years for all the groups) completed two 20s trials for each leg without center of pressure feedback at each of the following BBS levels: Static, Levels 12, 8 and 4. Each level corresponds to the degree of tilt of the platform surface with a lower number corresponding to lesser stability or more tilt. A 3x4 ANOVA was run with the dependent variables: overall stability index (OSI) and sway area. OSI is the mean distance of the center of pressure from the center of the platform. **RESULTS:** Significant level main effect was observed for both OSI and sway area (both $P <= 0.001$). At Level 12, OSI (1.2) and sway area (1.1cm²) were significantly less compared to other levels (all $P <= 0.001$). At Level 8, OSI (1.8) and sway area (2cm²) were significantly less compared to Static and Level 4 (both $P <= 0.002$). Static OSI (2.3) and sway area (4.9cm²) values were similar to those at Level 4 (OSI: 2.6; sway area: 10.9cm²). No significant group main effect or interaction was observed for either of the variables. **CONCLUSION:** The Athlete Single Leg Stability Test on BBS without feedback is not sensitive in detecting differences among those with and without CAI. Further testing should examine if standing with eyes closed on the static level on BBS provides a more sensitive way to challenge proprioceptive input in this population. Use of OSI as a dependent variable should be used with caution.

1920 Board #4 June 1 3:15 PM - 5:15 PM
Effect of Rest Intervals during the Star Excursion Balance Test on Postural Control in Individual with Chronic Ankle Instability

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 (No relationships reported)

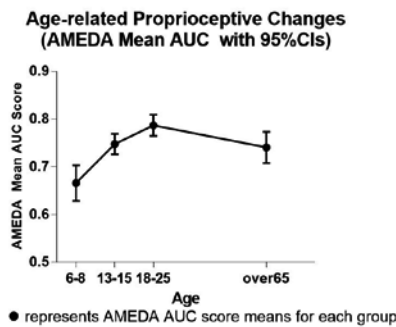
It has been proposed that inadequate rest intervals may contribute to decreased performance of activities. However, there are a number of proposed factors that may contribute to decreased performance. Individuals with chronic ankle instability (CAI) are known to exhibit decreased balance ability and compromised postural control. **Purpose:** To determine whether rest interval affects performance of the Star Excursion Balance Test (SEBT) associated with CAI and whether postural control can be a factor which may help discriminate between healthy individuals and those with CAI during the SEBT. **Methods:** Participants included 24 individuals (age: 21.9 ± 2.3 years) with a history of at least one ankle sprain in the past year and at least 2 episodes of giving way in the past 6 month prior to study enrollment, and 24 individuals (age: 22.7 ± 1.6 years) with no history of ankle sprain or instability in their lifetime. Subjects completed 3 trials in each of the 3 reach directions (anteromedial:AM, medial:M, posteromedial:PM) in random order. A total of three visits were required in order to complete the 3 rest intervals (10, 20, 40 seconds). Maximum lateral center of pressure velocity (MLCOPV) were calculated and compared between groups in each direction for each rest interval. **Results:** Rest interval did not influence differences of MLCOPV in healthy individuals and those with CAI during the SEBT (AM: Wilks' Lambda = 0.96, $F_{2,45} = 0.76$, $p = 0.47$, M: Wilks' Lambda = 0.98, $F_{2,45} = 0.45$, $p = 0.64$, and PM: Wilks' Lambda = 0.99, $F_{2,45} = 0.04$, $p = 0.95$. MLCOPV were not different between healthy individuals and those with CAI during the SEBT regardless of rest interval (AM; H: 0.8 ± 0.3 vs CAI: 0.8 ± 0.4, $F_{1,46} = 0.16$, $p = 0.68$, partial eta squared = 0.00, M; H: 0.8 ± 0.3 vs CAI: 0.7 ± 0.3, $F_{1,46} = 0.25$, $p = 0.61$, partial eta squared = 0.00, and PM; H: 0.8 ± 0.3 vs CAI: 0.8 ± 0.3, $F_{1,46} = 0.00$, $p = 0.92$, partial eta squared = 0.00). **Conclusion:** Based on these results, MLCOPV may not be a useful measure in estimating postural control in healthy individuals and those with CAI.

1921 Board #5 June 1 3:15 PM - 5:15 PM

Age-related Changes in Ankle Proprioception

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 (No relationships reported)

With aging decreasing function of peripheral proprioceptors may affect proprioceptive acuity and contribute to increased falls risk. The development of proprioceptive acuity across the lifespan has not been extensively examined. **Purpose:** To investigate the trend of age-related changes in active ankle proprioceptive acuity. **Method:** The right ankles of 80 right-handed healthy and active participants across four age groups were assessed - children (aged 6-8), adolescent (aged 13-15), adults (aged 18-25), and the elderly (aged 65-82). Ankle proprioception was assessed using active movement extent discrimination assessment (AMEDA). **Results:** There was a significant difference between the four groups ($F_{(3,76)} = 13.071, p < 0.001$). Significant differences in the mean area under the curve (AUC) accuracy score of the active movement extent discrimination ability were observed between children (0.666 ± 0.08) and the other three groups: adolescent ($0.748 \pm 0.046; P < 0.01$), adult ($0.787 \pm 0.047; P < 0.01$), and the elderly ($0.740 \pm 0.07; P < 0.05$), adolescent and adult ($P < 0.05$), and adult and the elderly ($P < 0.05$). No difference was found between adolescent and the elderly ($p > 0.05$). The AUC score of the elderly was worse than that of the adult ($p < 0.01$), while better than that of the children ($p < 0.05$). **Conclusion:** We inferred that the development trend of proprioceptive acuity in normally active participants progressed from being least sensitive during childhood to the highest level in young adulthood in parallel with the development of physiologic and physical function (i.e. peripheral proprioceptors and CNS development), and decreased for the elderly over 65 to a level close to that of the adolescent. Future research is needed to determine how much of the decline in proprioceptive function is due to degeneration in the CNS or peripheral nervous systems, or due to failure to maintain adequate exposure to environmental stimuli to reduce the overall proprioceptive function decline.



1922 Board #6 June 1 3:15 PM - 5:15 PM

Center Of Pressure Excursion Velocities During Recovery From Total Ankle Arthroplasty

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 (No relationships reported)

Ankle arthritis is most often post-traumatic and is associated with substantial disability and pain. A common intervention for severe ankle arthritis is joint replacement (arthroplasty). Previous research has suggested that balance as evidenced by center of pressure (CoP) excursions is not improved two years post-total ankle arthroplasty (TAA). However, it has been suggested that CoP excursion velocities may be a better measure of postural control. **Purpose:** To quantify recovery of balance as evidenced by CoP excursion velocities at 1 and 2 years post-surgery in the surgical (Sx) and non-surgical (NSx) limbs of TAA patients. **Methods:** Fifty-two individuals with unilateral ankle arthritis capable of unassisted ambulation performed three trials of quiet standing for a period of 10 seconds with their feet placed together. Bilateral ground reaction forces (GRFs) were recorded using two embedded force plates (1200 Hz, AMTI, Watertown, MA). This assessment was completed pre-operatively (PRE) and then 1 year (POST-1yr) and 2 years (POST-2yr) after TAA. Custom software (MatLab 2016, Mathworks, Natick, MA) was used to calculate CoP excursion velocities. Mean CoP excursion velocity (MEV) were calculated in the anteroposterior (AP) and mediolateral (ML) directions for the Sx and NSx. SPSS was used to conduct a pair of 2 x 3 (side by time) repeated measures ANOVAs with post-hoc t-tests to assess the effect of surgery and time on MEV. Significance was set at $p < 0.05$.

RESULTS: ML MEV was not different between limbs (Sx versus NSx) ($p=0.75$) or across time during recovery ($p=0.34$) nor was there a side by time interaction ($p=0.09$). A significant side by time interaction was present for AP MEV ($p<0.01$; NSx PRE: 34.1 ± 10.3 ; NSx POST-1yr: 41.5 ± 16.0 ; NSx POST-2yr: 58.7 ± 17.1 ; Sx PRE: 46.2 ± 14.2 ; Sx POST-1yr: 42.4 ± 12.4 ; Sx POST-2yr: 65.4 ± 13.7). Post-hoc assessment of the interaction revealed that AP MEV values converged with time. **CONCLUSIONS:** These data suggest that AP MEVs become more similar between the Sx and NSx with time potentially demonstrating improved symmetry. However, MEVs were not altered in either Sx or NSx. This may suggest that postural control mechanisms have not improved following TAA and that these individuals could benefit from focused balance training to decrease fall risk.

1923 Board #7 June 1 3:15 PM - 5:15 PM

Neuromuscular Training Alters Preparatory Lower Extremity Muscle Activation and Movement in Subjects with Ankle Instability

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 (No relationships reported)

Chronic ankle instability (CAI) may, in part, be due to poor positioning of lower extremity segments during movement. Altered preparatory muscle activation from sensorimotor deficits could perpetuate this problem. **Purpose:** to determine if a 6-week neuromuscular training program can alter preparatory lower extremity muscle activation and frontal plane movement in CAI subjects. **Methods:** 15 CAI subjects in a rehab group (23 ± 2 yrs, 178 ± 8 cm, 76 ± 9 kg, $83 \pm 7\%$ FAAM ADL, $56 \pm 10\%$ FAAM Sports, 3.6 ± 1.1 MAII, 4.7 ± 2.0 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22 ± 2 yrs, 177 ± 9 cm, 75 ± 12 kg, $81 \pm 9\%$ FAAM ADL, $56 \pm 12\%$ FAAM Sports, 3.4 ± 1.2 MAII, 5.9 ± 3.3 sprains). Subjects performed 10 jumps consisting of a max vertical jump plus a side cut. Functional analyses ($\alpha=0.05$) were used to detect a group x treatment interaction over time. If 95% CI did not cross the zero, significant differences existed. **Results:** Figure 1. The rehab intervention resulted in up to (i) 23% more gluteus medius activation from 75 ms pre-contact to initial-contact, while no changes were detected in other variables (frontal ankle angle, frontal hip angle, and peroneus longus activation). **Conclusions:** Strength and neuromuscular control exercises enhanced GM activation prior to a demanding, athletic movement. While no corresponding preparatory movement differences were detected, the motion effect might be evident during or after foot contact. More data are needed to determine if the observed training effect could play a role in reducing injury.

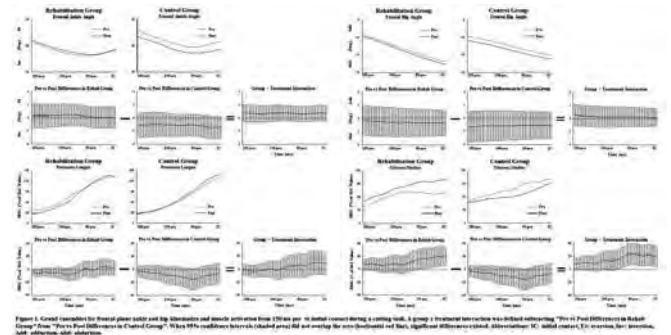


Figure 1. Control (grey) and Rehab (black) EMG activation (Volts) for various muscles during a jumping task. A group x treatment interaction was observed for the Gluteus Medius. * indicates a significant difference between groups. Error bars represent 95% CI.

THURSDAY, JUNE 1, 2017

D-46 Free Communication/Slide - Concussion

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 507

1924 **Chair:** Daniel C. Herman, FACSM. *University of Florida, Gainesville, FL.*

(No relationships reported)

1925 June 1 3:15 PM - 3:30 PM

Effects of Concussion Recovery Phase on Symptom Provocation using Vestibular and Assessments.

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(No relationships reported)

Ocular-motor testing is quickly emerging as a valuable component of the diagnostic portion of a sport concussion assessment when combined with symptom scores. However, the usefulness of oculomotor testing in helping to track recovery following a sports related concussion and aid in return to play decisions remains unclear.

Purpose: To evaluate the usefulness of several readily available oculomotor and vestibular tests that require minimal to know equipment for assessing S/S from injury and tracking recovery from a sport related concussion. **Materials and methods:** Participants were divided into 3 groups: healthy controls (n=58), acute concussion (n=21) and prolonged recovery (n=10). The acute concussion group suffered a concussion ≤ 9 days prior to initial assessment, while the delayed recovery group suffered a concussion ≥ 16 days prior to initial assessment. Repeated measures ANOVA compared initial, 2 week and 6-week follow-up values between groups. Follow-up logistic equation to determine the accuracy of the diagnostic protocol. **Results:** Provoked symptoms for the Gaze Stabilization, Rapid Eye Horizontal, Smooth pursuit, and Optokinetic drum tests' and total combined number of symptoms provoked as well as near point of convergence distance were significantly greater at baseline for both the acutely concussed and prolonged recovery groups compared to a healthy group. A binary logistic regression revealed that a model total symptoms provoked across all clinical test and NPC distance was 90% accurate in predicating healthy versus concussed group status. **Conclusions:** Ocular motor tests such as near point of convergence as well as symptom provocation following the Horizontal Gaze-Stabilization Test and Rapid Eye Horizontal Test appear to be 90% sensitive to the effects of a concussion. Additionally, they appear to give valuable insight during the recovery process that may give clinicians added information when making return to play decisions and tracking recovery following a sport related concussion. Given the limited equipment, training and small time requirement, ocular-motor tests such as near point of convergence, GST, REH are valuable additions to a concussion evaluation protocol.

1926 June 1 3:30 PM - 3:45 PM

Concussion Induces Temporary Cardiovascular Autonomic Dysfunction

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(No relationships reported)

Introduction: Numerous recent studies have indicated that concussions temporarily uncouple the relationship between the autonomic nervous and cardiovascular systems and thus promote abnormal heart rate variability. **Purpose:** The purpose of this study was to determine the acute effects of concussion on cardiovascular function using several common autonomic reflex tests. **Methods:** Twenty two recreational athletes (14 females, 8 males) were divided into two groups: recently concussed (n = 11) and control (n = 11). The recently concussed participants performed forced breathing, standing and Valsalva autonomic reflex tests on four occasions: 1. within 48 of injury, 2. 24 hours later, 3. 1 week after injury and 4. 2 weeks after injury. The matched controls performed the same tests on the same schedule. A Finapres Pro was used to continuously measure heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) responses to the tests, and group differences were analyzed using repeated measures MANOVAs and ANOVAs. **Results:** The concussed group had significant elevations in both resting SBP (144.1 ± 21.4 vs 126.6 ± 11.1 mmHG for the controls, $t_{20} = 2.41$, $P = 0.03$, $d = 1.03$) and HR responses to standing ($HR_{max}/HR_{min} = 1.8 \pm 0.4$ vs 1.5 ± 0.2 for the controls, $t_{20} = 2.08$, $P = 0.04$, $d = 0.88$) within 48 hours of injury, but those abnormalities were resolved by the next day. There was also a significant interaction with the HR responses to forced breathing ($F_{3,60} = 2.78$, $P = 0.04$, $\eta_p^2 = 0.12$), which indicated the concussed group's scores declined relative to the control's over the course of the four measurements. **Conclusions:** These results indicate that concussion caused a temporary disruption in autonomic control of

cardiovascular function and that autonomic reflex tests, such as the standing and forced breathing tests, may be valuable assessments with which to evaluate the recovery from concussion.

1927 June 1 3:45 PM - 4:00 PM

Attenuation of Spontaneous Baroreceptor Sensitivity following Concussion

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(No relationships reported)

Perturbations to systolic blood pressure (SBP) are buffered by a reciprocal change in heart rate (HR) through the baroreflex. Sensitivity of the baroreflex (BRS) to hemodynamic challenges is present across a range of blood pressures in otherwise healthy individuals, whereas with neurological trauma/impairment BRS declines as a characteristic of autonomic dysfunction. Previous evidence indicates that a state of transient cardiovascular autonomic dysfunction is present after concussion, but whether or not BRS is affected, has yet to be identified.

Purpose: To evaluate changes in BRS in recently concussed male athletes and non-injured controls during the first week following injury.

Methods: A prospective, parallel-group, repeated-measures and observational study was performed. Eight intercollegiate male athletes with concussion (age: 20 ± 1 years; height: 71 ± 5 inches; weight: 178 ± 18 pounds) and 6 non-injured male athletes (age: 20 ± 1 years; height: 71 ± 4 inches; weight: 180 ± 35 pounds) participated. Cardiovascular autonomic assessment (i.e., digital electrocardiogram and continuous beat-to-beat blood pressure) was performed in the seated upright position at rest within 48 hours (48H) of concussion and 1 week (Wk1) later. HR and systolic blood pressure (SBP) were determined and BRS was calculated using the bi-variate phase-rectified signal averaging technique of the respective digital signals.

Results: Separate univariate analysis of variance was performed and there were no group differences for demographics, HR or SBP at 48H or Wk1. At 48H, concussed athletes presented with a significantly reduced BRS compared to non-injured controls (concussion: 3 ± 2 vs. control: 6 ± 2 ms/mmHg; $p < 0.05$). At Wk1, the reduction to BRS in the concussed athletes was still apparent (concussion: 3 ± 3 vs. control: 7 ± 3 ms/mmHg; $p < 0.05$).

Conclusions: These preliminary findings demonstrate that reduced BRS is a characteristic of post-concussive autonomic dysfunction during the first post-injury week. Further work is needed to extend and define the implications of impaired BRS and determine whether it contributes to exercise intolerance during the progressive return-to-play.

1928 June 1 4:00 PM - 4:15 PM

The Effect of Exercise Induced Dehydration on SCAT3

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(No relationships reported)

Sports-related concussions are plentiful in the United States. Various diagnostic tools are utilized in order to monitor deviations from baseline in memory, reaction time, symptoms, and balance. Evidence indicates that dehydration may also alter diagnostic tests. **Purpose:** To determine the effect of exercise-induced dehydration on deviations in cognitive performance related to concussion diagnostics. **Methods:** Seventeen recreationally active subjects (age = 23.1 ± 3.1 years, height = 168.93 ± 10.71 cm, mass = 66.16 ± 7.14 kg). Subjects performed three thermoneutral, counterbalanced sessions (control, euhydrated, dehydrated). Subjects were either restricted (0.0 L/hr) or provided fluids (1.0 L/hr) while treadmill running for 60 min at an intensity equal to 65-70% age-predicted maximum heart rate (APMHR). Sport Concussion Assessment Tool 3 (SCAT3) was utilized to assess symptoms, memory, balance, and coordination. **Results:** We found a significant difference between sessions on modified BESS. ($F_{2,16} = 8.87$, $P = 0.003$). The control session had a significantly lower mean symptom score (2.93 ± 3.28) than the dehydrated session (10.93 ± 11.46 ; $P = .028$). The control session had a significantly higher mean memory score (28.27 ± 1.28) than the dehydrated session (27.60 ± 1.72 ; $P = .046$). **Conclusions:** Mild exercise-induced dehydration results in increased self-reported symptoms associated with concussions. Similarly, adequate hydration during exercise may help maintain cognitive function and balance during sport.

1929 June 1 4:15 PM - 4:30 PM

The Effectiveness Of Prescribed Rest Depends On Initial Presentation Following Concussion

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Reported Relationships: A.P. Kontos: Contracted Research - Including Principle Investigator; GE.

Following a concussion athletes are often prescribed physical and/or cognitive rest. However, the effectiveness of prescribed rest may depend on initial burden or presentation of signs and symptoms. More objective signs of concussion such as amnesia, disorientation/confusion, and loss of consciousness have been linked to poor outcomes and may reflect a greater burden of injury; whereas symptoms are more subjective and may be less reflective of injury burden.

Purpose: To determine if patients with signs of injury respond differently to prescribed rest following concussion compared to patients with a predominant symptom only presentation.

Methods: We conducted a secondary analysis of a prospective randomized controlled trial (RCT) of 93 pediatric concussion patients aged 11-17 years. Patients completed the Immediate Post-concussion Assessment and Cognitive Testing (ImPACT), Post-concussion Symptom Scale (PCSS), and the Balance Error Scoring System (BESS) within 24 hours of injury and at 3 and 10 days post-injury. Patients were randomized to rest or usual care and completed activity and symptom diaries for 10 days after injury. A series of 2 (group- Symptoms, 2+ Signs) x 2 (treatment- prescribed rest, usual care) ANOVAs were performed for each outcome measure. Univariate nonparametric tests (i.e., χ^2 with odds ratios, 95% CI) were used to examine the association between treatment and symptoms 1-9 days post-injury.

Results: Results revealed a significant group x treatment interaction for symptoms at 3 days post-injury ($F=6.31$, $p=.01$, $\eta^2=.07$). Prescribed rest increased the likelihood of being symptomatic at days 1-6 and 8 ($p<.05$) for the Symptoms group. In contrast, rest was beneficial for patients in the 2+ Signs group on verbal memory performance ($t=-2.28$, $p=.029$).

Conclusions: The effects of prescribed rest following concussion may be dependent on initial injury presentation. Compared to patients with objective signs of injury, patients with predominantly symptoms were more likely to remain symptomatic post-injury if prescribed rest, whereas patients with signs of injury benefitted from rest following concussion. Individualized treatment planning post concussion should start at the time of presentation and take into consideration initial presentation of concussion signs and symptoms.

1930 June 1 4:30 PM - 4:45 PM

Predictors Of Concussive Recovery In Adolescents: The Influence Of Race And Gender

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(No relationships reported)

Concussions in adolescents are a public health concern with the growing popularity of high school sports. State legislation mandates that athletes who are suspected of having a concussion be cleared by a clinician to return-to-play. More research is needed to identify populations at risk for protracted recovery. **PURPOSE:** The aim of this study was to identify clinical (e.g., concussion history, migraine history, learning disabilities/attention deficit hyperactivity disorders [ADHD]) and demographic factors (e.g., age, sex, race/ethnicity, health insurance status, mechanism of injury/ sport, education) that predict concussion recovery times. **METHODS:** In a retrospective cohort study of adolescents, 13 to 19 years old, evaluated for an acute concussion (≤ 10 days from injury) at a university-based concussion clinic, recovery times were calculated from the date of concussive injury to the date of clearance to return-to-play and/ or normal activities. The healthcare provider determined recovery based on physical examination, symptom reporting by the patient, parent, and/ or athletic trainer, ImPACT computerized battery performance compared with norms and/ or baseline scores (when available), and academic performance. A Cox proportional hazards model was used to identify predictors of concussion recovery times. **RESULTS:** There were 227 charts that met inclusion criteria. There were no differences in distributions of age and sex. The sample ($N = 227$) was primarily male (75%), and the median age was 15 years. Ethnic minorities (blacks and Hispanics) constituted 46% of the sample. The median time to recovery was 16 days in white males and 11 days in minority males. The median time to recovery was 26 days in females and 13 days in males. White females had the longest recovery time (median 27.5 days). Predictors of protracted recovery included ADHD ($HR = .449$, 95% CI = .272 - .741, $p = .002$) and prior concussion ($HR = .574$, 95% CI = .397 - .828, $p = .003$) in all sex and ethnic groups, while shorter

recovery times were predicted by male minority status ($HR = 2.12$, 95% CI = 1.30 - 3.46, $p = .003$). **CONCLUSION:** This study found significantly shorter recovery times in adolescent minority males compared to white females and identified ADHD and prior concussions as risk factors for protracted recovery.

1931 June 1 4:45 PM - 5:00 PM

An Examination of Adolescent Athletes and Non-athletes on Baseline Neuropsychological Test Scores

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(No relationships reported)

An estimated 15.3 million adolescent students are enrolled in high school. However, approximately 7.6 million participate in athletics. Research has examined different demographics in high school athletes, however athletic participation may play a larger role in test performance than previously thought. Currently, research involving concussion assessment utilizes non-injured athletes as controls, but due to the intense nature of athletics, this may not be appropriate. **Purpose:** Examine differences between athletes and non-athletes using a common computerized neuropsychological test. **Methods:** 662 adolescent high school students (athletes (ATH): $n=383$, non-athletes (NON): $n=279$) were administered a computerized neuropsychological test battery (ImPACT®) during baseline concussion assessment. Differences between groups were calculated using a one-way ANOVA. All statistical analyses were conducted using SPSS 23.0. Significance levels were set *a priori* at $p \leq .05$. **Results:** Statistically significant differences were found between ATH and NON in Composite Verbal Memory ($F(1, 660) = 4.653$, $p = .031$), Composite Reaction Time ($F(1, 660) = 15.869$, $p \leq .001$), and Total Symptom Score ($F(1, 660) = 38.996$, $p \leq .001$). Non-athletes performed better on verbal memory and reported more symptoms, while ATH had faster reaction times. No significant differences were found in composite visual memory, composite visual motor, and composite impulse control ($p \geq 0.05$). **Conclusion:** Significant differences were found between ATH and NON for symptom reporting, verbal memory, and reaction time. Athletes may have additional training or motivational factors during testing which may affect participation or return to play decisions. Overall, these significant differences in baseline performance should be accounted for when making concussion diagnostic and management decisions. Future research should be conducted to examine the influence of athletic participation on the recovery process to see if non-athletes can be used as healthy controls.

Supported by: The National Operating Committee on Standards for Athletic Equipment (NOCSAE).

1932 June 1 5:00 PM - 5:15 PM

Establishment of Normative Clinical Reaction Times in a Pediatric Population

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(No relationships reported)

Introduction: The puck-drop (PD) test has been utilized to assess clinical reaction time (CRT) and has been proposed as a tool to aid in the management of sports related concussion. The simplicity of the test and low cost make it an attractive tool in the management of these injuries; however, no normative data has been established in children, making post-concussion testing in this population difficult to interpret.

Purpose: The purpose of this study is to examine the use of the PD test in the pediatric and adolescent population: 1) to develop age specific normative values and 2) to examine the effect of sex and handedness on test performance.

Methods: Patients (ages 8-18) who presented to sports medicine clinics for evaluation and treatment of non-concussive injuries and whose presenting complaint would not confound completion of the PD test (LE injury, recovered injury, etc.) were recruited for baseline assessment. Testing was conducted in accordance to protocols previously described in the literature. Two practice trials were conducted. The distance of stick transversal was recorded to the nearest 0.5 cm, as well as the number of drops and failed attempts. The test was completed when 8 successful trials for each hand were recorded. Children with hands too small to circumvent the puck diameter were accommodated by starting at 10 cm above the puck base at the discretion of the test administrator.

Results

463 subjects completed the study ($n=178$ male, $n=285$ female, average age 13.04 +/- 2.57 years). Regression analysis of baseline CRT indicated a strong effect of age on overall CRT for both right and left hands ($R^2 = 0.21$, $p<0.001$, Figure 1). The estimates (SE) of right hand CRT ranged between 255.51 (4.66) to 216.15 (4.97) ms, and those of left hand ranged from 257.41 (4.71) to 219.08 (5.02) ms across 8-18 years of age. There were no differences in performance on CRT based on handedness ($p=0.78$) or sex. ($p=0.84$).

Conclusion: As a result of this study, normative values for the PD test were established for the pediatric population. Test performance varied with age. Test performance did not vary based on hand, preliminarily indicating hand dominance does not affect performance during this evaluation. Future studies should evaluate the effect of concussion on performance.

D-47 Free Communication/Slide - Free-Living Validation Studies

Thursday, June 1, 2017, 3:15 PM - 5:00 PM
Room: 103

1933 **Chair:** Andrea K. Chomistek. *Indiana University-Bloomington, Bloomington, IN.*
(No relationships reported)

1934 June 1 3:15 PM - 3:30 PM
Free-living Total Energy Expenditure Assessed using Three Accelerometer Models Validated against Doubly-Labelled Water

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PURPOSE: Methods for estimating total energy expenditure (TEE) in free-living conditions are needed as alternatives to the expensive and technically demanding gold-standard doubly labeled water (DLW) technique. Accelerometers are one such option. We evaluated three widely-used accelerometers (ActiGraph, Actical, and RT3) using a standardized data analysis procedure to determine their ability to accurately estimate TEE using manufacturer-provided algorithms. Second, we determined if the inclusion of simple variables in the regression model improved the accelerometer TEE estimate. **METHODS:** Healthy, nonsmoking, non-obese adults aged 25-60 y wore accelerometers during a 14-d DLW assessment of TEE. Data were collected at 3 sites (Pennington Biomedical Research Center (PBRC; n=47), Tufts University (n=38), and Washington University School of Medicine (WUSM; n=38)) as part of a study on caloric restriction and aging (the CALERIE Study). Accelerometer manufacturers' algorithms were used to convert minute-by-minute counts to energy expenditure per minute, from which TEE (kcal/d) was derived. Only days in which accelerometers were worn for ≥720 min were included in the analysis; at least one valid day was required. **RESULTS:** The three evaluated accelerometers provided estimates of TEE differing significantly from TEE measured by DLW (-690 to 220 kcal/d; pooled SE 44 kcal/d; p<0.0001). Regression equations generated from accelerometer-assessed TEE accounted for 46-74% of the variability in DLW-measured TEE (SEE 251-319 kcal/d or 9-11% of DLW-measured TEE), and all differed significantly from the line of identity (p<0.0001). When body mass and/or sex were included in regression models, all predictions were improved and the SEE was reduced to 7-9% of DLW-measured TEE. Accelerometer-specific equations were derived for the prediction of free-living TEE, which may prove useful and can be cross-validated in future studies. **CONCLUSIONS:** Using manufacturers' algorithms, the three accelerometers evaluated in this study estimated TEE with an error comparable to the within-subject between-day variability in DLW-measured TEE. Including simple variables such as age and body mass in the prediction equations improved the utility of the accelerometers for assessing free-living TEE.

1935 June 1 3:30 PM - 3:45 PM
Workplace Sedentary Behavior Questionnaire: Validity and Responsiveness to Change

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Self-report remains an important measurement method for physical activity and sedentary behaviors because it provides the contextual information needed in targeted behavioral interventions. **PURPOSE:** This study aimed to evaluate the validity and responsiveness to change of a workplace sedentary behavior questionnaire (SBQ) in assessing total sedentary behavior (1) at work and (2) outside of work during workdays, and during (3) non-workdays. **METHODS:** Participants (N= 359) were recruited from 16 worksites in the greater Minneapolis and Phoenix regions. Participants wore an activPAL3c accelerometer for 7 days at two timepoints (baseline and 12-week follow-up). They also completed a sedentary behavior questionnaire on the 7th day of each assessment timepoint. Time spent in each behavior from both measures was standardized to a 16-hour day on non-work days and 8-hours to both work hours and non-work hours on work days. The agreement between the two measures was assessed through single-measure with absolute definition ICC using a two-way random effects model. Bias estimates (mean difference [] and root of mean square error [RMSE = were used to compare reported behaviors to the activPAL values. Responsiveness to change following the intervention was assessed using the responsiveness statistic (RS). **RESULTS:** There was poor agreement between the SBQ and activPAL (ICC from 0.06 - 0.29) across all time periods. On average, participants over-reported their time spent sitting (Mean [95% CI]= 39.9 [31.1, 48.7] min/day, RMSE= 112.5) and moving (12.9 [9.39, 16.5] min/day, RMSE= 44.3), but under-reported standing (-52.9 [-60.5, -45.2] min/day, RMSE= 105.5) at work. Moreover, sitting time during their non-work hours was over-reported (51.7 [34.5, 68.8] min/day, RMSE= 211.8). Sitting on non-work days was underestimated (-87.2 [-111.6, -62.7] min/day, RMSE= 298.8). SBQ was similarly responsive to change compared to the activPAL except for sedentary time during non-work days (0.13 and 0.49 for SBQ and AP, respectively). **CONCLUSION:** Despite the poor absolute agreement between the SBQ and activPAL, overall bias estimates and responsiveness during work days were acceptable. Further studies are needed to explore ways to improve accuracy in sedentary behavior reporting during non-working days.

1936 June 1 3:45 PM - 4:00 PM
The Validity of Fitbit Charge in Free Living Conditions

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PURPOSE: Research is accumulating regarding the accuracy of wrist-worn consumer activity monitors in controlled lab settings. However, there is a lack of evidence of validity under free living conditions. The study investigated the accuracy of Fitbit Charge (FBC) for estimating minutes of moderate and vigorous physical activity (MVPA) compared to research grade accelerometers. A secondary purpose was to evaluate the accuracy of steps/day. **METHODS:** Ninety-four healthy men and women (mean age 41 ± 9 years) wore a FBC as part of a 12-week intervention. The participants were also asked to wear research grade accelerometers concurrently as the criterion physical activity measure during the last week of intervention. A minimal of 10 hours/day wear-time was applied to both methods. Estimated daily MVPA and steps taken from the FBC were compared against the criterion using indicators of Pearson correlation, mean absolute percent errors, mean percent errors, and equivalence testing. The activity classification agreement of MVPA at the minute level was evaluated with Kappa, sensitivity and specificity. **RESULTS:** Complete data were collected on 61 individuals with an average of 5.5 days of wear-time. The average daily MVPA measured by accelerometer was 76.3 minutes compared to a higher value, 118.7 minutes, estimated by the FBC. The correlation between the two methods was 0.8 (p<0.0001). The mean absolute percent errors and mean percent errors were 68.2% and -64.2% indicating a consistent overestimating MVPA by the FBC. The average daily steps were 8,897 and 7,716 measured by FBC and accelerometer, respectively, with a correlation of 0.76 (p<0.0001). The mean absolute percent errors and mean percent errors of steps estimated by FBC were 30.0% and -20.1%. Neither of the MVPA and steps measured by FBC fell into the ±10% equivalence zone set up by the accelerometer. The Kappa statistics of the classification agreement between the two methods was 0.32 with a low the sensitivity of 30.1% but a high specificity of 96.7%.

Abstracts were prepared by the authors and printed as submitted.

CONCLUSIONS: This FBC estimated substantially higher minutes of MVPA in free living conditions among healthy adults and significantly higher steps compared to research grade accelerometer. The researchers who use FBC to track physical activity need to interpret their results with caution.

1937 June 1 4:00 PM - 4:15 PM

Reliability and Validity of a Workers' Sitting Time Questionnaire (JNIOH-WPAQ) Using The Percentage Method

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(No relationships reported)

Questionnaires assessing sitting time generally use a questioning technique that asks for absolute length of time (hours and minutes) spent sitting. However, recent studies evaluating workers' physical activity questionnaires (WPAQ) showed that asking for the percentage of time rather than the absolute length of time spent sitting improved the questionnaire's properties. Furthermore, the study showed that most participants preferred the percentage method rather than the absolute time method. Therefore, we developed a new WPAQ (JNIOH-WPAQ) to investigate workers' sitting time using the percentage method. **Purpose:** To investigate test-retest reliability and criterion validity of sitting time assessed by the JNIOH-WPAQ. **Methods:** Our study included 138 workers who completed the WPAQ and wore a thigh-worn inclinometer (activPAL) over time as a criterion measure. The WPAQ measures time spent sitting within four typical domains of a worker's life: (a) working time, (b) commuting time, (c) non-working time on a workday, and (d) non-workday. We calculated intraclass correlation coefficients (ICC) as a reliability value and Spearman's ρ as a validity value. **Results:** The WPAQ demonstrated favorable reliabilities for sitting time in all four domains. That is, the ICCs for working time, commuting time, non-working time on a workday and non-workday were 0.86, 0.93, 0.80 and 0.77, respectively. As for validity, the ρ values of the WPAQ sitting time varied by domain. The ρ value during commuting time (0.86) was "strong" (0.70-0.89), whereas the ρ value on a non-workday (0.41) was "low" (0.30-0.49). On the other hand, the ρ values during working time (0.61) and non-working time on a workday (0.55) were "moderate" (0.50-0.69). **Conclusions:** The study showed that the JNIOH-WPAQ has acceptable measurement properties for investigating workers' sitting time, which makes this questionnaire a reasonable resource for future epidemiological survey. Supported by funding from the National Institute of Occupational Safety and Health, Japan (N-F25-08)

1938 June 1 4:15 PM - 4:30 PM

Evaluating Measures of Physical Activity and Sedentary Behavior Suitable for Large Epidemiologic Studies

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PURPOSE: Questionnaires typically used in epidemiologic studies to assess habitual physical activity (PA) and sedentary time (ST) are imprecise and do not assess the full spectrum of daily activities. This has limited our understanding of how these behaviors affect health. Thus, we tested two more precise and comprehensive measures, an accelerometer and an internet-based 24-hour recall (ACT24), as well as a questionnaire (Q). **METHODS:** Adults (50-70 y) enrolled in a 12-month study that included 3 criterion measures: PA energy expenditure (PAEE) measured by doubly labeled water (DLW), and two 7-d activPAL measures of active and sedentary time (A/ST). They also completed a 20-item past year Q about PA and ST (twice), an ACT24 recall of PA and ST every 2 months, and wore an ActiGraph (AG) on the waist twice for 7-d. AG equations (Freedson, Sasaki, Crouter 2-regression, Lyden machine learning [Soj3x]) were used to estimate PAEE. A/ST was quantified via Crouter, Soj3x and two cut-points (100 vertical axis [100VA]; 200 vector magnitude [200VM]). Accuracy was evaluated as % difference from the mean of the criterion values, while correlations between the true criterion and each test instrument were also calculated. **RESULTS:** Among those with DLW or activPAL measures, mean age and BMI was 63 y and 23.8 kg/m². Mean criterion values were: DLW PAEE (747 kcal/d, n=689) and activPAL A/ST (6.0/9.8 hrs/d, n=932). Accuracy in assessing PAEE was similar for the Q and ACT24 (-12% vs. 10%), but accuracy was lower for the Q than ACT24 for estimating A/ST (-48%/-18% vs. 3%/1%). Among AG measures, Crouter was most accurate for PAEE (-6%), while 100VA was most accurate for A/ST (1%/2%). Strength of the correlations for PAEE and A/ST were relatively consistent within each measure, but correlations were lower for Q ($r=0.28-0.41$), higher for ACT24 ($r=0.63-0.73$) and highest for AG Soj3x ($r=0.72-0.77$). Correlations for the other AG measures ($r=0.61-$

0.75) were similar to ACT24. Results did not vary greatly by sex, but all correlations for Q and ACT24 were lower for obese participants. **CONCLUSION:** ACT24 and AG measures of PA and ST were more accurate and had higher correlations than Q, suggesting that use of these more comprehensive measures in future epidemiologic studies could yield new etiologic discoveries, possibly leading to new intervention opportunities.

1939 June 1 4:30 PM - 4:45 PM

Dietary And Physical Activity Measurement Tools Accurately Predict Total Energy Expenditure In Adults Aged 50-74

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Unfavorable changes in body composition associated with the aging process can contribute to the development and severity of chronic diseases. Adequate dietary intake and physical activity (PA) after the age of 50 can reverse these changes to sustain overall health and quality of life. **PURPOSE:** We investigated which self-reported PA questionnaires (Community Healthy Activities Model Program for Seniors (CHAMPS) or American Association of Retired Persons (AARP) questionnaires), objective PA measures (ActiGraph), dietary questionnaires (Automated Self-Administered 24-hour (ASA24) dietary recall or Dietary History Questionnaire II (DHQ-II) , and anthropometric measurement outcomes best predicted total energy expenditure (TEE) measured by doubly-labeled water (DLW). **METHODS:** A secondary data analysis was performed from data collected over a 12-month period from The Interactive Diet and Activity Tracking in AARP (IDATA) study. **RESULTS:** Of the 681 participants with a mean age of 63.1 (range 50-74) 93% were Caucasian and almost half (49.5%) were male. Approximately one-fourth (26.6%) had a healthy body mass index while 42.0% were overweight and 31.4% obese. Mean TEE measured by DLW was 2,506 kcal (range 1,453 to 4,615 kcal). Stepwise linear regression was used to examine the possible significant outcomes that predicted TEE by DLW. Results indicated three outcome predictors of TEE. The overall model was significant, $F(3, 211) = 49.468, p < .001$. Specifically, resting energy expenditure (REE) estimated from the Mifflin-St. Joer equation (mean 1,496 kcal) ($Beta = -.433, p < .001$), steps measured by ActiGraph accelerometers (mean 12,530 steps) ($Beta = .290, p < .001$), and total dietary fiber measured from DHQ-II (mean = 22.9 g/day) ($Beta = .182, p < .001$) significantly predicted TEE from DLW. **CONCLUSIONS:** These results indicate that the older adults with the highest REE and who take more steps throughout the day expend more calories. Total dietary fiber may be a surrogate for adequate nutrient intake and healthy lifestyle behaviors thus contributing to the prediction of energy expenditure. In conclusion, estimating REE from the Mifflin-St. Joer equation, steps measured by ActiGraph, and fiber intake from DHQ-II are the most advantageous tools to determine TEE in older adults.

1940 June 1 4:45 PM - 5:00 PM

A Consumer Activity Tracker Is Sensitive In Detecting Change In Free-living Energy Expenditure And Steps

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Activity trackers (ATs) are valuable tools to monitor physical activity (PA) behavior and energy expenditure (EE). Despite the broad appeal of such devices for consumers and researchers, there is limited evidence of how well ATs detect change in PA behaviors in free-living settings. **PURPOSE:** To explore the sensitivity of ATs in detecting change in estimated EE and steps compared to changes in directly observed behavior and criterion steps in free-living settings. **METHODS:** Seven participants were directly observed on three separate days for 2-hours each day in free-living settings. Participants wore a commonly used criterion step counting (CSC) device, and popular hip- and wrist-worn consumer ATs. Criterion EE was assessed using a validated direct observation (DO) method. The CMS and DO were then used to classify pairs of sessions for each participant based on whether steps and EE changed by +/-5%, 15%, and 25% or not. The ATs were then used to perform the same classification. Percent agreement between the two methods were then calculated.

RESULTS:

Percent agreement: criterion steps compared to estimated steps			
CSC step change	5%	15%	25%
AT hip (% agreement)	90.4	85.7	80.9
AT wrist (% agreement)	100	95.2	85.7
Percent agreement: criterion energy expenditure compared to estimated energy expenditure			
DO EE change	5%	15%	25%
AT hip (% agreement)	66.6	66.6	76.2
AT wrist (% agreement)	71.4	66.6	61.9

CONCLUSIONS: These preliminary results provide evidence that ATs are sensitive in detecting change in steps and EE. For step estimates, the wrist AT was superior in the detection of change compared to the hip AT. The implications are that consumers, clinicians, and researchers may employ hip- and wrist-worn ATs as an objective tool to track changes in steps and EE in free-living settings. In particular, the AT wrist is highly sensitive to changes in steps and is a tool that can be used for individual and group interventions designed to increase locomotion behavior.

Funded by: NIH: 1F31HL129802-01

D-48 Clinical Case Slide - Cardiovascular II

Thursday, June 1, 2017, 3:15 PM - 4:55 PM
Room: 401

1941 **Chair:** Benjamin D. Levine, FACSM. *Texas Health Presbyterian Hospital Dallas, Dallas, TX.*

(No relationships reported)

1942 **Discussant:** Sameer Dixit. *Johns Hopkins University, Baltimore, MD.*

(No relationships reported)

1943 **Discussant:** Jerrad P. Zimmerman. *Carle Clinic, Urbana, IL.*

(No relationships reported)

1944 June 1 3:15 PM - 3:35 PM

Football Athlete with Chest Pain and Dysphagia

Adam Fletcher, Jeremy Kent, Walter Hoyt, John MacKnight, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: John MacKnight, MD, FACSM)

(No relationships reported)

HISTORY 22 year old collegiate football player was seen in clinic for several years of intermittent dysphagia with associated chest pain. Symptoms had occurred 3-4 times annually, but athlete had noted increasing frequency over the past several weeks with occasional associated heartburn. He was initially treated with oral omeprazole 40 mg daily for presumed gastroesophageal reflux disorder. Two weeks later, following an intense practice, he developed severe, burning, substernal chest pain and diaphoresis which prompted emergency department evaluation for possible cardiac etiology. **PHYSICAL EXAMINATION** Vitals: HR 56, BP 147/90, RR 18 General: Uncomfortable, writhing on exam table Neck: Supple. No lymphadenopathy. CV: Regular rate and regular rhythm with no murmurs. No friction rub heard. Distal pulses are intact. No lower extremity edema. Pulmonary: No respiratory distress. Lungs are clear to auscultation bilaterally. Abdominal: Soft, non-tender, non-distended. **DIFFERENTIAL DIAGNOSIS** GERD Esophageal stricture Esophageal spasm Acute coronary syndrome Myocarditis/Pericarditis Coronary or aortic dissection **TESTS AND RESULTS** WBC 5.5, HGB 13.7 Troponins- 0.09, 0.24, 3.63 (peak) CRP 0.2, ESR 9 Creatinine 1.8 CK (peak) 836 ECG: interpreted as having diffuse ST elevation Subsequent ECG: precordial J point elevation without concave ST elevations Echocardiogram: left ventricular ejection fraction of 45-50% Cardiac MRI: Small areas of focal mid-wall, late gadolinium enhancement (LGE) consistent with myocarditis Barium swallow study: transient "feline esophagus" without diverticulum or stricture EGD: longitudinal furrows with punctate white spots. Biopsies revealed increased intra-epithelial eosinophils up to 50 per hpf TSH 1.06 ANA, ANCA, Anti-SCL 70, C4 all negative **FINAL WORKING DIAGNOSIS** Presumptive Viral Myocarditis Eosinophilic Esophagitis (EoE), biopsy-proven **TREATMENT AND OUTCOMES** Placed on medical hold for remainder of football season Repeat cardiac MRI improved Returned to light weightlifting and easy spinning without recurrence of symptoms. Will be reevaluated by exercise stress test and echocardiogram before further return to sport decisions are made Remains on twice daily omeprazole 40 mg for management of his EoE until follow up with GI.

1945 June 1 3:35 PM - 3:55 PM

Cardiopulmonary- Soccer

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(No relationships reported)

HISTORY: A 19 year-old female collegiate division 1 soccer player was seen in athletic training room for follow up on 1 month history of rib pain and cough with blood tinged sputum. One week prior to training room visit, she was evaluated at a primary care clinic and diagnosed with pneumonia. She was placed on Azithromycin for 5 days which improved symptoms. The athlete was followed weekly in training room and although she tolerated a slow progression back to running, she again developed intermittent hemoptysis in the evenings after running. Pertinent family history included a grandmother who was recently diagnosed with a pulmonary embolism and found to have prothrombin gene mutation.

PHYSICAL EXAMINATION: Well appearing, no cervical or supra-clavicular lymphadenopathy. CV: regular rate and rhythm, with no murmurs, gallops, or rubs. Lungs: clear to auscultation bilaterally, without wheezes or crackles. Non-tender to palpation over costo-sternal junction. Extremities well perfused.

DIFFERENTIAL DIAGNOSIS: 1. Post infectious airway irritation 2. Arterial Venous Malformation 3. Pulmonary Embolism

TEST AND RESULTS: CBC: 4.8-13.2/40<202, PT: 13.6, INR: 1.0, PTT 29, Quantiferon Gold: negative. Protein C:98 Lupus S: 88 Cardiolipin AB:4 Factor V Leiden, prothrombin gene mutation, and lupus anticoagulant: negative

Chest X-ray : Infiltrate in posterior segment left lower lobe
CT PE: Multiple pulmonary emboli in bilateral distal lobar and segmental pulmonary arteries with probable right heart strain.

2D ECHO: 1. Normal left ventricular function. LV ejection fraction estimated to be 55 to 60%. **FINAL WORKING DIAGNOSIS:** Bilateral pulmonary emboli-provoked (likely causation-oral contraceptives)

TREATMENT AND OUTCOMES: Athlete was admitted to University Hospital for 24 hour observation after outpatient CT showed bilateral pulmonary emboli. A Work-up for coagulopathy was performed and the athlete was started on Apixaban 10mg PO BID x 7 days followed by Apixaban 5mg PO BID for a total treatment duration of 3 months. While on anticoagulation, the athlete was held out of all activities for 6 weeks, and then was slowly progressed to non-contact cardiovascular training, which she has tolerated well.

1946 June 1 3:55 PM - 4:15 PM

Cardiovascular Injury-Marathon Running

Stephen Schaaf, Beth Stepanczuk. *University of Pittsburgh Medical Center, Pittsburgh, PA.*

Email: schaafs@upmc.edu

(No relationships reported)

HISTORY: A 48-year-old female competitive marathon runner with no significant past medical history developed right sided neck pain while running a race. The patient completed the race at her typical pace, finishing top five in her age group. After the race, her right sided neck pain persisted. Around thirty minutes post-race she began to have sudden onset dizziness, causing her to fall to the ground. While on the ground, she soon developed severe vertigo, nausea, and emesis. EMS was immediately called and she was transported to the hospital. During transport the patient had loss of consciousness.

PHYSICAL EXAMINATION: Examination in the emergency room found the patient to be hemodynamically stable. She was noted to be lethargic but arousable, unable to stand due to vertigo, and had continued nausea and emesis. The rest of her physical exam was benign.

DIFFERENTIAL DIAGNOSIS:

- Cardiac arrest
- Carotid artery dissection
- Exercise associated hyponatremia
- Exercise associated hypotension
- Hemorrhagic stroke
- Hypoglycemia
- Ischemic stroke
- Vertebral artery dissection

TEST AND RESULTS: BMP, CBC, Troponin, UDS, EKG, and CT Head without contrast were all normal. CT angiography of the neck: Acute focal right vertebral artery dissection at C2-C3. MRI of the brain and MR angiography of the neck: Right cerebellar vermis infarct and confirmed right vertebral artery dissection at C2-C3 with associated thrombus. Cerebral angiography: Dissection of the right vertebral artery with associated non-occlusive thrombus and distal occlusion of the right PICA.

FINAL WORKING DIAGNOSIS: Right vertebral artery dissection and right cerebellar vermis infarct

TREATMENT AND OUTCOMES:

The patient was started on a heparin drip with transition to warfarin for anticoagulation and secondary stroke prevention. The patient will continue on warfarin for at least 3 months.

Abstracts were prepared by the authors and printed as submitted.

The patient was admitted to inpatient stroke rehabilitation and discharged to home after 5 days at an independent level. The patient continued to suffer from vertigo for which she was started on Clonazepam 0.5mg three times daily as needed which controlled her symptoms. She is enrolled in vestibular outpatient physical therapy. The patient is determined and plans to run the 2017 Boston marathon which she has already qualified for.

1947 June 1 4:15 PM - 4:35 PM

Dyspnea on Exertion - Former Marathon Runner

Rubria Marines-Price, Andrew R. Tomlinson, Tony G. Babb, FACSM, Benjamin D. Levine, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Tony G. Babb, FACSM)
Email: rubriamarines-price@texashealth.org
(No relationships reported)

HISTORY:

A 67-year-old former marathon runner with a history of venous thromboembolism was referred for cardiopulmonary exercise testing (CPET) for dyspnea on exertion (DOE), drop in fitness, and pre-surgical evaluation for pulmonary thromboendarterectomy (PTE). He was diagnosed with chronic thromboembolic (CTE) disease 3 months prior to referral. His V/Q scan showed multiple perfusion defects. Normal spirometry, lung volumes, and diffusion capacity. Right heart catheterization (RHC): RA 5 mm Hg; PA 37/15 mm Hg (mean 24); PCWP 8 mm Hg; PA saturation 67%; TDCO 4.2 L/min.

PHYSICAL EXAMINATION:

Height: 175 cm; weight: 71 kg; Caucasian male, normal respiratory rate, no evidence of breathlessness at rest.

DIFFERENTIAL DIAGNOSIS:

1. Respiratory and/or cardiovascular limitation
3. Deconditioning
4. Aging

TEST AND RESULTS:

CPET Results

Variable	Rest	SS 1	SS 2	Peak
Workload (W)	0	40	80	120
VO ₂ (L/min)	0.22	0.88	1.14	1.60
HR	77	124	149	179
Q _c (L/min)	3.24	7.2	7.45	9.19
V _E (L/min)	9.56	38.18	52.57	101.8
V _E /VCO ₂	59	43	45	53
SpO ₂ (%)	100	96	95	95
PetCO ₂ (mm Hg)	40	34	31	24
Lactate (mmol/L)	2.1	2.9	4.6	9.1
V _D /V _T (%)*	38	27	26	24

SS: steady state; * V_D/V_T estimated dead space to tidal volume ratio.

Interpretation:

Functional Class I; fair-to-average fitness by AHA criteria
Severe ventilatory inefficiency
Increased ventilatory demand and breathlessness
Blunted cardiac output due to decreased SV reserve

FINAL WORKING DIAGNOSIS:

CTE disease

Evidence of ventilatory inefficiency

Impaired hemodynamics

TREATMENT AND OUTCOMES:

PTE surgery

Post-surgery cardiopulmonary rehabilitation

Repeated CPET 15 months after surgery due to persistent DOE and no fitness gains

Repeated CPET Results (After PTE)

Variable	Rest	SS 1	SS 2	Peak
Workload (W)	0	40	80	140
VO ₂ (L/min)	0.24	0.82	1.09	1.60
HR	79	103	132	170
Q _c (L/min)	3.89	7.17	8.63	—
V _E (L/min)	11.19	33.04	46.88	111.88
V _E /VCO ₂	56	40	40	53
SpO ₂ (%)	100	100	99	98
PetCO ₂ (mm Hg)	37	37	36	26
Lactate (mmol/L)	2.8	2.1	3.6	9.9
V _D /V _T (%)*	34	27	28	24

SS: steady state; * V_D/V_T estimated dead space to tidal volume ratio.

Interpretation:

Mildly improved functional status

Improved hemodynamics

Mildly improved ventilatory inefficiency

TREATMENT AND OUTCOMES:

Cardiopulmonary rehabilitation and interval training

Consider RHC with exercise to evaluate for residual pulmonary vascular disease

Consider pulmonary vasodilator therapy if present

1948 June 1 4:35 PM - 4:55 PM

Applying Cardiopulmonary Exercise Testing to the Evaluation of Left Ventricular Function for Patients with Ventricular Assist Device Therapy

Jeffrey W. Christle¹, Kegan J. Moneghetti¹, Francois Haddad¹, Dipanjan Banerjee¹, Jon Myers, FACSM², Matthew T. Wheeler¹.
¹Stanford University, Stanford, CA. ²Palo Alto Veterans Administration Health Care System and Stanford University, Palo Alto, CA. (Sponsor: Jon Myers, FACSM)
Email: christle@stanford.edu
(No relationships reported)

HISTORY: Patient with severe heart failure and presence of a left ventricular assist device (LVAD).

PHYSICAL EXAMINATION: A patient with severe heart failure and LVAD (29 y, male, BMI 26 kg/m², INR > 2.0) was examined on two separate occasions two weeks apart with CPX on a cycle ergometer (continuous ramp, 20 Watts per minute).

DIFFERENTIAL DIAGNOSIS: n/a

TEST AND RESULTS: The first CPX was performed with the LVAD at its prescribed speed. The second test was performed at the lowest LVAD speed setting, at which point the LVAD was effectively not supportive. Both tests were performed to volitional exhaustion. The LVAD speeds for the first and second tests were 2400 rpm and 1800 rpm. Peak respiratory exchange ratios were 1.20 and 1.16, respectively. For the CPX with LVAD support, VO_{2,peak} was 24.4 ml/kg/min and peak workload was 167 Watts. For the CPX without LVAD support VO_{2,peak} was 27.7 ml/kg/min and peak load was 190 Watts.

FINAL WORKING DIAGNOSIS: Patient seems to have recovered a substantial amount of functionality, so that the LVAD may be unnecessary. Furthermore, the LVAD may be a hindrance to exercise performance and therefore adequate ventricular recovery.

TREATMENT AND OUTCOMES: Patient is being considered for reevaluation for need of LVAD. Focus is on further recovery and improvement of quality of life.

D-49 Clinical Case Slide - Leg

Thursday, June 1, 2017, 3:15 PM - 5:15 PM
Room: 402

1949 **Chair:** Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.*
(No relationships reported)

1950 **Discussant:** Terry Nicola, FACSM. *UIC Sports Medicine Center, Chicago, IL.*
(No relationships reported)

1951 **Discussant:** Martin P. Schweltnus, FACSM. *University of Pretoria, Pretoria, South Africa.*
(No relationships reported)

1952 June 1 3:15 PM - 3:35 PM

Foot Drop in a Cheerleader After a Yoga Pose

Vince Si, Melody Hrubes, Terry Nicola, FACSM. *University of Illinois at Chicago, Chicago, IL.* (Sponsor: Terry Nicola, FACSM)
(No relationships reported)

HISTORY

15-year-old healthy female referred for right foot drop and numbness of the right lower leg x 1 month and occurred during yoga. She is a cheerleader and is quite flexible, and the instructor had her do advanced poses that she had not done; she subsequently experienced pain in her anterior shins. She has experienced pain in anterior shins before; however, this time she had numbness and difficulty with ambulation and noticed she was tripping on the right. Of note, she was on oral antibiotics for recurrent ear infections that eventually required tubes to be placed. The antibiotics upset her stomach causing 15 pound loss from 12/2015 - 3/2016.

PE

Thin female, alert, in no distress

Extremities warm, well-perfused with 2+ pulses in DP, PT bilaterally Full range of motion in lumbar spine and bilateral hips without pain

Atrophy of the right tibialis anterior, no subluxation of right fibula, no swelling

5/5 in strength in bilateral hip flexion, knee extension, knee flexion, ankle plantarflexion, left ankle dorsiflexion, and left 1st toe extension. 0/5 strength in right ankle dorsiflexion, right ankle eversion and right 1st toe extension. 5/5 in right ankle inversion

THURSDAY, JUNE 1, 2017

Sensation: intact in left leg, minimally decreased over the right medial malleolus, significantly decreased over the right lateral malleolus, and absent along dorsum of right foot
 Reflexes 2+ and symmetric in bilateral patella and Achilles, toes downgoing, no clonus
 Beighton scale: 9/9
DIFFERENTIAL
 Peroneal neuropathy
 Plexopathy
 Radiculopathy
 Peripheral neuropathy
 Myelopathy
 Cauda Equina Lesions
 ALS
 Multiple Sclerosis
 Conversion Disorder

TESTS
 XR lumbar spine normal
 MRI of the right leg suggestive of common peroneal neuropathy; no focal mass seen compressing the nerve
 EMG/NCS: evidence of right common peroneal neuropathy proximal to the fibular head

FINAL WORKING DIAGNOSIS

Peroneal neuropathy across the fibular head

TREATMENT AND OUTCOMES

She was started on a short course of a corticosteroid taper and physical therapy. At 1-month follow-up, the patient reported significant improvement with decreased numbness and is able to perform maneuvers with cheerleading. Strength has also improved to 3/5 in right ankle dorsiflexion, 4/5 in right ankle eversion. She continues with PT and close follow-up with ortho and primary care sports medicine.

1953 June 1 3:35 PM - 3:55 PM

Lower Leg Injury-Dance

Brittany J. Moore, Karen Newcomer, FACSM, Cara Prideaux.
Mayo Clinic, Rochester, MN.
 Email: moore.brittany@mayo.edu
 (No relationships reported)

HISTORY: A 15 year old female high school dancer presented to clinic with recurrent left leg pain in setting of recently treated left fibular stress fracture. She initially presented 6 months prior with focal distal fibular pain. At that time stress fracture diagnosis was confirmed with X-Ray and MRI; imaging revealed incidental left talocalcaneal coalition (TCC). Treatment with walking boot immobilization and activity modification for 6 weeks resolved her pain. She returned to full activities including dance. After 4 months of pain free activity she now presented with left lateral fibular pain more diffuse than prior, worse with weight bearing. She denied trauma, swelling, numbness, tingling, or weakness. Her nutritional status was appropriate. Menstrual cycles were normal since menarche at age 11.

PHYSICAL EXAMINATION: Ankle and foot alignment was neutral. She was point tender over several inches of distal left fibula without tenderness of ankle or foot. Left subtalar pronation and supination motion was markedly limited compared to right, but pain free. Ankle strength was full and pain free through available range. Gait was normal. She was neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: 1. Recurrent fibular stress fracture 2. Fibular stress syndrome 3. Symptomatic TCC 4. Peroneal tendinopathy

TEST AND RESULTS: Left leg MRI, 6 months prior: distal fibular shaft cortical thickening with increased T2 signal of intramedullary canal and periosteum consistent with early stress fracture. Left leg X-Ray, 2 view: cortical thickening of distal fibular diaphysis unchanged from 6 months prior. Left ankle CT: left fibrocartilaginous TCC with cortical irregularity, subchondral sclerosis and cystic changes of middle subtalar facet and adjacent calcaneus surface.

FINAL WORKING DIAGNOSIS: Recurrent left fibular stress fracture secondary to impaired subtalar motion from TCC

TREATMENT AND OUTCOMES: 1. Walking boot immobilization for 4 weeks to treat stress fracture 2. Orthopedics referral and surgery for left TCC excision with intraoperative normalization of subtalar motion 3. Postoperative short leg immobilization for 10 days 4. Ankle range of motion and strengthening exercises started 2 weeks postoperatively 5. Returned to sport 2 months postoperatively once incision healed and ankle motion/strength appropriate

1954 June 1 3:55 PM - 4:15 PM

A Fibular Hook

Kevin N. Blythe, Bronson E. Delasobera. *MedStar Georgetown University Hospital, Washington, DC.*
 (No relationships reported)

History 26 yo female with several months of exertional posterior left proximal calf pain after training for 1/2 marathon. The pain is isolated to the proximal posterolateral calf without radiation, described as a dull ache and heaviness of 4/10 intensity.

Symptoms occur after 10 minutes of running, and lasts for 2-3 hours after runs. She has some tingling on the sole of the foot but no weakness, swelling or pallor. PT for calf strain provided no relief. She previously had negative evaluation by vascular surgery including ABIs, arteriogram and a dynamic MRI/A.

Physical Exam Left lower leg - no edema, lesions or deformity. Mild TTP of proximal calf, midline and lateral. No other TTP of lower leg, knee or L-spine. No knee effusion. Full ROM and strength at knee/ankle. Normal sensation over the L4-S1 distribution, 2+ distal pulses. Negative Homan's; negative straight leg raise, negative McMurray's, negative Tinel's, no cords palpated. Normal gait and heel-toe gait.

Differential Diagnosis 1) Chronic Exertional Compartment Syndrome 2) Lower Extremity DVT 3) Popliteus or Hamstring Insertional Tendonopathy 4) Lumbar Radiculopathy 5) Peripheral Nerve Entrapment

Test Results

L Knee MRI - small fluid collection under MCL, otherwise negative

L-Spine MRI - negative

Compartment Pressures:

Anterior - Rest 8 mmHg, Post-exercise 24 mmHg

Lateral - Rest 15, Post 25

Superficial Posterior - Rest 25, Post 30

Deep Posterior - Rest 8, Post 15

Lower extremity venous duplex - negative

Lidocaine injection of medial hamstring insertion - no relief

EMG - all motor and sensory nerves tested were within normal limits

L Knee joint steroid injection - no relief

L Posterior calf US- abnormal morphology of fibula at soleus insertion abutting tibial nerve

MRI L tib/fib - bony tug lesion of proximal posterior fibula near insertion of the soleus without surrounding edema

X-ray tib/fib comparison films - confirmed L fibular bone lesion identified as osteochondroma

Working Diagnosis Sessile osteochondroma involving the left fibular head/neck.

Treatment and Outcome US guided lidocaine injection of soleus insertion provided 80% relief. The patient was referred for surgical evaluation. Based on the surgical risks of adjacent tibial artery/nerve injury, a repeat trial of PT, including gait re-training, was prescribed. Follow-up in 8 weeks for re-evaluation.

1955 June 1 4:15 PM - 4:35 PM

Lateral Leg Pain in an Avid Hiker After a Fall

Alyssa M. Neph, Kentaro Onishi, Suehun G. Ho. *University of Pittsburgh Medical Center, Pittsburgh, PA.*
 (No relationships reported)

HISTORY: A 62-year-old female with a history of hip OA and low back discomfort presents with left lateral leg pain that started after a fall onto her back 11 months ago. Pain is described as a constant throbbing in the left lateral calf, ankle, and dorsal foot. Pain worsens with ambulation and is relieved by rest. Noninvasive vascular studies ruled out claudication. Prior treatments included left L5 nerve root block, lumbar ESI, SI joint injection, chiropractic treatment, pain medications, and therapy with limited success. She presents to our sports medicine clinic for a diagnostic ultrasound of the left lateral leg region.

PHYSICAL EXAMINATION: Guarded gait favoring weight bearing on right lower extremity. Mild tenderness over the proximal tibiofibular joint. No focal area of tenderness noted at lateral knee joint line or distal iliotibial band. Range of motion about the knee and ankle were both full without pain and strength was intact. Allodynia noted to light touch over left anterolateral leg, ankle, and dorsal foot. Straight leg raise and lumbar facet challenge were negative. Lumbar Spurling's was positive on the left.

DIFFERENTIAL DIAGNOSIS: 1. Superficial peroneal neuropathy 2. Common peroneal neuropathy 3. Lumbar radiculopathy

TEST AND RESULTS: -MRI lumbar spine: Mild multilevel DJD without significant stenosis. -MRI left tibia-fibula: Subtle edema in the peroneal muscle area. Diffuse symmetric atrophy in both muscles. -EMG/NCV: Decreased amplitude in left superficial peroneal response (4 mV vs 12 mV on contralateral side) and mildly prolonged peak latency. No signs of lumbar radiculopathy. -Left lateral leg/knee ultrasound: Swollen superficial peroneal nerve at the site of penetration through peroneus longus muscular fascia (0.08 cm proximally and 0.22 cm distally).

FINAL WORKING DIAGNOSIS: Left superficial peroneal neuropathy
TREATMENT AND OUTCOMES: 1. Sonographically guided superficial peroneal nerve hydrodissection (HD) x 2 resulted in improvement in painless walking distance and decrease in pain scale by 50-60%. 2. Repeat elective EMG/NCV 2 months later demonstrated signs of re-innervation of the left superficial peroneal nerve evidenced by normalized and symmetric sensory response amplitude (8mV) and peak latency measures with polyphasic motor unit potentials seen in the fibularis longus.

THURSDAY, JUNE 1, 2017

1956 June 1 4:35 PM - 4:55 PM

Foot Numbness - Basketball: Doc, My Foot Is Numb!Elizabeth Kaufman, MD, Bronson Elizabeth Delasobera, MD.
Georgetown, Washington, DC.

Email: ekaufman25@gmail.com

*(No relationships reported)***History:**

35 year old male on phentermine for weight loss, presented to sports clinic with complaint of right foot numbness that started 6 days prior. After a basketball game he noticed pain and swelling in his postero-lateral calf. He went hiking the next day and the pain increased. The next day he developed numbness to the bottom of his foot. He saw a podiatrist on day 4 and was diagnosed with radiculopathy and given Medrol. He did not have foot drop or weakness but complained of heel numbness. At the time of his visit, his pain had mostly resolved, the numbness is what persisted and brought him in.

Physical Exam:

Msk:

Spine: No midline tenderness, FROM, 5/5 strength all lumbar dermatomes, decreased sensation to touch over heel and lateral foot

Negative neural slump test, straight leg raise, Patricks, Fortins, Gaenslens, 1+ patellar and achilles reflexes

Compartments soft, but right leg with swelling compared to left, no warmth, redness or cords, mild tenderness laterally

Differential Diagnosis:

Lumbar Radiculopathy

Peripheral nerve entrapment

Compartment syndrome

DVT

Hematoma/mass

Partial gastrocnemius rupture

Tests & Results:

L-spine xray: L3/L4 retrolisthesis.

Sono: no DVT

MRI R leg: Grade 2 popliteus strain with edema/hematoma formation and compression of tibial nerve

Initial labs (1 week post injury): CK 856, Cr 1.3, UA 1+ protein, 1+ ketones. CBC, CMP, ESR, and CRP normal

Repeat labs (3 weeks post injury): normal CK, creatinine, UA

EMG with nerve conduction (3 weeks post injury): normal

Repeat MRI (6 weeks post injury): interval improvement yet persistent edema of the popliteus muscle

Xrays tib/fib/knee (6 weeks post injury): no evidence of heterotopic ossification

Final Working Diagnosis:

Tibial nerve compression due to popliteus muscle injury with concomitant mild rhabdo

Treatment:

Phentermine was stopped. He started PT after a 6-week period of rest from weight bearing exercise.

Outcome and Further Follow-Up:

The patient's symptoms improved with rest and physical therapy. There was a discussion about seeing a nerve surgeon, or doing a cortisone injection or nerve hydro-dissection, but the patient declined since he was improving. 6 weeks post injury he reported only mild numbness in his heel.

Return to Activity:

The patient was able to gradually return to cardio and was back to basketball at 3 months.

1957 June 1 4:55 PM - 5:15 PM

A F44 Paralympic Track and Field Discus Thrower: A Case ReportDonald L. Hoover¹, David M. Bellar², Lawrence W. Judge³.

¹Western Kentucky University, Bowling Green, KY. ²University of Louisiana at Lafayette, Lafayette, LA. ³Ball State University, Muncie, IN. (Sponsor: Matthew Harber, FACSM)

Email: don.hoover.pt.phd@gmail.com

(No relationships reported)

HISTORY: A 28 year old Paralympic track and field athlete presented for physical therapy evaluation. The athlete's history was positive for a congenital absence of the right fibula, resulting in a below the knee amputation at age two. However, at the time of the evaluation, he was asymptomatic, participated in daily training activities, and regularly competed in meets at the world-class level.

PHYSICAL EXAMINATION: The athlete demonstrated the following postural traits: forward head; forward, internally rotated shoulders bilaterally; decreased thoracic and lumbar curves; and anterior pelvic tilt. He demonstrated decreased active and passive range of motion in many of the muscles in his lower extremities, as well as asymmetries measured between legs. While manual muscle testing was 5/5 throughout,

he demonstrated a delayed recruitment of the gluteals/hamstring dominance bilaterally. The athlete was unremarkable in neurological and soft tissue assessment. He demonstrated a "poor" capacity to maintain lower extremity symmetry while squatting to moderate depth, as well as marked asymmetry in numerous measures of single leg athletic function.

DIFFERENTIAL DIAGNOSIS

1. Musculoskeletal imbalances

TEST AND RESULTS:

1. Abnormalities in lower quarter muscle length and function.

2. Asymmetrical performance in numerous tests of single leg athletic function.

FINAL WORKING DIAGNOSIS: Chronic musculoskeletal imbalances due to congenital deformity and compounded by repetitive athletic activity.

TREATMENT AND OUTCOMES: Many throwing athletes sustain musculoskeletal or nervous injuries due to repetitive microtrauma to these tissues. Paralympic throwers are at greater risk of such injuries, due partly to the chronic effects of asymmetrical biomechanical demands. The physical therapist evaluated this athlete, identifying musculoskeletal imbalances and prescribing therapeutic exercises to address these limitations. The throwing coach integrated these prescribed activities into the athlete's annual training program so as to foster his power development in an injury-free manner. This case report highlights a cooperative relationship between sports medicine and coaching professionals that assisted a Paralympian in peaking for the 2016 Rio Games.

D-50 Clinical Case Slide - Shoulder III

Thursday, June 1, 2017, 3:15 PM - 5:15 PM

Room: 504

1958 **Chair:** David Jewison. *University of Minnesota, Minneapolis, MN.**(No relationships reported)*1959 **Discussant:** Bryan Wiley. *Kaiser Permanente, Rancho Cucamonga, CA.**(No relationships reported)*1960 **Discussant:** Clifton Page. *University of Miami, Miami, FL.**(No relationships reported)*

1961 June 1 3:15 PM - 3:35 PM

Acute Atraumatic Shoulder Pain in a 39 Year Old FemaleSheila E. Taylor. *Wellspan Sports Medicine, York, PA.* (Sponsor: Mark Lavalley, FACSM)

Email: sheila.e.taylor@gmail.com

(No relationships reported)

Presentation: 39 year old female with acute onset of severe left shoulder pain and weakness 8 weeks prior. No history of trauma or prior shoulder injuries. Due to progressively worsening nature of pain, MRI was ordered prior to referral which revealed tears of supraspinatus, infraspinatus and biceps tendon.

History: Patient admitted to IV drug use and recent hospitalization for endocarditis and septic pulmonary emboli related to her IV drug use.

Physical Exam:

Left shoulder exam: No significant erythema, or edema. AROM: severely limited AROM in all planes due to pain. PROM: limited with pain. Strength: Diffuse weakness as compared to right side. Supraspinatus: 2/5, External Rotators: 2/5, internal rotators: 4/5, Biceps: 3/5, Triceps: 4/5. Tender to palpation over anterior shoulder, coracoid, long head of biceps and lateral deltoid. Negative Hawkins and Neers.

Broad Differential Diagnosis: Etiology of rotator cuff tear: Infectious- septic, osteomyelitis; trauma- bone bruise, contusion; degenerative; inflammatory- RA; ischemic- AVN; metabolic- gout; neoplastic- tumor; Iatrogenic- drug induced

Lab Studies: Fluoro guided aspiration and culture that revealed pseudomonas, susceptible to cipro, elevated WBC, CRP, and ESR. Positive RF, Negative ANA, Negative Lyme

Other Studies: Arthroscopy, irrigation, debridement, humeral and synovial biopsy which revealed acute synovitis, culture positive for pseudomonas. Humeral bone biopsy negative for osteomyelitis.

Consultations: Infectious disease

Working Diagnosis: Rotator cuff tear secondary to chronic septic arthritis related to IV drug use

Treatment: Arthroscopic irrigation, debridement, IV antibiotics and subsequent prolonged oral antibiotics, physical therapy, activity modification, cessation of IV drug use.

Outcome: Patient continues to have small improvements in her pain s/p above treatment and physical therapy.

Author's Comments: This case entails a common complaint (acute shoulder pain and MRI revealing rotator cuff tear) with uncommon mechanism. It is thought that her chronic septic arthritis eroded the insertion of her rotator cuff as evidenced by the soft bone found on arthroscopy. Moving forward, the question is when and if to repair her rotator cuff given her high risk of future illicit drug use and increased risk of repeat infection.

1962 June 1 3:35 PM - 3:55 PM

A Collapse that Led to Shoulder Pain

Michael Seifert, Krystian Bigosinski. *Maine Medical Center, Portland, ME.* (Sponsor: Heather Gillespie, FACSM)
Email: mseifert@mmc.org
(No relationships reported)

HISTORY: A 55 year old female presents for right shoulder pain. She has a history of multiple sclerosis, recent falls complicated by a right 6th rib fracture and a right 4th phalanx fracture, a 35 pack year history of tobacco use, and an unknown fracture of her right shoulder sustained at age 16. Her current shoulder pain began four weeks prior to her visit while reaching behind her back in the shower. She felt like her shoulder popped out of place. She has achy pain, worse when touching her shoulder or using her walker. It improves with lying down and with a sling. Acetaminophen and ibuprofen do not provide relief. Physical therapy as part of her multiple sclerosis treatment has not helped.

PHYSICAL EXAMINATION:

BP: 122/82, Pulse: 69, Respirations: 16, SpO2: 96%
Shoulder:

- No gross abnormality, no step-offs along the clavicle.
- Tender over the entire humeral head and anterior shoulder.
- No swelling, warmth, or erythema.
- ROM:
 - o Right flexion 85 degrees active, 95 degrees passive.
 - o Right abduction 90 degrees active, 100 degrees passive.
 - o Adduction, internal rotation, external rotation and extension were full and equal bilaterally.
- 5/5 strength
- Special tests: positive empty can, Hawkin's, O'Brien's, and Speed's test. Negative crossed arm adduction, AC compression, and sulcus sign. Unable to perform Neer's test due to pain.

DIFFERENTIAL DIAGNOSIS:

- Torn rotator cuff
- Glenohumeral arthritis
- Humeral head fracture as part of Osteogenesis Imperfecta
- Avascular necrosis
- AC joint arthritis
- Shoulder dislocation/subluxation
- Elder Abuse

TEST AND RESULTS:

- Shoulder 3 view XR:
 - Extensive posttraumatic deformity of proximal right humerus with marked irregularity of articular surface.
 - Possible non-displaced superimposed acute or subacute fracture
 - Slightly displaced posterolateral right 4th and 5th rib fractures
- Shoulder MRI:
 - Marked abnormality of the right humeral head with contour deformity
 - Progressive collapse of superior articular surface, with focal marrow edema. This may be posttraumatic or relate to avascular necrosis
 - No rotator cuff tear.

FINAL WORKING DIAGNOSIS:

Avascular necrosis of the humeral head

TREATMENT AND OUTCOMES:

- Placed in arm sling for pain control
- Referred for surgical replacement of the humeral head
- Referred for workup for osteogenesis imperfecta, given multiple fractures

1963 June 1 3:55 PM - 4:15 PM

Shoulder Pain - Recreational Basketball

Julian D. Willoughby, Daniel Blatz. *Rehabilitation Institute of Chicago, Chicago, IL.* (Sponsor: Joseph Ihm, MD, FACSM)
(No relationships reported)

HISTORY:

A 35-year-old right hand dominant male with a history of right rotator cuff injury years ago presented with right shoulder pain for 3 weeks. He plays recreational basketball regularly but did not recall a specific injury. He described intermittent numbness, burning, and aching of the right posterior shoulder and proximal arm. Denied weakness, neck pain, or changes in pain with arm movement.

PHYSICAL EXAMINATION:

Examination revealed atrophy of the right infraspinatus when compared to the left. There was no tenderness to palpation along the scapula, periscapular muscles, clavicle, acromion, or rotator cuff insertion points of the proximal arm. Cervical and shoulder range of motion were full and non-painful. Empty can test elicited pain and slight weakness on the right compared to the left; resisted external rotation showed 4/5 strength on the right and 5/5 on the left; resisted internal rotation 5/5 bilaterally and without pain, and lift off limited on the right compared to the left. Spurling test negative. Remainder of bilateral upper limb strength was 5/5. Sensation intact throughout. Biceps, brachioradialis, and triceps reflexes symmetric. Radial pulses strong and symmetric.

DIFFERENTIAL DIAGNOSIS:

1. Infraspinatus tear
2. Suprascapular nerve impingement.
3. Brachial neuritis
4. Cervical radiculopathy
5. Upper trunk brachial plexopathy

TEST AND RESULTS:

R upper extremity EMG:
Right infraspinatus with significant amount of abnormal spontaneous activity; normal motor unit action potential morphology and recruitment characteristics. All other muscles tested including the paraspinals were normal.

R shoulder ultrasound:

Hypoechoic 1.6 cm structure without internal color doppler flow adjacent to the suprascapular muscle.

R shoulder MRI:

Large paralabral cyst measuring 11x31 mm transaxially, spanning the spinoglenoid notch cranially and caudally. Tearing of the posterior superior and posterior labrum. Edema within the infraspinatus muscle.

FINAL WORKING DIAGNOSIS:

Suprascapular nerve impingement due to paralabral cyst.

TREATMENT AND OUTCOMES:

1. Surgical referral
2. Underwent surgical decompression of the suprascapular nerve
3. Pending follow-up at this time
4. This case highlights the utility of EMG to diagnose an uncommon nerve entrapment in the setting of a common shoulder pathology

1964 June 1 4:15 PM - 4:35 PM

Shoulder Injury- Snowboarding

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(No relationships reported)

HISTORY: A 25yo R hand dominant M sustained a shoulder injury during a fall snowboarding. Reported "catching an edge", falling directly on L shoulder. Immediate pain, difficulty with ROM at the shoulder. Presented 3 days after fall. Reported decreased ROM, swelling, and trouble sleeping due to pain, especially lying on the affected side. Had tried ice, topical methyl salicylate without improvement. Reported numbness, tingling in his L hand. Denied any previous injury/surgery.

PHYSICAL EXAMINATION: On inspection, L shoulder appeared inferior to R. Swelling, ecchymosis noted over L clavicle. No gross deformity or tenting. An asymmetrical appearance and feel when comparing both clavicles, L clavicle not as prominent and well-defined. Mild tenderness to palpation over L AC joint, severe tenderness at L SC joint. Decreased ROM with overhead movements, abduction across the body. Biceps, triceps, brachioradialis reflexes and sensation intact. Pulse intact.

DIFFERENTIAL DIAGNOSIS:

1. Clavicle fracture
2. SC joint dislocation
3. SC joint sprain
4. AC joint sprain

TESTS AND RESULTS:

2 view L clavicle, no fracture. Given concern for posterior dislocation of clavicle, CT upper chest/neck to rule-out damage to structures behind clavicle was ordered. He could not afford a CT scan so it was decided that his PE was not concerning for damage to posterior structures. Serendipity and lateral sternum radiographs at 2-week follow-up, no posterior dislocation, normal anatomical alignment of SC, AC joints. No labs were indicated.

FINAL/WORKING DIAGNOSIS:

SC joint sprain (grade I)

TREATMENT AND OUTCOMES:

1. Immobilization in a sling for 1-2 weeks for patient comfort
 2. Pain control with ibuprofen, acetaminophen
 3. Early range of motion exercise, followed by home or formal physical therapy Initially referred to Orthopedics, but did not go due to financial concerns.
- 2-week f/u, out of the sling a majority of the time. Complained of "popping" sensation at SC joint. Started ROM exercises, resistance band work at home. Wanted to return to work (box sorter at shipping company) with lifting restriction/light duty.

4-week f/u, great improvement in pain symptoms and return of function, returned to work without issue or restrictions. NSAID daily. No laxity at the joint and exam symmetrical. "Popping" resolved. Patient lost to further follow-up.

1965 June 1 4:35 PM - 4:55 PM

Shoulder injury- Rugby, Progressive Shoulder Pain After Fall

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HISTORY: A 28-year-old female US Naval Academy college freshmen sustained a left wrist injury after fall on outstretched hand during an intercollegiate rugby match. She endorsed immediate onset pain, tingling, hypoesthesias into her hand in a median nerve distribution. Originally diagnosed with acute carpal tunnel syndrome and treated with a surgical release she presents to clinic with generalized, worsening left shoulder pain and weakness for 3 months.

PHYSICAL EXAMINATION: Examination at the time of presentation revealed no shoulder tenderness or swelling. Normal neurologic examination and capillary refill demonstrated. Strength and range of motion were also normal. Neck exam demonstrated no abnormalities and negative Spurlings test. The physical exam remained unchanged for two months before patient developed anterior shoulder hypoesthesias and ipsilateral palmar hypoesthesias in nondermatomal pattern.

DIFFERENTIAL DIAGNOSIS: 1. Cervical nerve root compression 2. Chronic Regional Pain Syndrome 3. Conversion Disorder 4. Brachial Plexopathy 5. Thoracic Outlet Syndrome 6. Parsonage-Turner Syndrome **TEST AND RESULTS:** Left shoulder anterior posterior, y-outlet view radiographs: —unremarkable left shoulder EMG left upper extremity: —normal electrodiagnostic study without evidence of brachial plexopathy or peripheral neuropathy MRI brachial plexus: —normal MRI Left forearm, humerus, and shoulder MRI: —normal MRI Cervical Spine MRI: —normal study

FINAL WORKING DIAGNOSIS: Conversion Disorder

TREATMENT AND OUTCOMES: 1. Relative rest, ice, compression and NSAIDs for 4 weeks with no improvement. 2. Activity modification demonstrated minimal improvement in shoulder pain 3. Range of motion, shoulder, and neck strengthening exercises with minimal improvement in symptoms 4. Further history revealed adjustment issues with college life, family stressors 5. Psychology consult placed and cognitive behavioral therapy started 6. Further follow-up with team physician revealed complete resolution of symptoms and progressive return to play protocol was initiated

1966 June 1 4:55 PM - 5:15 PM

Arm Pain - Baseball

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(No relationships reported)

HISTORY: A 20 year-old collegiate baseball left handed pitcher, developed left arm pain and swelling. His symptoms started after hunting with a shotgun, holding the gun to his left shoulder. He had no known other injuries. The first night he noticed stiffness localized to his chest and pectoral area. The following morning his left hand, forearm and arm were swollen and mildly discolored with prominent veins. His hand also felt funny and heavy. He had no chest pain or dyspnea. He continued to participate in baseball until he brought this to the attention of his athletic trainer two days later. He then presented to the emergency room for further evaluation.

PHYSICAL EXAMINATION: BP 130/70 mmHg | Pulse 62 | Temp 36.6 °C | Resp 18 | Ht 1.905 m | Wt 90.719 kg | BMI 25.00 kg/m² | SpO₂ 98% Constitutional : Alert, no distress. Neck: Supple, non-tender. Cardiovascular: Heart regular rate and rhythm, no murmur. Respiratory: Lungs clear. Extremities: Diffuse swelling and mild duskeness of the left upper extremity compared to right. Prominent, dilated veins on left upper chest. Sluggish capillary refill with palpable but weak pulses. Arm circumference was 33.5 cm on the left and 32 cm on the right. Forearm circumference was 29.5 cm on the left and 28 cm on the right. Strength was normal. Neurological: Normal sensation to light touch.

DIFFERENTIAL DIAGNOSIS: 1. Deep venous thrombosis 2. Thoracic outlet syndrome 3. Soft tissue hematoma 4. Proximal biceps rupture

TEST AND RESULTS: Chest radiographs: - Clear lungs. Normal cardiac silhouette and pulmonary vasculature. Left upper extremity duplex ultrasound: - Acute venous thrombosis with total obstruction of the left subclavian vein and left axillary vein. The internal jugular, brachial, basilic and cephalic vein were patent. Labs: - Normal CBC and metabolic panel.

FINAL WORKING DIAGNOSIS: Paget-Schrotter Syndrome - Acute venous thrombosis with total obstruction of the left subclavian and axillary veins.

TREATMENT AND OUTCOMES:

1. Anticoagulation with heparin drip. 2. Venous thrombolysis, mechanical thrombectomy and angioplasty via interventional radiology. 3. Left first rib resection

via transaxillary approach done 7 days after initial presentation. 4. Return to pitching with return of full velocity by 8 weeks post operatively with no residual symptoms or recurrence.

D-59 Free Communication/Poster - Activity Interventions and Programming in Older Adults

Thursday, June 1, 2017, 1:00 PM - 6:00 PM

Room: Hall F

1988 Board #1 June 1 2:00 PM - 3:30 PM

Light and Moderate to Vigorous Physical Activity Correlates with Physical Fitness in Hispanic Elders

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Recent evidence suggests that light activity (LA) as well as moderate to vigorous physical activity (MVPA) are associated with reduced mortality from all causes. Physical fitness (Pfit) is also associated with better health maintenance and functionality, particularly among elders. However, the association between LA and Pfit components has not been explored in this population. **Purpose:** To evaluate the association between Pfit and LA, LA to MVPA (LMVPA), and MVPA in a group of Hispanic elders in Puerto Rico. **Methods:** Sixty-two elders (24 females, 38 males; mean age= 76.4±8.4 yrs) completed a battery of Pfit testing (sit and reach for flexibility, hand dynamometer and arm curls in 30 sec. for muscle strength and resistance, distance in 6 min for cardiorespiratory fitness, and foot up and go for agility), and wore an ActiGraph accelerometer (GT3X+) attached to a waist band during 7 consecutive days. Wilcoxon rank-sum tests were conducted to detect differences by sex, and spearman correlations to determine associations between Pfit, LA, MVPA, and LMVPA. **Results:** Pfit and physical activity variables were not different between females and males; but some differences were detected in some anthropometric variables (WHR; 0.96±0.07 vs. 0.91±0.07, and muscle resistance = 18.3±3.3 vs. 15.4±4.9, respectively, P<0.05). LA (27.7±11.5 hr/day), MVPA (59.7±118.0 min/week) and LMVPA (28.7±12.3 hr/day) correlated with cardiorespiratory fitness (0.30, 0.31, 0.28; respectively, P<0.03); time in agility test (-0.38, -0.27, -0.35; respectively, P<0.04), and muscle strength (0.29, 0.26, 0.28; respectively, P<0.05). Flexibility correlated only with LA and LMVPA (0.30, 0.29; respectively, P<0.04). **Conclusion:** Our results suggest that LA as well as LMVPA positively influence cardiorespiratory fitness, agility, muscle strength and flexibility components of Pfit in Hispanic elders. Therefore, LA could be integrated in physical activity recommendations for this population.

1989 Board #2 June 1 2:00 PM - 3:30 PM

A Unique Yoga Meditation Program's (Yo-Med) Effect on Balance and Proprioception in Older Fallers

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Falls are a major factor affecting mortality and morbidity in older individuals. Proprioception is a central factor modulating fall frequency and severity. Although specific protocols have been developed to improve proprioception in older fallers, many are too challenging or not palatable to a large segment of the population. **Purpose:** Given the current popularity of yoga, and the effectiveness of mental imaging in training proprioception, this study examined the effectiveness of our newly developed yoga meditation program (Yo-Med) on balance and proprioception in a sample of older persons with moderate risk of falling. **Methods:** Sixteen older persons were randomly assigned to one of two training interventions; Yo-Med Group (Yo-Med) or Proprioception Training Group (PT). Each group received 45 minutes of specified training, 3 days per week, for 6 weeks. Pre- and post-training outcome measures were used to quantify the effect of both interventions. Measurements taken included; The Balance Error Scoring System (BESS), The Tenetti Balance and Gait Assessment, Dynamic Posturography (Proprio 5000), Joint Position Sense, and Joint Kinesthesia.

Results: The primary findings of the study were that neither the Yo-Med or PT intervention groups showed statistical improvements in proprioception tests or field tests of balance. The Proprio 5000 overall dynamic motion analysis score (DMA) showed a significant time by group interaction ($\eta^2=.271$; $p=.039$) and the time spent on the test (TOT) showed a trend toward a significant time x group interaction ($\eta^2=.221$; $p=.066$), both favoring the Yo-Med group.

Conclusion: Our results indicate that our Yo-Med program has the capacity to improve dynamic balance even beyond a standard proprioception training program. The lack of significant findings in our proprioception and field tests were likely due to the healthy nature of our sample and the duration of the intervention. Given our successful results in dynamic balance we suggest that this study be repeated with a larger sample with a greater risk of falls across a longer intervention period.

1990 Board #3 June 1 2:00 PM - 3:30 PM
Effect Of Strength Training On "excess" VO₂ In Older Adults

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Exercise tolerance is instrumental to obtain the health benefits associated with physical training in older adults. During cycling an "excess" in oxygen cost (VO₂) relative to power output (PO) (*i.e.* higher VO₂/PO ratio) appears above the lactate threshold (LT). This loss of muscle efficiency, of which type I fibers fatigue and/or increased type II fibers recruitment are putative causes, impairs exercise tolerance. **PURPOSE:** We tested the hypothesis that strength training, by increasing maximal force and reducing the recruitment of high-threshold motor units at a given exercise intensity will reduce the "excess" VO₂. **METHODS:** 8 healthy older males (67±5yrs.) performed 5-weeks of ST (three, one-hour sessions per week). *Pre* and *Post* training we measured muscle strength (1RM Squat and Deadlift) and performed an incremental cycling test to exhaustion to determine: *i)* peak power output (PO_{peak}) and VO_{2peak}; *ii)* the slopes of the VO₂/PO relationship below (S₁) and above (S₂) the LT (modeled using a double-linear fit). Parameters were compared with paired *t*-test. **RESULTS:** Following strength training, muscle strength and PO_{peak} increased (+24 ± 9 % Squat, + 30 ± 16 % Deadlift; +8 ± 7 % PO_{peak}, $p<0.05$) while VO_{2max} did not change (+2 ± 5 %, $p=0.24$). No "excess" VO₂ was present before (S₁=10.4±1.2, S₂=10.2±2.7 ml·min⁻¹·W⁻¹, $p=0.86$) or following strength training (S₁=9.3±0.3, S₂=10.2±2.7 ml·min⁻¹·W⁻¹, $p=0.38$). However, S₁ significantly decreased ($\Delta=-1$ ml·min⁻¹·W⁻¹, $p=0.045$) after training. **CONCLUSIONS:** The "excess" VO₂ typically displayed by young subjects was absent in our older adults. An age-related selective atrophy of type-II muscle fibres may explain the absence of a loss of efficiency in the heavy-intensity domain in older adults. Strength training significantly improved muscle strength by ~30% and was associated with a reduction of VO₂/PO relationship in the moderate-intensity domain (*i.e.* reduced S₁). This finding entails an improved efficiency of type-I fibres contraction in the moderate-intensity domain following training. Although further studies are warranted to identify a direct cause-effect relationship, this finding support a role of strength training in improving aerobic exercise tolerance through an improvement of muscle efficiency in the moderate-intensity exercise domain.

1991 Board #4 June 1 2:00 PM - 3:30 PM
Effects Of Long-term Elastic Resistance Training On Oxidative Damage Of DNA In Older Adults

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 (No relationships reported)

It is theorized that age-related physiological changes are a consequence of the accumulation of random oxidative damage to deoxyribonucleic acid (DNA), lipids, and proteins. The major by-product of oxidative DNA damage, 8-Oxo-7,8-dihydro-2'-deoxyguanosine (8-oxo-dG), is the most extensively analyzed oxidative stress marker. The concentration of this biomarker increases as age increases. A higher concentration of 8-oxo-dG is related to diseases such as Alzheimer's, osteoporosis and oncogenesis. Despite the multiple benefits of resistance training on the aging process, the effect upon mitochondrial function and oxidative stress in older adults is unknown. **Purpose:** To determine the effects of a long-term, moderate-intensity elastic resistance training (ERT) program on oxidative damage of DNA in older adults. **Methods:** 46 sedentary older adults (69.1 ± 5.1 yr) were randomized into two groups: Control Group (CG) (n=15) and ERT group (ERTG) (n=31). A 32-wk ERT program was performed 2d/wk with 6 exercises (3 for upper and 3 for lower extremities) completed for 4 sets of 15 repetitions. Perceived effort was 6-7 on the OMNI-RES scale for elastic bands during the first 4 wks and at 8-9 for the final 28 wks. Urine 8-oxo-dG was analyzed using

high-performance liquid chromatography at baseline, 16 and 32 wks. Urinary levels of 8-oxo-dG were calculated relative to creatinine levels. Trial (3) by group (2) repeated measures ANOVA was used to determine differences. **Results:** 8-oxo-dG was not different between groups at baseline (CG: 3.20 ± 2.51; ERTG: 3.72 ± 2.47 nmol/nmol creatinine). ERTG showed a significant ($p<0.05$) decrease in 8-oxo-dG for time and group of 26.07% at 16 wks and 49.43% at 32 wks. **Conclusion:** It is possible to reduce oxidative damage of DNA in older adults through regular ERT performed at moderate intensity. A longer training duration provokes greater effects on oxidative stress metabolism. These results highlight the possibility of using a non-invasive and low cost diagnostic method in conjunction with a simple and inexpensive ERT to prevent oxidative stress in older adults.

1992 Board #5 June 1 2:00 PM - 3:30 PM
Dynamic Postural Control and Hip Abductor Muscle Performance Following a 12-week Introductory Golf Program

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Aging is associated with physiological declines that impair the ability to perform activities of daily living and increase fall risk. Specifically, older adults demonstrate poorer mediolateral (ML) postural control and hip abductor muscle (ABD) performance as compared to young adults, and fallers demonstrate greater declines than non-fallers. Moreover, individuals with poorer ML postural control also have weaker hip abductors. **PURPOSE:** The purpose of this study was to investigate the effects of an introductory golf training program on dynamic ML postural control and hip ABD performance in an older military veteran. **METHODS:** One older military veteran (74 years old) completed 12 weeks of an introductory golf training program (2-90 minute sessions/week) that began with introductory swing training and progressed to regular golf play. *Pre-* and *post-training*, ML postural control was assessed via a choice reaction step task (10 trials). Weight-shift time, step time and movement time were calculated for 5 trials when stepping with the left limb. Peak hip ABD isometric torque and rate of torque development (RTD) was assessed utilizing a previously validated weight-bearing assessment (3 trials). **RESULTS:** Weight-shift time, step time and movement time decreased by 8.1%, 19.15% and 19.26%, respectively. Peak hip ABD torque increased 16.1% (0.81 N/kg to 0.94 N/kg) and RTD increased in the first 200 ms of the isometric contraction 83.62% (1.19 N/kg·s to 2.19 N/kg·s). **CONCLUSION:** Following the 12-week golf intervention, the participant was able to shift his weight and execute the step more rapidly, resulting in a shortened movement time and providing evidence of improved dynamic ML postural control. Additionally, the hip ABD performance improved as evidenced by increases in peak torque and RTD. The golf swing is initiated through near maximal activation of the gluteal musculature resulting in hip abductor torques on par with drop jump landings. Additionally, during a swing, the golfer rapidly shifts the center of pressure through a large range of the base of support. The demands of the golf swing likely served as a training stimulus to improve the ML postural control and hip ABD performance of our older military veteran, suggesting that golf is a viable physical activity intervention to attenuate declines associated with aging.

1993 Board #6 June 1 2:00 PM - 3:30 PM
Analysis of Aquatic Training Program In Water On Functional Parameters Of Elderly Women

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PURPOSE: To examine the effects of a training program based on impact and explosive movements performed in swimming pools on body composition (Total body weight, Body Mass Index-BMI, waist Hip Index-WHI, Fat Mass, lean mass), explosive strength (squat jump-SJ, counter movement jump-CMJ, counter movement jump arm swing-CMJas), and gait parameters (centre of pressure-COP, longitudinal displacement-LD) in women over 60 years
METHODS: seventy healthy and physically active old women (60 ± 4.19) was divided into a training group based on multi-jumps performed in a swimming pool ("n=35, GE") and a control group ("n=35, CG"). GE trained three times a week, an hour and a half per session and for a period of 32 weeks. Tests of body composition, explosive strength and gait parameters were applied before and after the training program

RESULTS: There were significant differences in body weight (GE=+2% vs CG=-1%; p=0, 013), BMI (GE=-1.6% vs. CG=-1%, p= 0,023) and WHI (GE=-1.6% vs CG= 1%; p=0, 042) between GE vs CG. Differences in SJ, CMJ, CMJas height (jump height), flight time and Take off velocity and gait parameters (Centre of pressure, p=0, 033) were found between GE vs CG (JG vs CG = (p≤0, 05 and 0,001), with positive changes for GE

CONCLUSIONS: The results suggest that 32 weeks of training with explosive and impact movements in swimming pools improve the strength expressions and induces significant adaptations in gait parameters, but not enough to alter body composition

1994 Board #7 June 1 2:00 PM - 3:30 PM
Effects of Exercise Intervention on Falls Risk Score in Aging Adults with History of Falling

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(No relationships reported)

Falls are the leading cause of death by injury and most common cause of nonfatal injuries among adults 65 years and older in the United States. Current evidence suggests that at least 1 in 3 persons 65 years and older will experience a fall each year. Modifiable risk factors such as muscle weakness, mobility, and balance have been identified. Therefore, it is important to identify interventions that can positively alter the risk factors and decrease falls risk.

PURPOSE: To determine the effects of an exercise intervention on falls risk in aging adults with a history of falling.

METHODS: Twenty-two aging adults (74.41±7.57 years; 1.62±.10 m; 78.58±19.20 kg) with a falls history (Fallers) completed this study. An 8-week intervention program utilizing the LEBED method, a dance therapy program, was implemented for 1 hour, twice per week, and attendance was recorded at each session. A Faller was defined as a participant who had fallen within the year prior to the study. Falls risk scores (FRS) were calculated using the NeuRA FallScreen® Physiological Profile Assessment (PPA) at pre- and post-intervention. The components that make up the composite FRS include proprioception, leg strength, balance, reaction time, and visual acuity. Pre- and post-intervention FRS were compared. A repeated measures ANCOVA for pre- and post-assessment data with attendance as a covariate was conducted (p<0.05).

RESULTS: The average attendance during the 8-week intervention was 73.6±15.4%. There was no statistical significant difference between pre- (1.39±0.91) and post-assessment (1.66±1.43, p>0.05) FRS.

CONCLUSIONS: This study compared pre- and post-assessment FRS in aging adults after an 8-week dance therapy intervention. Results indicate that the intervention was not effective in influencing the composite FRS in aging adults with a history of falls. However, investigation of the individual PPA components might show improvements in specific areas. Analysis of each PPA component may represent important improvements for falls risk. Further research should consider length of intervention, larger sample size, and frequency of sessions and respective attendance to design targeted intervention programs to decrease falls risk.

Research supported by grant from the Potomac Health Foundation.

1995 Board #8 June 1 2:00 PM - 3:30 PM
Preliminary Analysis: Effects Of An Intervention Program In Aging Adults With History Of Falling

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(No relationships reported)

Falls are the leading cause of death by injury and most common cause of nonfatal injuries among adults 65 years and older in the United States. The largest risk factor for falls is previous history of falling. Different types of falling prevention programs have been implemented, however, the effects of intervention programs on fallers remain poorly understood. **PURPOSE:** To determine the effects of an 8-week exercise intervention program in the Timed Up and Go (TUG) test in aging adults with a history of falling. **METHODS:** Twenty-seven aging adults (74±9.8 years; 1.61±0.1m; 80.2±23.6kg), with a history of falling within the year prior to the study, participated in an 8-week exercise intervention program. The intervention program consisted of the LEBED method, a dance therapy program. The intervention program was implemented for 1 hour, twice per week, and lasted a total of 8 weeks. Participants completed the TUG test pre and post-intervention. A timed test, the TUG requires participants to start in a seated position, stand and walk 3 meters (m), turn around a cone, and return to the original seated position. The average time, in seconds, from three trials was used for analysis. A paired-samples t-test was used to compare participants' pre- to post-intervention measures (p<0.05). **RESULTS:** No statistically significant difference existed between TUG pre-intervention (9.45±3.71) and post-intervention (9.86±4.45, p>0.05) values. **CONCLUSION:** This study examined the effects of an

8-week exercise intervention program on a mobility measure for aging adults with a falls history. No differences in pre- and post-intervention TUG values were detected. Based on the findings of this study, the eight-week intervention program used had no meaningful effect in improving mobility for fallers. A plausible explanation is that participants were already within the TUG 95% confidence interval for their age group (8.2 – 10.2 seconds), and therefore further improvements may be difficult to achieve. Nonetheless, further interventions should focus on improving outcomes for individuals with a history of falls.

Research supported by grant from the Potomac Health Foundation

1996 Board #9 June 1 2:00 PM - 3:30 PM
Effects of Resistance Training on Health Related Fitness In Elderly People

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Resistance training (RT) has been shown to increase muscular strength and concurrently improve functional ability in elderly people (EP). However, there is relatively little research available regarding the impact of RT on health related fitness components in EP. **PURPOSE:** The aim of this study was to examine the impact of a 12-week RT intervention on body composition, flexibility, and cardio-vascular, respiratory and metabolic systems in EP. **METHODS:** 120 subjects were randomly assigned into three experimental (E1: 65-74, E2: 75-84 and E3: over 85 years) and tree by age equal control groups. The following outcome measures were assessed prior to, and immediately following the intervention: muscle mass, body fat, sit and reach, side lying hip abduction ROM, blood pressure, maximum heart rate (HRmax), basal metabolic rate, total cholesterol, LDL-Cholesterol and HDL-Cholesterol, forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1). Participants trained tree times per week for 12 weeks, for a total of 36 sessions. Each session consisted of the following 8 exercises: squats, step-ups, calf raises, back extensions, single arm/leg back extensions, sit-ups, vertical leg lifts, biceps curls with a stick. Pre- and post-intervention data were compared using paired t-tests or Wilcoxon signed ranks test, with an alpha set at p < 0.05. **RESULTS:** Following the 12-week intervention a significant increase was found for flexibility (2.26-8.67%), HRmax (2.11-2.47%), basal metabolic rate (1.1-1.51%), FVC (0.3-0.7%) and FEV1 (0.5-0.9%) for all experimental groups. LDL- Cholesterol decreased for all experimental groups (5.35-11.57%) and blood pressure only for E2 (3.38%) and E3 (4.62%). Body composition positively changed only for E3 (muscle mass for 1.43%, and body fat for -2.54%). **CONCLUSIONS:** The study indicates that participation in a 12-week RT program may lead to improvement in flexibility, enhanced functions of cardio-vascular and respiratory system as well as betterment in some of metabolic system functions. Our study shows that RT is a physical activity suitable and recommended for elderly individuals as it has potential to improve health related fitness, which could lead to a healthier, more functional and independent aging.

1997 Board #10 June 1 2:00 PM - 3:30 PM
Intervention Study On The Exercise Order Of Combined Aerobic & Resistance Training In The Elderly

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PURPOSE: Combined aerobic and resistance training has been postulated as the most effective strategy to product both neuromuscular and cardiovascular adaptations in the elderly. However, few studies have examined the effects of intra-session exercise order on muscle strength and arterial stiffness in the elderly. This study investigated the effects of aerobic exercise before and after resistance training on body composition, muscle strength, and arterial stiffness in the elderly. **METHODS:** Thirty-one elderly subjects (70.5±3.5 years) were randomly assigned to one of three groups that performed aerobic exercise first (AR: 4 male, 6 female), performed resistance training first (RA: 4 male, 7 female), and did not perform any training (CON: 2 male, 8 female). The AR and RT groups performed aerobic exercise consisted of cycling at 60% heart rate reserve (HRR) and resistance training consisted of 5 types of exercises (leg curl, leg press, chest press, seated row, shoulder press) at 70-80% one repetition maximum (1RM) twice a week for 10-week. Body composition was evaluated by height, weight, body fat percentage, lean body mass and waist circumference. Muscle strength was measured by 1RM and arterial stiffness was evaluated by carotid-femoral pulse wave velocity (cfPWV). Pre- and post-intervention group comparisons were analyzed using a two-way ANOVA with repeated measures. **RESULTS:** A significant group by time interaction effect was observed in body fat percentage (F=6.87, P=0.004). Significant interaction effects were observed in 1RM (leg press: F=19.394, P=0.001; leg curl: F=17.495, P=0.001; chest press: F=10.188, P=0.001; seated row: F=32.753, P=0.001; shoulder press: F=15.419, P=0.001). However, no significant differences between the AR and RA groups were observed. In contrast,

there was a significant difference regarding cPWV between the AR and RA groups ($P < 0.05$). cPWV significantly reduced in the RA group (8.8 ± 2.1 m/s to 7.6 ± 1.9 m/s, $P < 0.05$), while increased in the AR group (7.9 ± 2.8 m/s to 10.0 ± 2.6 m/s, $P < 0.01$). **CONCLUSIONS:** Based on our results, no effects of different intra-session exercise order were observed regarding body composition and muscle strength. However, aerobic exercise after resistance training reduced arterial stiffness and difference of exercise order was observed.

1998 Board #11 June 1 2:00 PM - 3:30 PM
Effects Of Periodized Resistance Training On Sarcopenia Classification In Older Inactive Women
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 (No relationships reported)

Sarcopenia is the age-related loss of lean mass and is associated with strength and functional impairment. Criteria developed by the European Working Group on Sarcopenia in Older People (EWGSOP), the International Working Group (IWG), and the Foundation for the National Institutes of Health Sarcopenia Project (FNIHSP) classify sarcopenia using measures of appendicular lean mass (ALM), gait speed (GS) and/or grip strength (GR). Conventional resistance training in older women with symptoms of sarcopenia has been investigated, but the impact of periodized resistance training (PRT) on sarcopenia status is unknown. **PURPOSE:** To determine if 10 weeks of PRT will alter sarcopenia classification in women with sarcopenia symptoms. **METHODS:** Inactive women ($n = 25$) aged 72.3 ± 4.6 years, who were sarcopenic or were symptomatic were recruited. Sarcopenia criteria (ALM, GS, GR) were measured using dual-energy x-ray absorptiometry, a dynamometer, and a 4-meter walk test. Participants were randomized to a PRT group ($n=13$) or an active control group (CON; $n = 12$) and met 3 days per week for 10 weeks. Baseline measures were repeated post-intervention. Sarcopenia status at baseline and post-intervention was determined using current criteria, and a McNemar's test was used to determine changes in sarcopenia status from baseline to post intervention. Significance was set at $p \leq 0.05$. **RESULTS:** Non-sarcopenic participants increased in PRT group from baseline ($n=7$) to post intervention ($n=8$) by EWGSOP criteria; IWG criteria, baseline ($n=10$), post intervention ($n=12$), with no change in FNIHSP criteria. CON showed increases in non-sarcopenic classification from baseline ($n=8$) to post intervention ($n=10$) by IWG criteria, but no changes in classification by EWGSOP or FNIHSP criteria. There were no significant between group changes in distribution frequency of sarcopenia classification (EWGSOP, $p = 0.392$; IWG, $p = 0.841$; FNIHSP, no change). **CONCLUSIONS:** Results indicate that 10 weeks of PRT, while effective at maintaining levels of lean mass, does not elicit significant changes in sarcopenia classification variables to impact overall sarcopenia classification. However, these results are limited by sample size and demonstrate the need for future research to investigate these aims in larger samples with longer duration interventions.

1999 Board #12 June 1 2:00 PM - 3:30 PM
Structured Exercise Classes And Non-structured Exercise Increase Functionality In Older Adults
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 (No relationships reported)

Advancing age is typically associated with decreases in aerobic capacity and strength and loss of muscle mass and bone density. Evidence-based community exercise programs that emphasize strength, flexibility, and balance have been shown to improve functionality and increase independence. Pre-and-post assessment is critical to measuring program success and individual improvement. **PURPOSE:** To provide a summary of five collaborative teams that used standardized tests to measure changes in functional fitness scores among adults. **METHODS:** Adults ranged in age from 39-90+ years. Six tests for strength, aerobic fitness, flexibility, and dynamic balance were administered: CHAIR stand, ARM curls, 2-min STEP, sit-and-REACH, BACK scratch, and 8-FOOT up-and-go. Paired t-tests were used to analyze pre-and-post scores. Test sessions were arranged with the 5-6 collaborators and conducted in fall/spring: (1) F2008, (2) F2010, (3) F2014, (4) Spr2015, and (5) Spr2016. At the completion of the pre-tests, collaborators provided individual feedback and exercise recommendations to the adults and encouraged enrollment in a fitness class. **RESULTS:** Significant pre-and-post-results, Mean (SD), were found for the following tests. **Fall2008** CHAIR: $M = 14.29$ (2.27), $M = 21.21$ (5.19), $p < 0.001$; ARM: $M = 16.79$ (2.36), $M = 21.57$ (3.80), $p < 0.005$; EIGHT-FOOT: $M = 5.44$ (1.33), $M = 4.81$ (1.05), $p < 0.01$; **Fall2010** CHAIR: $M = 18.14$ (2.67), $M = 22.00$ (2.52), $p < 0.005$; ARM: $M = 24.86$ (3.49), $M = 27.86$ (3.63), $p < 0.01$; STEP: $M = 144$ (9.60), $M = 131$ (7.63), $p < 0.005$; **Fall2014-to-Spr2015** CHAIR: $M = 14.73$ (3.26), $M = 18.07$ (3.10), $p < 0.001$; ARM: $M = 16.20$ (2.65), $M = 20.73$ (3.31), $p < 0.0001$; STEP: $M = 90$ (15.15), $M = 108$ (18.63),

$p < 0.001$; REACH: $M = 1.55$ (2.58), $M = 3.57$ (3.52), $p < 0.05$; **Spring2016** ARM: $M = 17.32$ (4.66), $M = 196.04$ (5.47), $p < 0.05$; EIGHT-FOOT: $M = 5.67$ (1.40), $M = 5.16$ (1.03), $p < 0.05$. **CONCLUSIONS:** Significant results indicating improved functionality were found for each testing session. Greater improvements were reported with longer time periods between pre-to-post assessment (e.g., F2014-to-Spr2015) and for 2 sets of test results administered only to adults enrolled in two evidence-based prevention/intervention programs (F2008 & F2010).

2000 Board #13 June 1 2:00 PM - 3:30 PM
Role Of Self-regulation In A Community-based Physical Activity Intervention For Older Adults
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Regular physical activity can reduce the risk of falls, hypertension, osteoporosis, stroke, and diabetes, yet only 27.3-44.3% of older adults meet recommended physical activity (PA) guidelines. Use of self-regulation (SR) techniques may increase compliance in a group-based behavior change PA intervention for older adults, yet it is unclear which SR strategies are effective in older adults to increase PA level and stay active. **PURPOSE:** The purpose of this study is to examine change in PA, and improvement in the use of SR techniques employed by individuals in a 10-week exercise and lifestyle behavior change program. **METHODS:** Fifty-two older adults (age=72.3, yrs \pm 8.0) completed a 10-week group exercise and lifestyle behavior change program called Physical Activity for Life for Seniors (PALS). Three days/week over 40 minutes, participants completed ten exercises in a circuit, at 1 minute intervals. The 30-minute lifestyle behavior change class included SR problem solving techniques for staying active. SR was measured using the Self-Regulation for Exercise Scale (1=never to 5=very often), which examined SR techniques for self-monitoring, goal setting, social support, reinforcement, relapse prevention and time management. PA was measured using the CHAMPS questionnaire (caloric expenditure/week). Significant differences ($p < 0.05$) in response to the intervention were identified using paired t-tests. **RESULTS:** In this population of older adults, significant improvements ($p < 0.000$) were noted in SR techniques (SR self-monitoring: 1.573 ± 0.72 vs 3.19 ± 0.91 ; SR goal setting: 1.55 ± 0.75 vs 3.02 ± 0.88 ; SR social support: 1.35 ± 0.55 vs 2.09 ± 0.67 ; SR reinforcement: 1.92 ± 0.76 vs 2.77 ± 0.67 ; SR relapse prevention: 1.45 ± 0.56 vs 2.17 ± 0.63 ; SR time management: 1.45 ± 0.80 vs 2.80 ± 1.01) and total PA energy expenditure: 2143.31 ± 2153.24 vs 4092.99 ± 2635.78 ; moderate to vigorous energy PA expenditure: 742.84 ± 1476.00 vs 2366.96 ± 2112.94). **CONCLUSIONS:** These results suggest that including SR strategies in a 10-week group exercise and lifestyle behavior change intervention can lead to an increase in total PA, especially the moderate to vigorous PA in this population. Goal setting, self-monitoring and time management were used most frequently following the intervention.

2001 Board #14 June 1 2:00 PM - 3:30 PM
The Psychometric Properties Of The Self-efficacy For Walking Scale In Community-dwelling Older Adults
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The Self-efficacy (SE) for Walking Scale, developed by McAuley et al., (2000), targets an individual's confidence (range 0-100) to walk briskly for a duration of time. **PURPOSE:** The purpose of this study was to analyze the psychometric properties of the SE for Walking Scale in community-dwelling older adults, a 6-item scale with increasing 10-minute intervals (0 to 60minutes). **METHODS:** Participants ($N=300$, $M_{age} = 73.8 \pm 8.2$ yrs) were recruited from senior centers and completed the following: 1) SE for Walking Scale, 2) 6-minute walk test (Rikli & Jones, 1999), and 3) self-report aerobic physical activity (PA). Data were analyzed in RStudio for internal consistency reliability and concurrent validity with walking performance and PA level. **RESULTS:** The SE for Walking Scale was scored using the mean score of all items ($M=58.4 \pm 34.4$). There was high internal consistency reliability across all items (> 0.96) and correlations of each item with the overall mean score ranged from 0.80 to 0.98. Concurrent validity with walking performance ($M=431 \pm 119$ yds), as measured by yards walked in 6 minutes, with moderate (PPMC=.56); there was no correlation with current aerobic PA level (PPMC=.15; $M=220 \pm 284$ min/wk). **CONCLUSIONS:** The SE for Walking Scale in community-dwelling older adults has evidence of reliability and moderate correlation with walking performance. However, the non correlation with current PA level may suggest other important constructs, such as intention, previous experiences with PA, or social support, influence relationships between self-efficacy, ability, and actual current physical activity behavior. These additional constructs may be important considerations in PA interventions in older adults.

2002 Board #15 June 1 2:00 PM - 3:30 PM
Effects Of A Physical Exercise Program To Improve The Level Of Independence In Elderly

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PURPOSE: Previous studies showed that some older adults can carry out basic activities of daily living (BADL) independently, but with some difficulty generating daily problems in their community and their home. However, little is known about implement exercise programs in elderly population. The aim of this study was to investigate the effect of a physical exercise program on the level of independence in the elderly population.

METHODS: This study involved a total of 52 elderly participants between 62 and 89 years of age (71.2% female) who attended to Comprehensive Care Center Senior Adult from Ecuador. Participants were randomized into a control group (CG, n=36) and experimental group (EG, n=36), which performed a physical exercise program (3 months; 3 days per week/45 minutes per session). The assessment to determine the level of independence was carried out through validated BARTHEL test which evaluated BADL with the following ranges of scores: 0-20=total dependence, 21-60=severe dependence, 61-90=moderate dependence, 91-99=little dependence, 100=total independence. Data were recorded at baseline and 2-post-test (1st month during the intervention and in the end of the intervention period). A descriptive analysis of frequencies and percentages in order to determine the change of the range of independence was used for qualitative variables. A factorial ANOVA of repeated measures was applied to analyze the effects and interactions between the factors: study groups and measure moments on the Barthel test overall score (0-100).

RESULTS: Experimental group showed trend towards to increase Barthel overall score (MD=11.77±6.26; p=0.066) compared to the control group after intervention. Post-intervention, experimental group showed an increase of 15.4% of participants with total independence, whereas control group only increased 3.8%.

CONCLUSIONS: A 3-months physical exercise program could improve the levels of independence in the elderly population; however, it could be necessary long-term interventions.

2003 Board #16 June 1 2:00 PM - 3:30 PM
Disease Burden is Associated with Differences in Diurnal Patterns of Physical Activity in Older Adults

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 (No relationships reported)

Physical activity is an important risk factor for disease and functional outcomes with aging. Measurement of objective physical activity by accelerometry has become common in recent years and is often reported as total or average daily physical activity. However, a better understanding of the diurnal patterns of physical activity may elucidate the associations among physical activity, disease, and functional outcomes in older adults. **PURPOSE:** To evaluate the relationship between disease burden and objectively measured physical activity, overall and by time-of-day. **METHODS:** Physical activity (PA) was measured using wrist-worn ActiGraph Link accelerometers continuously over 7 days in 63 older participants (31 women, aged 68±10 yrs) of the Longitudinal Aging Study at Towson (LAST). Data was smoothed into one minute intervals and expressed as the average counts per minute across the three axes. Diurnal patterns of activity were modeled as the average activity counts over six 4-hour time bins. Number of chronic diseases was determined using a health history questionnaire and calculated as the sum of eight different diseases (hypertension, high cholesterol, heart disease, diabetes, arthritis, respiratory disease, gastrointestinal disease, and psychological well-being). Disease burden was categorized as either low (0-2 chronic diseases) or high (3 or more). The association between the mean of the log-transformed activity counts and disease burden was modeled overall and across each time bin using linear regression, adjusting for age, sex, and BMI. **RESULTS:** Total 24-h PA (counts) was lower in those with high disease burden compared to those with low disease burden (3.2x10⁶±0.9x10⁶ vs. 3.8x10⁶±1.0x10⁶ counts, p = 0.01). When examining diurnal patterns, early morning (4:00am-8:00am), afternoon (noon-4:00pm), and early evening (4:00pm-8:00pm) PA was lower in those with high disease burden compared to individuals with low disease burden (p<0.05 for each period). **CONCLUSIONS:** PA is lower in older adults with high chronic disease burden, particularly in the late afternoon and evening. Interventions aimed at increasing PA in older adults with multiple chronic conditions should consider targeting daily nadirs of activity by promoting PA during the afternoon and evening when their activity is typically lowest.

D-60 Free Communication/Poster - Concussion II

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2004 Board #17 June 1 3:30 PM - 5:00 PM
Eye Tracking as a Sports Concussion Assessment Tool: A Meta-Analytic Review

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Reported Relationships: N. Snegireva: Salary; *SensoMotoric Instruments. Consulting Fee; SensoMotoric Instruments.*

Sports concussion is a growing concern for many sports globally, with currently no standalone objective diagnostic tool. Several literature reviews on sports concussion are available, however few have focused on the use of eye tracking technology (ETT) as a possible diagnostic tool. **PURPOSE:** Provide a systematic synopsis of empirical evidence related to sports concussion diagnostics and ETT, highlight the limitations and the viability of ETT. **METHODS:** Electronic databases search was conducted in accordance with PRISMA guidelines. 134 selected studies were subjected to a full text scrutiny by two reviewers according to the predefined in- and exclusion criteria. A meta-analysis was conducted on the variables reported in 2 or more independent studies. Risk of bias was assessed using the RoBANS tool, and effect sizes were calculated in RevMan5 using the inverse-variance method and 95% confidence interval. **RESULTS:** The review integrates 10 publications on sports concussion and ETT with 410 participants (concussed N = 153, controls N = 257). Effect sizes were calculated across 12 variables for reflexive and self-paced saccades, smooth pursuit (SP), and fixations. Only 3 variables showed statistical significance: number of fixations outside of AOI (Z = 5.65, p < 0.001), radial error of SP (Z = 4.44, p < 0.001), and tangential error of SP (Z = 3.59, p < 0.001). As there is only limited research on EET in sport concussion and dependent measures vary across the studies considerably, it was only possible to conduct the meta analysis on a maximum of 3 studies, which is not sufficient to adequately estimate heterogeneity. **CONCLUSIONS:** Relative to controls, the concussed participants showed deficits in radial and tangential errors of SP and in number of fixations in a fixation stability task, but not in saccadic eye movements. Due to its quick and objective nature, ETT may be a promising diagnostic tool for sports concussion, but more comparable research is needed to establish best practices.

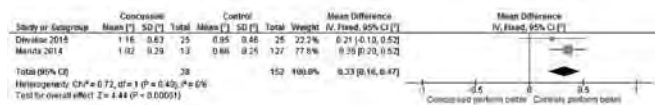


Figure 1: Radial error of the smooth pursuit

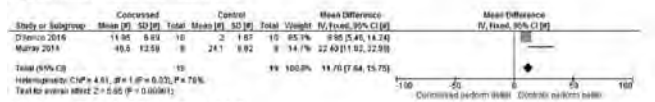


Figure 2: Number of fixations outside of AOI

2005 Board #18 June 1 3:30 PM - 5:00 PM
No Performance Changes Following a Concussion Amongst National Hockey League Players

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Athletic performance following sport-related concussion (SRC) is an emerging area of research. Lingering neurological deficits in postural control and neurocognition may impair athletic performance. Previous reports have found no difference in performance after SRC among professional hockey players as measured by routine statistics (e.g. goals, assists), yet advanced metrics may identify subtler differences in performances have not been studied. **PURPOSE:** To examine changes in hockey player performance using advanced metrics upon returning from a SRC as compared to non-injury time loss players. **METHODS:** Between 2008 and 2015, 90 National Hockey League (NHL) players with documented concussions and 51 NHL players who missed games due to non-injury related causes were identified. Players with intervening missed times and confounding orthopaedic injuries were excluded. Advanced metrics were retrieved from WAR-on-ICE blog and available statistics were compared to NHL.com to ensure validity. A total of 51 metrics were identified and performance was compared between pre- and post-concussion over 5 games, 10 games, or the season (all games

prior versus all games post-concussion). Dependent variables were compared with a 2 (Group) x 2 (Time) repeated measures ANOVA and a conservative alpha value of 0.01 was set due to lack of variable independence. RESULTS: There were no significant interactions between groups for the 5 game analysis. Significant interactions were noted only for Time on Ice - Percentage (percentage of time a player was on the ice) for 10 games (Concussion: +0.59%, Control: -0.97%; $P < 0.001$, $d = 0.007$) and full season (Concussion: 0.34% change, Control: +0.96%, $P = 0.04$; $d = 0.055$). Several variables including high danger scoring chances and PDO (on-ice save and shooting percentages) were below 0.05, but effect sizes were less than 0.1; suggesting the differences were not meaningful. CONCLUSIONS: These results suggest there are no meaningful performance differences in NHL players upon return from SRC. The only significant finding was an inconsistent change in time on ice following injury, but the effect sizes were very small (Cohen's $d < 0.06$). These findings are consistent with previous studies which found little impaired performance in professional hockey or basketball players upon return from SRC.

2006 Board #19 June 1 3:30 PM - 5:00 PM
Head Impacts In Men's Lacrosse: Incidence And Force Application
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Men's Lacrosse players are susceptible to Sports Related Concussions (SRC's) due to magnitude and frequency of head impacts during practices and games. Currently there is a paucity of data quantifying head impacts in men's lacrosse. **PURPOSE:** The purpose of this study was to quantify the magnitude and frequency of head impacts in a NCAA Division III men's lacrosse team over a six-week period (second half) of the regular season. **METHODS:** Twenty-three men's lacrosse players wore head impact monitors during five home games and fourteen practices. The head impact sensor was placed in a head band and positioned underneath the nuchal line in the back of the head. Analyses were completed for magnitude, frequency, player position, and location of head impacts comparing games vs. practice. **RESULTS:** A total of 269 head impacts were recorded, 133 impacts during games and 136 during practice. There was no significant difference ($p > 0.05$) in peak linear acceleration between games and practices ($37.18 + 15.47g$ vs. $36.8 + 14.4g$), peak rotational acceleration ($4.15 + 2.29g$ vs. $3.96 + 2.07g$), and peak rotational velocity ($16.44 + 8.89g$ vs. $16.32 + 8.59g$). In games there were $5.78 + 6.90$ impacts per player, while in practice there were $5.91 + 3.79$ impacts per player, which resulted in no significant difference ($p > 0.05$). For positions, there was no significant difference ($p > 0.05$) in peak linear acceleration across all positions. Location of impact resulted in no significant difference ($p > 0.05$) for all six locations measured; crown, base, left, right, front, and back of the head. **CONCLUSION:** Magnitude and frequency of head impacts in NCAA Division III men's lacrosse did not differ between practices and games during the second half of the regular season, nor were head impacts position dependent. Further research is required to understand the potential implications of head impacts in men's lacrosse.

2007 Board #20 June 1 3:30 PM - 5:00 PM
Sleep Quality and Concussion Recovery Utilizing Subjective Sleep Assessments
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(No relationships reported)

Sleep is pertinent in maintenance of cognitive functions including learning and memory formation, and may play a role in brain recovery following concussion. However, the relationship between sleep quality and concussion recovery remains unclear. **PURPOSE:** To determine if post-concussion sleep quality, as measured by subjective sleep assessments, influences days to recovery. **METHODS:** Seventeen college-aged participants (age: 19.6 ± 1.2 years, height: 174.3 ± 9.4 cm, mass: 76.4 ± 23.2 kg) were recruited following concussion diagnosis by a physician. Once clinically recovered based on symptom severity, neurocognitive, and balance performance scores, participants completed the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS) to assess for sleep quality since concussion. Analyses included PSQI global scores, PSQI individual scores from seven sleep components: duration, disturbance, latency, day dysfunction, efficiency, overall quality, and medication, and ESS total scores. We considered PSQI global scores ≤ 5 "good sleep quality" and > 5 "poor sleep quality". ESS scores ≤ 10 indicated lesser fatigue and > 10 greater fatigue based on published cutoffs. Pearson's correlations were conducted to determine the relationship between sleep quality outcomes and days to recovery. Independent samples t-tests were performed to compare days to recovery between participants with 1) good and poor sleep quality and 2) lesser and greater fatigue ($\alpha \leq 0.05$). **RESULTS:** We found that greater sleep efficiency following concussion was strongly correlated with fewer days to recovery ($r = -0.66$, $p = 0.004$). Days to recovery did not significantly differ between participants based on sleep quality (good quality: 15.3 ± 5.5 days; poor quality: 24.4 ± 30.8 days; $t(4,1) = -0.65$, $p = 0.548$). Fatigue-related

groups did not differ based on days to recovery (lesser fatigue: 14.8 ± 6.3 days; greater fatigue: 12.3 ± 2.2 days; $t(14) = 0.79$, $p = 0.442$). **CONCLUSION:** Participants with better sleep efficiency were more likely to recover faster compared to those with poorer sleep efficiency. Sleep efficiency may be an important factor in brain recovery. Clinicians should consider providing educational sleep interventions with a focus on maximizing total time asleep compared to total time in bed following concussion.

2008 Board #21 June 1 3:30 PM - 5:00 PM
Relationship Between Subconcussive Impacts on Clinical Measures of Neurologic Function in College Women's Soccer Players
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(No relationships reported)

Sport concussions have been associated with acute and chronic neurologic impairment. The specific contribution of sub-concussive impacts in women's soccer has not been adequately studied.

PURPOSE: To explore the relationship between sub-concussive head impacts on clinical measures of neurologic impairment in Division I women's soccer players. **METHODS:** College women's soccer players ($n = 19$) completed two clinical measures of neurologic function (pre- and postseason) commonly employed when evaluating concussion. These tests included computerized neurocognitive testing (CNS Vital Signs) and the Balance Error Scoring System (BESS). Peak head linear and rotational accelerations were recorded using the X2Patch. Statistical analyses included 12 separate multiple linear regression analyses (enter method on change scores (preseason minus postseason) computed for each of our dependent variables, including all 11 CNS Vital Signs standard scores and the BESS total errors. The 5 independent variables included for each analysis consisted of: (1) head impact frequency, (2,3) head impact frequency exceeding the sample's 95th percentile (linear and rotational), and (4,5) the total impact cumulative magnitude (linear and rotational). **RESULTS:** College women's soccer players sustained a median of 78 head impacts over the course of a single season. We observed significant regressions for Composite Memory ($p = 0.02$, $R^2 = 0.71$), Verbal Memory ($p = 0.04$, $R^2 = 0.64$), Visual Memory ($p = 0.04$, $R^2 = 0.65$), and Reasoning ($p = 0.03$, $R^2 = 0.68$), but none of the other CNS Vital Signs or BESS outcomes ($p > 0.05$; R^2 range: 0.25–0.58). In most cases, total head impact frequency had a positive effect (improvement), yet the total impact cumulative magnitude had a deleterious effect on observed change scores. **CONCLUSION:** With the few exceptions noted above, any changes in performance were widely independent of total impact frequency, severity (> 95 th percentile), and cumulative impact magnitude over one season. Repetitive sub-concussive head impacts over a single season do not result in pronounced short-term neurologic impairment. The effect of cumulative head impact burden should be further investigated to determine long-term changes resulting from a potential dose-response over a player's college career. Supported by NOCSAE.

2009 Board #22 June 1 3:30 PM - 5:00 PM
Dynamic Balance Deficits Following Concussion
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Dynamic balance deficits during gait have been observed following concussion and often linger beyond an athlete's return to activity. However, there are limited data describing balance performance during functional movements.

PURPOSE: To determine if participants with a concussion history demonstrate dynamic balance deficits compared to control participants during single leg squats and single leg hops. **METHODS:** Participants with a concussion history ($n = 15$, median time since concussion = 126 days; range 28–432) were matched by age, mass, and height to control participants ($n = 15$). Participants performed single leg squats while standing on a force plate from which center of pressure path and speed were obtained. During single leg hops, participants jumped off a 30cm box placed 50% of their height behind a force plate, landed on a single leg, and attempted to come to a stable position as quickly as possible. Single leg squat outcomes were averaged across legs as there were no between leg differences ($p = 0.480$); dominant leg = leg participant kicks ball with). Time to stabilization (TTS; time taken for center of pressure to stabilize after landing) was calculated for the single leg hop, and each leg was analyzed separately due to concerns with between leg differences ($p = 0.055$). Groups were compared using

ANCOVA, controlling for average days since concussion. **RESULTS:** No group differences were observed for single leg squat center of pressure path ($p=0.197$) or speed ($p=0.765$). Dominant leg TTS was not different between groups ($p=0.431$). The previously concussed group demonstrated longer TTS than the control group during non-dominant leg single leg hop ($p=0.024$; mean diff. = -0.34 s; 95% CI: 0.04, 0.64). **CONCLUSIONS:** Lingering dynamic balance control deficits after concussion may contribute to an increased risk of musculoskeletal injury. While single leg squat may not challenge balance control sufficiently, future study of the more dynamic single leg hop is needed to determine the potential diagnostic and prognostic value following concussion. Non-dominant limb static balance assessment is common following concussion. Slight balance impairments may be better identified when assessing the non-dominant leg due to preexisting between limb neuromuscular control disparities, as was the case in our investigation.

2010 Board #23 June 1 3:30 PM - 5:00 PM
Risk Factor Metrics for Adolescent Female Soccer Injury and Concussive Events

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PURPOSE: The vestibular, visual, and somatosensory (cervical proprioception) systems may have deficits without overt symptoms. One study identified athletes with pre-season neck pain, decreased balance, and/or headache as 2.4 to 3.65 times more likely to suffer concussion. The purpose of this study was to evaluate multiple baseline metrics as identifiers of risk for musculoskeletal and/or concussive injury.

METHODS: 15 female high school varsity soccer athletes, mean age of 15 years (± 1.2) and mean BMI of 20 (± 2.4), were assessed using pre-season movement screens including King-Devick (K-D), balance error scoring system (BESS), lower quarter Y-balance test (LQ-YBT), and functional movement screen (FMS). Historical data was collected for neck pain, dizziness, and headache, and injuries were tracked during the competitive season.

RESULTS: K-D score was 47.06 (± 6.56) seconds. BESS score was 10.39 (± 4.18) seconds, right LQ-YBT composite was 94.4 (± 5.5) and left was 94.5 (± 5.0). FMS score was 15.11 (± 2.04). No statistical significance was identified in this study directly linking pre-season metrics as indicators for musculoskeletal or concussion injury. Concussion had correlational trends with each of the following pre-season metrics: history of prior concussion, pre-season headache, and neck pain. Statistical significance was found for individuals with pre-season neck pain who later suffered a musculoskeletal and/or a concussive injury (Fischer's Exact test = 0.040).

CONCLUSIONS: Pre-season metrics failed to identify athletes at risk of suffering a musculoskeletal injury or concussion. The data identified a possible link between pre-season neck pain and later injury or concussion and a correlative trend between pre-season metrics and musculoskeletal injury or concussion. Small sample size limited the power and generalizability of the study. The ability to identify those at risk of musculoskeletal injuries and/or concussion from simple pre-season metrics including prior history, current symptoms, and movements may be an important step in making youth athletic participation safer. Further studies with larger data sets using similar pre-season metrics may demonstrate utility for identifying individuals at risk for musculoskeletal and/or concussive injury.

2011 Board #24 June 1 3:30 PM - 5:00 PM
Pre- and Post-season Assessments Of Neurologic Function In Youth Football Players

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Nearly 70% of US football players are younger than high school age, yet little is known about the potentially damaging effects of repetitive sub-concussive head impacts in this population. Objective measures of neurologic function used to evaluate concussions may be useful for assessing neurologic impairment in non-concussed players. **PURPOSE:** To assess neurologic function of youth football players before and after a full season using selected clinical measures commonly used for concussion evaluation. **METHODS:** During a five year span (2011-2015), fifty-six middle school (7th & 8th grade) football players (13.0 ± 0.6 yr) were evaluated before (PRE) and after (POST) their respective seasons, using objective, clinical assessments of neurologic function. Sixteen subjects participated for two consecutive seasons, allowing season-to-season (7th vs. 8th grade) subgroup comparisons to be made. Participants were assessed PRE and POST for oculomotor function (King-Devick Test; KD; sec), simple reaction time (RT; sec), and standing balance, performed during an eyes-open (EO) and eyes-closed (EC) condition. Balance testing was performed on a force plate and results were calculated as center of pressure excursion (95% ellipse area; cm²) during the balance task. **RESULTS:** KD time was significantly faster ($P < 0.0001$) from

PRE (50.22 ± 10.56 sec) to POST (46.02 ± 9.57 sec). PRE to POST differences in RT (0.31 ± 0.05 vs. 0.30 ± 0.05 sec; $P = 0.12$), EO (1.47 ± 0.96 vs. 1.23 ± 0.82 cm²; $P = 0.05$), and EC (2.20 ± 1.58 vs. 2.00 ± 2.90 cm²; $P = 0.41$) were not significant. Only KD time (55.03 ± 13.65 vs. 47.88 ± 12.48 sec) was significantly different (faster; $P < 0.001$) when comparing 7th grade PRE to 8th grade PRE measures. **CONCLUSION:** No short-term deficits in neurologic function were discovered when comparing PRE to POST group means. Oculomotor function assessed by the KD test seems to improve during a youth football season, though it is unclear if a learning effect, maturation and/or other factor(s) may underlie this finding. While these results suggest that short-term impairment in neurologic function is not pervasive in youth football, examination of individual responses and associations with head impact exposure are necessary to fully elucidate the interaction of repetitive head impacts and neurologic function of youth football players.

2012 Board #25 June 1 3:30 PM - 5:00 PM
The Effect of Legislation on Concussion Management and Return-to-Play Policies in High Schools

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Purpose: Previously, we conducted a survey and published results that showed that there was a significant difference in concussion awareness education provided to athletes participating in football (97%), hockey (65%), and boys (57%) and girls (47%) soccer ($P < 0.01$) and the use of sideline screening tools was significantly greater for football ($P = 0.03$). After publication of the study, state legislation was passed requiring training for coaches and concussion education for all athletes and parents. The purpose of the current study was to examine the effect of this legislation. **Methods:** A survey link was sent via email to the athletic directors of 108 schools that participated in the original study. They were asked to complete the survey and forward it to coaches and athletic trainers if available. The survey consisted of questions to determine concussion education, management and return-to-play policies in girls' soccer (GS), boys' soccer (BS), boys' football (FB) and boys' ice hockey (IH). A Chi-Square analysis was conducted to determine statistical significance where appropriate. **Results:** Ninety participants representing 52 school completed the survey. Participants were asked about concussion education for athletes and parents (92% GS and BS, 94% FB and 77% IH reported providing education to athletes; 76% GS and BS, 93% FB, 68% IH reported providing education to parents). Generally, participants reported that an athletic trainer (ATC) was routinely present at the games of all 4 sports. An ATC was routinely present at practices for 60% of the schools for GS, 76% for BS, 93% for FB and 14% for IH. This difference was significant ($p < 0.001$). On-field or sideline screening tools were reportedly used at the schools 64% of the time in GS, 66.7% BS, 80.6% FB and 80% IH ($p = 0.402$). Coaches and ATCs were asked how frequently the athletes self-reported a possible concussion. GS and FB athletes were more likely to report a concussion than BS or IH athletes. Once a concussion occurs, 100% of the schools reported that written authorization from a physician was required prior to return-to-play for all sports **Conclusion:** Concussion education has improved since the passage of state legislation. In addition, sideline screening tools, while previously used predominantly for boys' football are now being used in other sports.

2013 Board #26 June 1 3:30 PM - 5:00 PM
Baseline Predictors Of Prospective Concussion In Collegiate Athletes

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Reported Relationships: M. Putukian: Consulting Fee; Major League Soccer. Contracted Research - Including Principle Investigator; NCAA-DoD research grant, NOCSAE research grant, Ivy League research grant.

Purpose:

It has been proposed that female gender, history of prior concussions, depression, anxiety, headaches/migraines, and learning disorders (LD) may be associated with an increased likelihood of sustaining a concussion and prolonged clinical recovery. In previous work we demonstrated that none of these anticipated concussion modifiers were predictive of clinical recovery time in a group of concussed collegiate athletes. In contrast, initial post-injury symptoms and scores on cognitive measures predicted recovery time.

The current study evaluates possible baseline predictors of prospective concussion in collegiate athletes.

Methods:

One thousand one hundred fifty three collegiate student athletes (M=799, F=354) were assessed at baseline.

Athletes completed a modified sideline concussion assessment tool (m-SCAT) including symptom checklist, Standardized Assessment of Concussion (SAC), modified Balance Error Scoring System (m-BESS), Generalized Anxiety Disorder scale (GAD-7), Patient Health Questionnaire (PHQ-9), and self-report history of concussion, LD, headaches/migraines, and depression/anxiety. Athletes also completed the Immediate Post-Concussion Assessment and Cognitive Test (ImPACT).

Following baseline assessment, all athletes were tracked by athletic medical staff to determine if a prospective concussion occurred during the study period. Athletes diagnosed with concussions were followed by athletic medicine staff. We then compared baseline performance between concussed and non-concussed athletes.

Results:

One hundred forty six athletes were diagnosed with a concussion during the study period.

With the exception of concussion history, none of the baseline clinical measures or modifiers were clinically significant. Concussion history significantly predicted future concussion. 10.24% of athletes with no concussion history, 16.35% with one concussion, and 22.12% with ≥ 2 concussions were concussed prospectively ($X^2(2) = 16.124, p < .001$).

Conclusion:

With the exception of previous concussion history, there were no meaningful pre-injury predictors of subsequent concussion. Though it may be useful to obtain clinical assessments and modifiers at baseline in order to improve management, these assessments do not predict the likelihood of subsequent concussion.

2014 Board #27 June 1 3:30 PM - 5:00 PM
Variation In King-Devick Performance Time By Primary Language And History Of A Learning Disorder

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The King Devick (K-D) is a brief screening test for sport-related concussion (SRC) that involves rapid number naming and assesses reaction time, visual-motor function and reading skill. This test has been used to screen athletes for potential SRC by comparing performance on this test with baseline performance. Some authors have recently begun to explore normative data for this test, but little is known about variation in baseline performance time on this test, or how that might affect its utility for SRC detection. **PURPOSE:** To examine variation in baseline performance time on the K-D test by demographics and medical history. **METHODS:** We analyzed data from an ongoing prospective cohort study of varsity collegiate athletes sponsored by the National Collegiate Athletic Association and the Department of Defense from 2014-2016. We analyzed first time administration of the K-D only, examining differences in means with 95% CI by demographics and medical history Student's T-test. **RESULTS:** We report on first-time administration data from 2331 athletes (20.1 +/-3.4 yrs) at five universities. Performance time did not differ by age. Athletes whose primary language was not English had significantly slower baseline times (44.7 s., 95% CI: 43.0-46.3) than primary English speakers (41.2 s., 95% CI: 40.9-41.5), as did those with history of a learning disorder (45.7 s., 95% CI: 43.7-47.6) compared to those without a learning disorder (41.1 s., 95% CI: 40.8-41.4). Athletes in collision sports had significantly faster performance time (40.7 s., 95% CI: 40.3-41.1) compared to those in non-collision sports (42.4 s., 41.9-42.9). History of prior concussion and attention deficit hyperactivity disorder (ADHD) were not significantly associated with performance time. **CONCLUSION:** Performance time on the K-D is significantly slower in athletes who have a primary language other than English and those with a history of a learning disorder. These results suggest caution in the use of normative data with this test given significant individual variation. Future studies should explore whether sensitivity of this test for detecting brain injury is affected by these characteristics.

2015 Board #28 June 1 3:30 PM - 5:00 PM
Impact of Concussion History on Sway Velocity and BESS Scores in Division I Football Players

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PURPOSE: Impaired postural control is a hallmark sign of a concussion injury, with balance disturbances persisting weeks after initial injury. Postural deficits can negatively impact one's performance and increase one's risk for injury. The purpose of our study was to investigate if concussion history has an effect on balance measurements.

METHODS: 75 Division football players (age = 19.76 ± 1.1) from one university participated.

The Balance Error Scoring System (BESS) test was scored by one evaluator for all participants. The Stability Evaluation Test (SET) on the VSR Sportá system by NeuroCom® (Clackamas, OR) was used to assess sway velocity. The BESS and SET were completed in the same testing session; order was randomized. Players performed the standard 3 stances (double leg, single-leg, tandem) on 2 surfaces (firm and Airex Balance-Pad; Airex (Switzerland)). For the 6 trials, players closed their eyes, placed hands on iliac crests, and held the position for 20 seconds. Regarding the SET: in the event of a fall, the participant was given a second opportunity to complete the trial. In the event of a second fall, the "mark as a fall" button was selected, and the athlete moved on to the next trial. A fall was defined as touching a hand or foot down for support, or stepping off the plate. An overall sway velocity score was calculated for each trial, as well as a total composite score.

RESULTS: There were significant and positive correlations between sway velocity and BESS errors, indicating as sway velocity increased so did the number of errors, on the following trials: single leg firm surface ($r_s = .62, p < .001$), tandem stance firm surface ($r_s = .72, p < .001$), single leg foam surface ($r_s = .25, p = .029$), tandem stance foam surface ($r_s = .70, p < .001$), and composite scores ($r_s = .68, p < .001$). There was a positive relationship between the two variables, and the strength of relationship is considered larger than typical.

There were no statistical associations between concussion history and sway velocity or BESS errors.

CONCLUSION: Concussion history does not appear to have an impact on sway velocity measures or BESS scores. However, there was a significant and positive correlation between sway velocity and BESS errors during four of the trials and the composite scores, supporting the validity of the BESS test.

D-61 Free Communication/Poster - Correlates and Behavioral Aspects of Physical Activity

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2016 Board #29 June 1 2:00 PM - 3:30 PM
Aerobic Fitness and Neurocognitive Performance in Older Adults from Costa Rica and the United States

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PURPOSE: To determine the association between aerobic fitness and neurocognitive performance, and to compare the cognitive function in elderly from Costa Rica (CR) and United States (US). **METHODS:** A sample of 78 older adults from CR (males = 26, females = 52) and 100 participants from Kansas, US (males = 35, females = 65) was recruited. Participants underwent a graded exercise test on a treadmill to determine peak oxygen uptake (VO_{2peak}), and completed a comprehensive test battery designed to assess cognitions: cognitive screen, simple speed of processing, spatial visualization, visuospatial processing, episodic memory and verbal abilities, executive functioning and cognitive control, and working memory. Z-scores on each neurocognitive dimension was computed to create an index of global neurocognitive performance called cognitive function total score (CFTS). Inferential analysis included a 2x2 ANCOVA (sample by gender) on z-scores for cognitive variables (adjusted by age). Pearson correlations were computed between VO_{2peak} and cognition dimensions and CFTS. **RESULTS:** No significant z-score interactions were found on neurocognitive performance (p > 0.05). Regardless of the sample, males scored higher than females on visuospatial processing (Males = 0.691 ± 0.392 vs. Females = -0.422 ± 0.273; p = 0.021). For the entire sample, VO_{2peak} was correlated to visuospatial processing (r = 0.251, p ≤ 0.001) and CFTS (r = 0.178, p = 0.021). For the male sample, VO_{2peak} was correlated to working memory (r = 0.396, p = 0.019) in the KS sample, and to visuospatial processing (r = 0.431, p = 0.045) in the CR sample. For the female sample, VO_{2peak} was correlated to visuospatial processing (r = 0.342, p = 0.006), executive functioning and cognitive control (r = 0.357, p = 0.004), and CFTS (r = 0.328, p = 0.008) in the KS sample, and to executive functioning and cognitive control (r = -0.311, p = 0.030) in the CR sample. **CONCLUSIONS:** Cognitive function was similar between male and female elderly from CR and US. Aerobic fitness as assessed by the VO_{2peak} was related to visuospatial processing and the elderly ability to organize visual information into meaningful patterns and understanding how they might change as they rotate and move through space.

THURSDAY, JUNE 1, 2017

2017 Board #30 June 1 2:00 PM - 3:30 PM
Feasibility of Conducting Ecological Momentary Assessment of Exercise Antecedents using an Online Survey Distribution Platform

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Ecological Momentary Assessment (EMA) allows individuals to report perceptual, affective, social, and behavioral factors in real time, reducing recall bias and allowing multiple measures per day. While this approach may help build a predictive model of exercise behavior, EMA procedures typically require additional devices (e.g. palm pilot, electronic diary), which can increase participant (PPT) burden and study costs. **PURPOSE:** Determine feasibility of conducting EMA using an online platform capable of distributing survey links to personal smartphones via text message. **METHODS:** Eligible PPTs were enrolled in the study for 14 days. Each day, text messages, containing a link to the EMA survey, were distributed at 9:30am, 1:30pm, 5:30pm, and 9:30pm (\$0.01 per text). The survey assessed hypothesized antecedents of exercise (e.g. affective states, social interactions, stressful events, hydration status, food intake, exercise self-efficacy) and allowed PPTs to log exercise behaviors. PPTs were instructed to complete each survey within 60-min of receipt. Feasibility of this approach (e.g. recruitment, study adherence, survey compliance) was assessed using descriptive statistics and frequency analyses. **RESULTS:** Between 6/13/16 and 9/24/16, recruitment efforts yielded 22 individuals interested, with 19 adults consenting to enrollment (22.58±3.11 years, 25% women, 67% non-Hispanic white) and completing the study. Of 1064 text message prompts, 82.98% of surveys were completed within the 60-minute time frame. On average, PPTs completed 3.26±0.41 valid surveys per day within 17±16-min of receipt (79% within 30-min). Average survey duration was 4.40±7.93-min (86% within 5-min). 18 individuals had at least one week where they completed 75% of all surveys sent and 12 individuals had at least one week where they completed 85% of all surveys sent. PPTs reported 4.9±2.71 exercise bouts per week (range = 1 to 11), with 187 surveys indicating at least one type (21.5%) and 12 surveys indicating two types of exercise (1.38%). **CONCLUSIONS:** Using a survey distribution platform designed for use in personal smartphones demonstrates initial feasibility in young adults. Two weeks of observation appears necessary to elicit at least 75% survey compliance in most participants.

2018 Board #31 June 1 2:00 PM - 3:30 PM
Training-related Factors Associated With Running Adherence In Recreational Runners: A 3-year Follow-up Cohort Study

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The maintenance of physical activity in the long term is challenging. Understanding the factors associated with physical activity adherence is important to prevent potential dropouts from physical activity. **PURPOSE:** The aims of this study were to investigate running adherence and its association with training characteristics in recreational runners. **METHODS:** This study was a 3-year follow-up analysis of a prospective cohort study. The 141 participants (108 men, 76.6%; 33 women 23.4%) who had participated in a previous cohort study were invited to participate. Online questionnaires collected information on running adherence, training characteristics, and health problems sustained during three years of follow-up (2010 to 2013). Multivariate logistic regression was used to investigate associations between running adherence and training characteristics. **RESULTS:** In total, 97.9% (n=138) of the participants maintained the running practice during the 3-year follow-up without any substantial disruption period. The most common motivation to keep running was "to be healthier" (63.3%, n=88). The most common reasons to drop out of running were musculoskeletal injuries (33.3%, n=22) and lack of time (30.3%, n=20). Running on rigid training surface and treadmill were associated with higher odds of dropping out of running, respectively OR 3.84, 95% CI 1.20 to 12.2 and OR 8.50, 95% CI 1.96 to 36.7. However, high running frequency was associated with lower odds of dropping out of running (OR 0.41 95% CI 0.28 to 0.59). Running distance >20 km/week and running training duration were associated with lower odds of dropping out of running, respectively OR 0.24 95% CI 0.10 to 0.59 and OR 0.44 95% CI 0.22 to 0.88. **CONCLUSIONS:** Most of the recreational runners have maintained running practice during this 3-year follow-up period without any substantial period of interruption since 2010. The most common motivations to maintain running adherence were "to be healthier" and "for fun". The most common reasons to stop running were

musculoskeletal injuries and lack of time. Some training characteristics (training surface, running frequency, running distance and running training duration) may influence running adherence.

2019 Board #32 June 1 2:00 PM - 3:30 PM
Understanding the Motivational Strategies Used by Exercise Professionals: A Latent Profile Analysis Approach

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 (No relationships reported)

PURPOSE: Using the self-determination theory understanding of what constitutes need-supportive and controlling motivational styles and their implications, the aim of this study was twofold: 1) Identify different profiles of motivational strategies used by exercise professionals in gym contexts; 2) Examine associations between these motivational profiles and perceptions of job pressure, exercisers' motivation, work-related need satisfaction/frustration, type of motivation, and burnout. **METHODS:** Participants were 366 exercise professionals (193 males; experience = 7.7±5.8 years). Questionnaires assessing the analysed variables were completed online. Using a Latent Profile Analysis (LPA) approach, reported need-supportive and controlling motivational strategies were used to estimate profiles solutions (one to four), with the means and variances of the indicators freely estimated in all classes. The relationship between profiles and outcomes was also analysed. **RESULTS:** The 3-profiles model was retained as the best solution (lower scores in AIC, CAIC, BIC, and ABIC, and greater scores in Entropy; BLRT = 322.954; p<.05), composed by: a need-supportive profile (n = 225; characterized by high scores in supportive strategies and low on controlling ones), a controlling profile (n = 42; characterized by high scores in controlling strategies and low on need-supportive ones), and a mixed profile (n = 99; characterized by high scores in both need-supportive and controlling strategies). The need-supportive profile displayed the most optimal pattern, with significantly higher scores in perceived exercisers' and professionals self-determined motivation, work-related need satisfaction and professional efficacy, and lower scores in perceived job pressure, need frustration, emotional exhaustion, and depersonalization (p<.05). On the contrary, the controlling profile displayed the most maladaptive pattern of associations. **CONCLUSION:** Although much emphasis has been given to promote need-support, diminishing controlling practices, that can also so-occur, seems comparably important. Professionals relying mostly on this type of strategies displayed more problems related to the quality of their own motivation and burn-out.

2020 Board #33 June 1 2:00 PM - 3:30 PM
Motivational Correlates of Physical Activity among Adults with Type 2 Diabetes

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 (No relationships reported)

PURPOSE: About 61% of adults with type 2 diabetes are not meeting the current physical activity guidelines. This study examined the usefulness of the theory of planned behavior (TPB) for understanding physical activity intention and behavior in this population. **METHODS:** A link to an electronic survey that included a demographics questionnaire, a TPB questionnaire, and the Godin Leisure-Time Exercise Questionnaire (GLTEQ) was distributed through several social media outlets during an 8-week period. The TPB questionnaire used 7-point Likert-type scales to measure attitude, subjective norm, perceived behavioral control (PBC), and intention. The GLTEQ assessed weekly frequency of moderate and vigorous physical activity. **RESULTS:** Although 48 adults consented to participate in the research, only 23 adults (M_{BMI} = 56.18, SD = 11.41; M_{BMI} = 29.55, SD = 7.65; 56.5% male; 78.3% White) reported having type 2 diabetes and provided complete survey data. Two hierarchical regression analyses with forced entry within each block were used to examine the predictors of physical activity intention and behavior. The final model that included attitude, subjective norm, and PBC explained 60.0% of the variance in intention, but PBC was the only significant predictor ($\beta = .73$; $p < .001$). For the prediction of physical activity, the model that included only intention ($\beta = .45$; $p = .03$) accounted for 20.5% of the variance. The addition of PBC did not add a significant amount of explained variance and was not a significant predictor of physical activity. **CONCLUSION:** These results are similar to previous research and suggest that the TPB is useful for understanding the physical activity intention and behavior of adults with type 2 diabetes. Further research with larger and more diverse samples are needed to inform intervention design.

2021 Board #34 June 1 2:00 PM - 3:30 PM
Processes Of Change Used To Fulfill With The Recommendations Of Healthy Practice Of Acsm
 Maria Marentes Castillo¹, Jorge Zamarripa¹, Manuel De la Cruz², Samantha Medina-Villanueva¹, José A. Pérez-García¹.
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The stages and processes of change of the Transtheoretical Model have been used to design programs that facilitate exercise adherence. The stages that explain when people change refer to pre-contemplation (PC = inactive without any intention to change), contemplation (C = inactive with intention to change), preparation (P = active but not fulfilling the recommendations of the American College of Sports Medicine [ACSM]), action (A = has complied with the recommendations of the ACSM but for less than six months) and maintenance (M = has complied with the recommendations ACSM for more than six months). The processes that explain how this change occurs are divided into *cognitive processes* (CP), implying thoughts, attitudes and awareness, and *behavioral processes* (BP), which involve actions. This model suggests that the effectiveness of the change depends on doing the right things (processes) at the right moment (stage). **PURPOSE:** To analyze which processes are the most used in the stages to fulfill ACSM recommendations for regular exercise. **METHODS:** A total of 533 participants (48% female and 51.8% male) aged 11 to 76 ($M = 33.22 \pm 15.27$) took part in the study. The Spanish version of the stages of change questionnaire (SCQ) and the processes of change questionnaire for physical activity (PCQ) were used to collect the data. **RESULTS:** The internal consistency of the subscales CP ($\alpha = .90$) and BP ($\alpha = .92$) were satisfactory. Results of One-Way ANOVA revealed significant differences in CP ($F_{(4,525)} = 27.707, p < .001$) and BP ($F_{(4,525)} = 45.580, p < .001$) at different stages. Tukey HSD post hoc test indicated that participants in C, P, and A stages used cognitive processes more than those in PC. In addition, those in M were found to have a higher use of cognitive processes than participants in C and PC. Moreover, participants in C, P, and A used more behavioral processes than those in PC. Also, participants in M used behavioral process more than participants from any other stage. **CONCLUSION:** The use of CP and BP are essential in order to advance from lower stages up to M. However, the use of CP was higher in C, whereas BP was employed the most in M.

2022 Board #35 June 1 2:00 PM - 3:30 PM
An Integrative Perspective of Validating a Simplified Chinese Version Behavioral Regulation in Exercise Questionnaire-2
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 (No relationships reported)

An Integrative Perspective of Validating a Simplified Chinese Version Behavioral Regulation in Exercise Questionnaire-2
Purpose: The Behavioral Regulation in Exercise Questionnaire (BREQ)-2 is an instrument designed to assess individuals' motivation in physical activity (PA) participation. The BREQ-2 aims to measure five motivation constructs including external, introjected, identified, intrinsic, and amotivation. Although BREQ-2 has been frequently used in PA motivation studies, the validation test of the Chinese version of the BREQ-2 (C-BREQ-2) has rarely been conducted. The study aims to examine psychometric property, measurement invariance, latent mean difference, as well as predictive validity of a C-BREQ-2.
Methods: Participants were middle and high school students recruited from Shanghai, China. The final sample ($N = 437$, 49% for boys) was randomly split into two subsamples with the first subsample ($N = 208$) was used for exploratory factor analysis (EFA) and the second subsample ($N = 229$) used for confirmatory factor analysis (CFA). Measurement invariance and latent mean difference across gender was examined. Structural equation modeling (SEM) was utilized to explore different motivation constructs in predicting adolescents' moderate to vigorous physical activity (MVPA).
Results: Both EFA and CFA tests identified a 14-item, three-factor (i.e., autonomous motivation, introjected motivation, and external motivation) model. Both convergent and discriminant validity tests of the scale were met. Additionally, the revised scale is invariant at both configural, full metric, and full scalar levels across genders. The following latent mean comparison revealed that boys perceived higher introjected regulation than girls. Finally, only introjected regulation significantly and positively predicted adolescents' MVPA.
Conclusions: The revised C-BREQ-2 seems to be a validated scale. Researchers can use this scale to better understand Chinese adolescents' motivation towards PA.

2023 Board #36 June 1 2:00 PM - 3:30 PM
Behavioral Processes For Healthy Exercise According To The ACSM Through The Stages of Change
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ABSTRACT
 The stages and process of change are two key constructs in modifying risk behaviors according to Transtheoretical Model. The stages involve pre-contemplation (PC = inactive without any intention to change), contemplation (C = inactive with intention to change), preparation (P = active but not fulfilling the recommendations of the American College of Sports Medicine [ACSM]), action (A = has complied with the recommendations of the ACSM but for less than six months) and maintenance (M = has complied with the recommendations ACSM for more than six months). Meanwhile, the behavioral processes (BP) involve Substituting Alternatives (SA), Enlisting Social Support (ESS), Rewarding Yourself (RY), Committing Yourself (CY), Reminding Yourself (RY). **PURPOSE:** To analyze what behavioral processes are most commonly used in the different stages to fulfill the recommendations of healthy exercise of the ACSM. **METHODS:** A total of 533 subjects (48% female and 51.8% male; 33.22 ± 15.27 ; range = 11-76). A translation into Spanish spoken in Mexico of the stages of change questionnaire and questions related to behavioral processes belonging to the questionnaire process of change for physical activity were used. **RESULTS:** The internal consistency of the different BP ranged from .66 to .80. The results of One-Way ANOVA revealed significant differences in IK, BAR, CACO, CB and IHO in different stages ($F_{(4,525)} = 13.973 - 44.570, p < .001$). The post hoc Tukey's HSD test indicated that, in general, the use of SA (PC<C, P, A<M), ESS (PC, C<P<A, M), RY (PC<C, P, A<M), CY (PC<A, C, P<M) and RY (PC, C<P, A<M) increase through stages. **CONCLUSION:** The CY process show more relevance to generate the intention to change the sedentary lifestyle, however, RY, SA y CY processes contributed more for healthy exercise for more than six months.
Keywords: Transtheoretical Model, Exercise, Mexico

2024 Board #37 June 1 2:00 PM - 3:30 PM
Exercise Dependence, Affect, And Preferred Weight Of Female Exercisers
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Regular exercise offers many benefits, but some individuals may develop a dependency on exercise to continue receiving these benefits, such as affect regulation or attaining a preferred weight. **PURPOSE:** To examine associations among exercise dependence, affect, and current and preferred weight of female exercisers who hire personal trainers. **METHODS:** Female exercisers ($n=39$; 47+13 yrs; 167+36 lbs) who hire personal trainers at fitness centers in the Midwest completed the Exercise Dependence Scale-Revised (EDS-R), Positive Affect and Negative Affect Scale, and Eating Attitudes Test (EAT-26). A separate questionnaire collected demographic and exercise information as well as perceptions about their personal trainer. A difference score between their current and preferred weight (C-PW) was also created. Pearson correlations were used to identify predictor variables that were related ($p < .10$) to the exercise dependence score, and these predictor variables were included in a backward multiple regression with the exercise dependence score as the criterion variable. **RESULTS:** The exercise dependence score was related to positive affect ($r = .33, p < .05$) negative affect (NA: $r = .29, p = .07$), C-PW ($r = -.45, p < .01$), current weight ($r = -.31, p = .05$), minutes per week exercising without their personal trainer (ExwoT: $r = .37, p < .05$), and the extent they followed their personal trainer's suggestions for exercise ($r = .36, p < .05$). Regression results indicated a final model of three predictors (NA, C-PW, ExwoT) for the exercise dependence score, $R^2 = .45, R^2_{adj} = .41, F(3,35) = 9.36, p < .001$. The unstandardized and standardized coefficients are provided in parentheses for NA (1.169, .335, $p < .001$), C-PW (-1.195, -.343, $p < .05$), and ExwoT (.046, .431, $p < .01$). **CONCLUSION:** Female exercisers with more negative affect who were closer to their preferred weight and exercised more without their personal trainer were found to have higher exercise dependence scores. Thus, female exercisers may be using exercise as a means to self-regulate negative affect, and as they get closer to their preferred weight, they exercise more than what they do with their trainer. Personal trainers and exercisers should be aware because as women become more tolerant of exercise, this behavior may lead to clinically significant issues.

THURSDAY, JUNE 1, 2017

2025 Board #38 June 1 2:00 PM - 3:30 PM
The Effects of Playing Pokemon Go on Physical Activity and Lifestyle Changes
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 (No relationships reported)

Pokémon Go, an augmented reality smartphone game has been credited for improving physical activity and wellness.

Purpose: To examine changes in physical activity habits and mental and physical wellness as a result of playing Pokémon Go.

Methods: Surveys were administered to seventeen regular Pokémon Go users, ages 18-65 years old. The survey was designed to compare time, type and frequency of physical activity (PA) as well as physical, mental and lifestyle factors prior to and following playing Pokémon Go. Paired-sample t-test compared the difference in the number of PA sessions/week before and after Pokémon. IBM SPSS Statistics version 24 were used for statistical analyses.

Results: For all participants surveyed, 30% of their time playing Pokémon Go is spent in a seated position (car, golf cart, other) and 70% is spent in a mode of PA (walk, bike, rollerblade). 24% of participants solely play utilizing a form of PA, while nearly half of the participants said that $\geq 75\%$ of play is spent walking. Half of the participants categorized their intensity while playing as light, while the other half play with moderate intensity. Paired-sample t-test compared the difference in the number of PA sessions/week before and after Pokémon, which was 0.44 ± 1.72 ($P=0.306$). 41% have engaged in more PA as a result of playing, while the difference in minutes of PA/week before and after Pokémon is only 0.147 ± 14 min. Since beginning Pokémon, participants have moved an average of 104 km and report decreased stress and less anxiety from playing.

Conclusion: The majority of participants who play Pokémon Go do so while walking at various intensity levels. The popular exergame can lead to an increase in physical activity frequency, however the duration of exercise does not seem to be affected. Improved wellness was also noted with reports of decreased stress and anxiety as a result of playing. Overall, Pokémon Go can have a positive influence on both physical and mental wellness.

2026 Board #39 June 1 2:00 PM - 3:30 PM
Sources Of Competition Stress Among Elite Tennis Players In ITF Women's Circuit
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 (No relationships reported)

PURPOSE: Competition stress is closely related to competition performance. This study was to identify sources leading to competition stress in elite tennis players participating International Tennis Federation (ITF) match.

METHODS: The sample consisted of 258 female tennis players (mean \pm SE age = 21.07 ± 3.38 yr) participating in ITF Women's Circuit. According to sports level, there were 35 first-grade players, 86 second-grade players, and 137 players below second-grade. A modified version of the competitive state anxiety questionnaire was used to measure the types and the characters of competition stressors. All participations responded to the questionnaire with 39 validated questions using a five point Likert-scale. SPSS18.0 was used for the statistical analyses using principal component analysis (PCA) and variance test, and a significant level was set at $P \leq 0.05$.

RESULTS: According to PCA, technical and tactical defeat (33.23 ± 14.32), interpersonal relationship (21.35 ± 11.32), environmental factors (19.84 ± 10.87), unpleasant physical effects (15.71 ± 10.55), and life experience (9.87 ± 7.07) were detected as the major components of competition stressors successively. The stress level of first-grade players in technical and tactical defeat ($p < 0.01$), interpersonal relationship ($p < 0.01$), and environmental factors ($p < 0.05$) were significantly higher than that of other levels, while there was no statistical difference in physical effects and life experience among different sports level. The stress levels of all players in technical and tactical defeat ($p < 0.01$), and life experience ($p < 0.01$) on the qualifying and final match were dramatically higher than that in other match rounds, while there were no differences in other stressors.

CONCLUSIONS: Determinants of competition stress were multiple among female tennis players attending ITF matches, including technical and tactical defeat, interpersonal relationship, environmental factors, unpleasant physical effects, and life experience. Levels of multiple stressors were linked to player's grade and tournament rounds. Recognizing individual stressor is essential for tailored pre-match intervention. Supported by the Hubei Science Education Project (2016B155) and Humanities and Social Sciences research center (HBCIR2015Y008).

2027 Board #40 June 1 2:00 PM - 3:30 PM
Exploring the Relationship Among Physical Fitness Level, Social Norm Perceptions and PA Intention
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College students' healthy behavior choices are influenced by social norms, defined as the standards by which an individual judges the appropriateness of a behavior. Intentions then directly affect behavior. The Focus Theory of Normative Conduct (FTNC) identifies task value, outcome expectations and injunctive norms (i.e. what others approve of) as underlining mechanisms moderating the relationship between descriptive norms (i.e., what others do) and intentions. While FTNC identifies underlying psychosocial mechanisms, the interaction between physiological factors and social norms are currently unexplored. **PURPOSE:** The purpose of this study was to investigate the relationship among aerobic fitness (VO_2 max), percent body fat, social norms, and physical activity intention. **METHODS:** Participants ($N = 43$, 25 females, 18 males; mean age = 21 ± 6 years) college undergraduate students. A survey consisting of previously validated measures was administered to assess normative perceptions, task value, and outcome expectations. Body fat, aerobic fitness, muscular strength and endurance and flexibility were assessed in the university's applied physiology laboratory by an ACSM certified health fitness specialist. **RESULTS:** Hierarchical regression equations were run to address the research questions. Block 1 for each analysis remained constant with descriptive norms entered as the independent variable. Descriptive norms accounted for 39.5% of the variance in intention to be active [$F(1,41) = 27.33, p < .001$]. Insertion of interaction variable one (descriptive norm $\times VO_2$ max) into the model did not contribute significantly to the model ($b = .017, p = .52$), indicating VO_2 max was not a moderator (Aiken & West, 1991). Insertion of interaction variable two (descriptive norm \times percent body fat) into the model did not contribute significantly to the model ($b = .02, p = .46$), indicating VO_2 max was also not a moderator. **CONCLUSION:** Results suggest that descriptive norms may play more of an important role in college students' decisions to be physically active than previously thought. Additionally, the findings suggest that regardless of current physical fitness level, emphasizing the positive behaviors of respective peer groups is a potential avenue for practitioners seeking to increase physical activity in students.

2028 Board #41 June 1 2:00 PM - 3:30 PM
Cross-sectional And Longitudinal Correlates Of Leisure Time Physical Activity: The Tromsø Study 1979-2008
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Reported Relationships: B. Morseth: Honoraria; Lecture fee from Pfizer.

PURPOSE: The aim of this study was to examine potential cross-sectional and longitudinal correlates of leisure time physical activity (LTPA) in a large population-based study.

METHODS: Data are collected from 30 765 individuals (49.7% men) aged > 20 years who participated in at least one of five Tromsø Study surveys between 1979 and 2008. In each survey, the participants completed a self-administered questionnaire and underwent physical examinations. LTPA were assessed by the validated "Saltin-Grimby" 4-scale questions. Potential correlates of LTPA (sex, age, body mass index (BMI), education, smoking, self-reported cardiovascular disease, self-perceived health, and employment status) were tested using ordinal logistic regression in cross-sectional and longitudinal models.

RESULTS: As shown in the Table, sex, age, education, BMI, smoking, occupational physical activity, and excellent self-perceived health were cross-sectional correlates of LTPA ($P < 0.05$), after adjustment for respective correlates. Men had 33-115% higher odds of being physically active in leisure time than women, and odds of being physically active in leisure time in general decreased with increasing age ($P < 0.05$). High occupational activity levels increased the odds of being physically active in leisure time, and smokers were 22-47% less likely to be physically active than non-smokers ($P > 0.05$). Having a healthy BMI was associated with higher odds of being physically active in leisure time, compared with being underweight and overweight/obese. Longitudinal associations between participant characteristics in 1979-80 and LTPA in 2007-08 largely confirmed these findings. Baseline LTPA (1979-80) was a strong predictor of LTPA in 2007-08 ($P < 0.05$) (Table, longitudinal model).

CONCLUSION: Several individual-level factors were associated with LTPA. The most inactive individuals in leisure time were female, older, smokers, obese or underweight, and had lower education.

Adjusted odds ratio of being at a higher LTPA level by characteristics					
	Adjusted Odds Ratio (95% Confidence Interval)				
	1979-80 (n=14 039)	1986-87 (n=18 533)	2001 (n=2969)	2007-08 (n=7834)	Longitudinal model 1979-80 and 2007-08 (n=5037)
Sex					
Women	1.0	1.0	1.0	1.0	1.0
Men	2.15 (1.99-2.31)	1.87 (1.76-1.99)	1.33 (1.14-1.56)	1.52 (1.39-1.67)	1.47 (1.28-1.67)
Age					
20-29	1.02 (0.94-1.10)	1.17 (1.09-1.27)			1.06 (0.91-1.24)
30-39	1.0	1.0	1.0	1.0	1.0
40-49	0.96 (0.88-1.04)	1.06 (0.98-1.14)	0.98 (0.79-1.23)	0.77 (0.64-0.94)	0.93 (0.81-1.05)
50-59	0.76 (0.65-0.89)	1.10 (1.00-1.21)	1.20 (0.94-1.53)	0.64 (0.53-0.79)	0.72 (0.49-1.03)
60-69		0.80 (0.65-0.99)	1.38 (1.08-1.76)	0.68 (0.56-0.84)	
70-79				0.53 (0.39-0.73)	
80-89				0.26 (0.13-0.53)	
BMI (kg/m ²)					
<18.5	0.69 (0.56-0.85)	0.61 (0.49-0.75)	0.94 (0.31-2.86)	0.69 (0.35-1.35)	0.92 (0.61-1.39)
18.5-24.9	1.0	1.0	1.0	1.0	1.0
25-29.9	0.81 (0.76-0.89)	0.78 (0.73-0.84)	0.94 (0.79-1.11)	0.82 (0.74-0.91)	0.83 (0.72-0.96)
≥30	0.64 (0.53-0.76)	0.54 (0.48-0.62)	0.69 (0.55-0.86)	0.51 (0.45-0.58)	0.48 (0.34-0.68)
Education level					
≤9y	1.0	1.0	1.0	1.0	1.0
10-12y	1.19 (1.10-1.29)	1.21 (1.12-1.30)	0.97 (0.79-1.19)	1.40 (1.23-1.60)	1.17 (1.02-1.34)
>12y	1.55 (1.42-1.69)	1.45 (1.34-1.57)	1.26 (1.03-1.55)	1.53 (1.34-1.75)	1.26 (1.08-1.47)
Smoking					
No	1.0	1.0	1.0	1.0	1.0
Yes	0.60 (0.53-0.65)	0.57 (0.53-0.60)	0.78 (0.66-0.92)	0.53 (0.47-0.60)	0.71 (0.63-0.80)
Self-reported cardiovascular disease					
No	1.0	1.0	1.0	1.0	1.0
Yes	0.71 (0.49-1.03)	0.84 (0.68-1.04)	0.84 (0.59-1.21)	1.09 (0.89-1.33)	0.40 (0.15-1.03)
WPA					
Mostly sedentary	1.0	1.0	1.0	1.0	1.0
Walking	1.29 (1.20-1.40)	1.46 (1.37-1.56)	1.33 (1.11-1.58)	1.30 (1.17-1.45)	1.10 (0.96-1.26)
Walking and lifting	1.50 (1.36-1.65)	1.69 (1.56-1.84)	1.42 (1.16-1.74)	1.28 (1.13-1.45)	0.99 (0.83-1.18)
Heavy manual labour	1.54 (1.33-1.79)	1.98 (1.73-2.28)	2.61 (1.68-4.05)	1.56 (1.29-2.02)	1.41 (1.06-1.87)
Employed					
No	1.0	1.0	1.0	1.0	1.0
Yes	0.82 (0.67-0.99)	0.90 (0.77-1.05)	1.58 (0.82-3.06)		1.02 (0.69-1.52)
Self-perceived health					
Very bad		1.0	1.0	1.0	
Bad		0.82 (0.44-1.54)	1.89 (0.73-4.90)	0.85 (0.26-2.73)	
Neither good nor bad		0.89 (0.48-1.64)		1.18 (0.38-3.69)	
Good		1.40 (0.76-2.58)	2.80 (1.09-7.20)	2.18 (0.70-6.84)	
Excellent		2.28 (1.24-4.21)	5.78 (2.21-15.11)	4.68 (1.49-14.74)	
LTPA					
Inactive					1.0
Light					2.58 (2.20-3.02)
Moderate					4.85 (3.96-5.94)
Vigorous					10.78 (7.47-15.56)

2029 Board #42 June 1 2:00 PM - 3:30 PM
At-risk Preschoolers' Perceived Physical Competence and Observed Fundamental Movement Skills
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Purpose: Children's perceived physical competence (PPC) may be related to their fundamental movement skills (FMS). Baseline data from the Colorado LEAP study were explored to examine the relationship between at-risk preschoolers' PPC and observed FMS.

Methods: The LEAP study was conducted in 4 preschools serving preschoolers (n=250) at high risk for obesity. The Pictorial Scale of Perceived Competence for

Young Children assessed preschoolers' PPC. The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) subtests for balance, running speed and agility (locomotor), upper-limb coordination (ball skills) and strength assessed children's actual FMS. Spearman's rho correlations were used to assess the relationships between PPC and each BOT-2 subtest. Hierarchical linear regression analyses were conducted for each of the four BOT-2 subtests to investigate the amount of variance in FMS explained by PPC (overall model controlled for age, sex, ethnicity, and BMI z-score). **Results:** Spearman's rho correlations showed significant correlations between PPC and FMS when data were examined separately by sex and/or ethnicity. There were significant positive correlations between PPC and ball skills for males ($r=0.20$, $p<0.05$) and non-Hispanic preschoolers ($r=0.18$, $p<0.05$). There was a significant negative correlation between PPC and balance in Hispanic females ($r=-0.31$, $p<0.05$). Regression analyses showed PPC was significantly related to locomotor scores ($\beta=14$, $t=2.19$, $p<0.05$) with the overall model accounting for 16% of the variance in locomotor scores, $F(5,219)=8.43$, $p<0.05$. Further, PPC was significantly related to strength scores ($\beta=12$, $t=1.97$, $p<0.05$) with the overall model accounting for 20% of the variance in strength scores, $F(5,216)=10.48$, $p<0.05$. **Conclusions:** The correlation between PPC and FMS in preschoolers varies by sex and ethnicity in LEAP study participants. Moreover, PPC is significantly related to locomotor and strength skills. Promoting FMS development in preschoolers could potentially influence their movement competence or confidence, thus enhancing their physical literacy and ultimately physical activity engagement.

2030 Board #43 June 1 2:00 PM - 3:30 PM
Types Of Leisure, Leisure Motivation, And Well-being In University Students With An Emphasis On Physical Activity
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It is well-documented that leisure is conducive to psychological well-being for a variety of population. However, a scarcity of research on types of leisure influenced by individual attributes and health status as well as contributing factors for leisure satisfaction. **PURPOSE:** The research aims to investigate the types of leisure influenced by individual attributes and health status as well as the contributing factors for leisure satisfaction. **METHODS:** Cross sectional data were collected by administering Leisure Satisfaction Scale (LSS), Leisure Motivation Scale (LMS), Types of Leisure Scale, Perceived Stress Scale (PSS), Health Risk Survey, and Demographic Survey including Body Mass Index (BMI) to 199 university students. **RESULTS:** Leisure satisfaction was inversely correlated with perceived stress ($r = -.21$, $p < .01$) and amotivation ($r = -.23$, $p = .01$). Perceived stress was positively associated with amotivation ($r = .23$, $p < .05$). Stepwise multiple regression shows that intrinsic leisure motivation was a single strong predictor for leisure satisfaction even after controlling for elementary school leisure, high school leisure, extrinsic leisure motivation, and perceived stress [$b = .83$, $\beta = .71$, $t = 4.72$, $p < .01$]. Interaction analyses in multiple regression demonstrate that there was a significant interaction between BMI and social support, which indicates that the impact of BMI on active leisure differs depending on levels of social support ($\Delta R^2 = .048$, $F [1, 138] = 7.02$, $p = .009$). There was a significant interaction between BMI and perceived stress, indicating the impact of BMI on passive leisure differs depending on perceived stress ($\Delta R^2 = .034$, $F [1, 148] = 5.23$, $p < .05$). **CONCLUSION:** Intrinsic leisure motivation appears to influence leisure satisfaction, which may lead to lowered levels of stress. Conversely, leisure apathy (amotivation) may lead to elevated levels of perceived stress. University students with high BMI do not tend to engage in physically active leisure in the presence of high perceived social support. Also, university students with high BMI were more likely to engage in passive leisure in the presence of low stress levels. These findings could shed light on the motivational strategies health care providers can use to support health-promoting leisure activities such as physical activity.

2031 Board #44 June 1 2:00 PM - 3:30 PM
Affective Associations as Predictors of Physical Activity in Cancer Survivors
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 (No relationships reported)

Traditional physical activity promotion programs have focused on changing cognitions with the belief that physical activity decisions are made by weighing the benefits and costs of performing the behavior. However, recent research reveals that affective associations with physical activity (e.g. positive feelings about exercise) can also

predict physical activity behavior. These findings suggest that cognitive measures and feeling measures may both be important predictors of participation in physical activity. **PURPOSE:** The objective of the study was to use psychosocial factors, including affective associations, to predict physical activity intentions and physical activity behavior in cancer survivors. **METHODS:** A convenience sample of cancer survivors ($n=122$) were recruited for the study. Participants completed a survey which included questions on demographics, current physical activity, survivorship, cognitive measures, affective associations, and implicit measures. Multiple regressions were run to predict intentions and physical activity behavior. **RESULTS:** Majority of the participants were Caucasian (83%), and breast cancer survivors (62%) out of treatment with a mean BMI of 30 kg/m². Results show physical activity intentions were significantly predicted by cognitive measures ($p<0.01$). In contrast, positive affective associations ($p<0.01$), worry about physical activity ($p<0.01$) and implicit measures ($p<0.05$) were the only significant predictors of physical activity behavior. Affective measures predicted physical activity behavior approximately 2 weeks later, even when intentions were included in the regression model ($p<0.05$). **CONCLUSIONS:** The current study suggests cognitive beliefs predict physical activity intentions and affective measures separately predict physical activity behavior in cancer survivors. These findings could be implemented into physical activity programs focusing on both increasing cognitive beliefs about physical activity and increasing positive feelings towards physical activity.

2032 Board #45 June 1 2:00 PM - 3:30 PM
Weight Training and Self Determined Motivation: A Longitudinal Analysis of Previously Untrained, Sedentary Women

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PURPOSE: To examine the impact of weight training on autonomy, competency, relatedness, and self determined motivation over a period of 28 months. We hypothesized that women who participated in a 12 week weight training program would exhibit significant increases in autonomy, competency and self determined motivation over time. In addition, we hypothesized that the treatment group would exhibit a more self determined motivational profile than the control group. **METHODS:** The sample consisted of 44 sedentary women with no prior weight training experience. The mean age was 22 years (range 18 - 29) and BMI's ranging from 19.3 to 46.7 ($M=27.0$). Upon random group assignment, psychosocial and anthropomorphic data were collected from all participants at baseline. The treatment group training protocol consisted of three 45-60 minute sessions/week. The treatment group also received a training manual and supervision from certified personal trainers for 14 of their 36 total sessions. The control group received the manual after post testing (week 13) and instructions on how to perform the exercises. Follow up assessment of all psychosocial variables was conducted at 28 months post baseline. **RESULTS:** Psychosocial and anthropomorphic data did not significantly differ across groups at baseline. A between group effect was present $F(1, 39) = 4.332, p < .05$ at three months with the treatment group ($4.61 + .65$) displayed a higher level of competence ($t(22) = 4.33, p = .05$) than the control group ($3.72 + .63$). Repeated measures ANOVA indicated a significant increase in Autonomy ($p = .032$) and Competency ($p = .002$) for the treatment group from baseline to 28 months. **CONCLUSIONS:** An exercise intervention typified primarily by free weight exercises over 28 months is more efficacious than a weight training instruction booklet alone for increasing women's feelings of autonomy and competence. Future analyses inclusive of a post intervention follow up period would test lend further insight by assessing both groups during a time exclusive of any supervised training.

2033 Board #46 June 1 2:00 PM - 3:30 PM
Effects of External Stimuli on Exercise Engagement in College Females
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 (No relationships reported)

Important to the promotion of physical activity is the assessment of the psychological effects that occur when trying to adhere to exercise regimens. By measuring the effects of exercise on mood, enjoyment, and perceived exertion it allows for the ability to evaluate engagement in one's program and provides a means to measure and potentially predict their continuance in the exercise. **PURPOSE:** To examine the effects of external stimuli on mood, enjoyment, and perceived exertion in college females. **METHODS:** 18 college female subjects (age: 19 ± 1 years) completed 4 separate trials of treadmill walking with a different intervention for each trial. The conditions being tested: no external stimuli (NES), self-selected music (MU), self-selected video with sound (VS), and self-selected video without sound but with captions (VC). Every 3 minutes throughout the 30-minute session, the subjects rated perceived exertion and mood with the Borg rate of perceived exertion (RPE) scale and the Fast Assessment of Children's Emotion scale (ES). At the end of each

session, the participants evaluated their enjoyment of the exercise using the Physical Activity Enjoyment Scale (PACES). Statistical comparisons on each condition were determined as well as any correlations between having stimuli (MU, VS, and VC) vs no stimuli using a single factor ANOVA, contrast, and Bonferroni statistical analysis. **RESULTS:** We found when comparing no stimuli to all external stimuli collectively, PACES ($F=6.08, p < 0.05$) and ES ratings ($F=2.66, p < 0.05$) were significantly different. Specific to the PACES scale, we found significance when comparing NES to MU ($t=2.90, p < 0.05$), NES to VC ($t=3.11, p < 0.05$), and NES to VS ($t=4.03, p < 0.05$). RPE was not statistically significant in any condition ($F=0.01, p > 0.05$). **CONCLUSION:** Greater levels of overall enjoyment and increased mood were seen when an external stimuli was used as compared to exercising with no stimuli. No changes in perceived exertion were seen whether a stimulus was used or not. For best adherence to an exercise program use of external stimuli is recommended.

2034 Board #47 June 1 2:00 PM - 3:30 PM
Sustainable Healthy Commuting: Environmental Factors Associated With Bicycling And Walking Among Danish Students.

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Cycling and brisk-walking to university, leisure-time activities and part-time jobs represents an opportunity to incorporate sustainable transport related moderate- to-vigorous physical activity (MVPA) and exercise into daily routine among students, and thus, may make an important contribution to health. Denmark has a strong and well-developed cycling culture with good walkable paths and cycle lanes, infrastructure and traffic. Still, a large proportion of commuters choose to use other means of transport when cycling and walking would be a highly appropriate transport mode.

Purpose: The aim of this study was therefore to investigate the associations between commuting mode and environmental factors in a group of young students in Aalborg municipality in Denmark.

Methods: In an internet survey gathered data about students' commuting behaviour and their perception of the influence of environmental factors. Comparisons were made using cross tabulation and chi-square statistical tests ($p<0.05$).

Results: In total, 348 students, mean age 23 ± 2.1 years, responded to the questionnaire, of which 80.5 % were categorised as active commuters (walkers and cyclists) and 19.5 % were categorised as passive commuters (car and public transporters). The mean commuting distance for the active commuters were $3.0 \text{ km} \pm 1.4$ and $2.9 \text{ km} \pm 1.6$ for the passive commuters when summarizing all localisations (part-time job, leisure-time activities and university location). The passive commuters perceived the traffic as more unsafe than the active commuters when commuting to part-time job (31.4% vs. 11.5%, $p<0.05$) and leisure time activities (69.6% vs. 52.8%, $p<0.05$). Those students who were categorized as active commuters more likely to go by bike to their university location than those categorized as passive commuters (37.9% vs 19.1%, $p<0.05$) if they perceived the cycling paths as well maintained.

Conclusion: Those categorised as active commuters perceived the environment as more comprehensive for active commuting than those categorised as passive commuters.

2035 Board #48 June 1 2:00 PM - 3:30 PM
Personality And Motivational Profile Of Participants Adherent And Non-adherent To An Exercise Program
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Physical exercise can be an effective intervention, with a positive effect on health and improving quality of life. However, studies show that 50% of persons starting an exercise program will drop out within the first 6 months. Thus, most people does not the chronicles benefits provide by regular physical exercise. **Purpose:** To determine exercise behavior (personality and level of motivation) of participants during a 1 year exercise program. **Methods:** 29 volunteers (17 women's) Age (years) 34.97 ± 9.51 , BMI (kg/m²) 26.47 ± 4.36 and attendance (months) 8.1 ± 3.45 , were grouped by adherent (Adh) and non-adherent (NAdh). Personality and level of motivation were assessed via translated version of the BREQ-2 (Markland D, Tobin VA, 2004) and IMPRAF-54 (Barbosa MLL, Balbinotti AAM., 2006) and attendance during 1-year exercise program were assessed too. A Mann Whitney U. Test, Spearman correlation and

Logistic regression are used. **Results:** Considering attendance in months, Spearman correlations were made with sociodemographic measures and scales scores IMPRAF, BREQ and NEOPIR. Correlations were found in attendance with the IMPRAF sociability ($\rho = 0.4$) and NEOPIR extraversion ($\rho = -0.43$). These variables were adjusted in a linear regression model ($R^2 = 0.53$) and they had coefficients significantly different from zero (IMPRAF sociability $B = 0.29$, $t = 2.158$ $p = 0.04$ and $B = -0$ NEOPIR extraversion, $38 t = -2.24$ $p = 0.03$). Finally, considering Adh ($N = 6$) or NAdh ($N = 23$) group, there are significant only for NEOPIR extroversion ($U = 31.5$, $p = 0.04$), where the Adh (119.0) has a median less than the NAdh (106.5). **Conclusion:** In this study, the longer training produced greater sociability (need basic psychological issues related to acceptance and gaining new friends, self-esteem and motivation for physical activity practitioners) and lower extraversion (possibly due to a structured that exercise was offered). CEPE, CEMSA, CNPq, CAPES, AFIP.

2036 Board #49 June 1 2:00 PM - 3:30 PM
Physical Strength by Mental Health Profile in School-Aged Boys and Girls
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Mental health can play an important role in the development of a good health-related physical fitness, especially during physical education (PE) classes. In fact, kids with low self-esteem and psychological wellness are often inclined to avoid carrying out physical assignments in front of their peers due to the fear to be ridiculed. Similar psychological processes occur in children with high stress and anxiety associated to exercising. This could have a negative impact on the development of an appropriate level of strength, which is considered an important indicator of wellbeing at all ages. **PURPOSE:** To assess primary school boys' and girls' physical strength associated to mental health profiles. **METHODS:** A sample of 189 children (88 boys, 101 girls) aged 10-11 participated in the study. Physical strength measurements were carried out according to EUROFIT protocol, and included 30-sec sit-ups (SU), standing broad jump (SBJ), bent arm hang (BAH), and handgrip (HG) tests. In addition, participants were asked to fill self-esteem, psychological wellbeing, anxiety, and stress questionnaires. **RESULTS:** Cluster analyses evidenced two main profiles in boys: "partial psychopathology" (PP) and "partial mental health" (PMH). Participants showing the former profile had lower scores in SU (PP: 13.09; PMH: 17.89), SBJ (PP: 96.89; PMH: 123.57), BAH (PP: 3.91; PMH: 8.74), and HG (PP: 12.15; PMH: 14.60). Both profiles had low scores in relation with cut-off points for their age. Girls only belonged to PP, also showing lower results than expected at their age (SU = 15.22; SBJ = 111.59; BAH = 7.27; HG = 12.25). **CONCLUSIONS.** Partial mental health is not a sufficient condition for triggering the development of healthy physical strength. PE teachers need to create the proper conditions for children to reach full mental wellbeing, which may increase their chances to achieve beneficial levels of physical fitness.

2037 Board #50 June 1 2:00 PM - 3:30 PM
Relation between Body Composition, Physical Fitness, and Mental Health in Primary School Students
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According to the World Health Organization, the fulfillment of a complete health state implies balance between physical and mental condition. Physical fitness (PF), comprised of health-related strength, endurance, and flexibility, is an essential indicator of physical condition. Good levels of PF have been linked to lower risk of injuries and chronic diseases. In addition, body composition (BC) is an indicator of health, the accumulation of abdominal body fat having being associated to higher cardio-metabolic risk. However, mental state can negatively affect individuals' overall health regardless of their physical condition. For instance, research has demonstrated that high anxiety in athletes may not only increase the risk of psychological diseases, but also activate unhealthy physiological processes. **PURPOSE:** To assess the relation between body composition, physical condition, and mental health in primary school students. **METHODS:** A sample of 339 children aged 10-11 were asked to fill self-esteem, psychological wellbeing, anxiety, and stress questionnaires. Measurements of PF comprised handgrip (HG), standing long jump (SLJ), 30-second sit-ups (SU), sit-and-reach (SR), and course navette (CN) tests. Body composition was assessed by means of waist circumference (WC). **RESULTS:** Outcomes showed a significant negative correlation of WC with CN ($r = -.509$; $p < .001$), and SLJ ($r = -.175$; $p = .033$). However, WC was positively correlated with HG ($r = .355$; $p < .001$). No significant correlations were found between the elements

of mental health, PF, and BC. **CONCLUSIONS.** Both mental health and physical condition must be taken into account if we aim to increase people's overall health state. Despite previous literature suggests a connection between these two spheres of health, our outcomes seem to hint at isolated approaches, implying the implementation of different strategies to enhance physical condition and mental state simultaneously, though separately.

2038 Board #51 June 1 2:00 PM - 3:30 PM
Auditory Discrimination and Short Term Memory are Preserved during Simulated Altitude and Moderate Intensity Exercise.
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PURPOSE: This study was conducted to examine the cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise to examine whether short term memory or auditory oddball task performance were affected beyond a certain threshold of simulated altitude and whether exercise improves or worsens cognitive function during these conditions. **METHODS:** Fourteen recreationally active college students (M=9, F=5) aged 18-35 participated in this study, which consisted of six experimental days, with three simulated altitude conditions: sea level (SL), simulated moderate altitude (MA; 15.4% F_{O_2} , ~2400 m) or simulated high altitude (HA; 12.8% F_{O_2} , ~3900 m); and two exercise conditions: rest or moderate intensity cycling exercise at 60% altitude-specific peak power output, in a randomized-order, crossover design. Accuracy and reaction time on an auditory oddball task and a Sternberg memory task were assessed, alongside the amplitudes and latencies of their associated event-related potentials. **RESULTS:** Exercise improved auditory reaction time, regardless of altitude ($p < 0.01$), though task accuracy was not affected under any condition. In addition, simulated altitude induced lower P300 amplitudes and slower latencies during the auditory oddball task ($p < 0.01$), while exercise improved latencies at HA and SL, but not at MA ($p = 0.03$). Sternberg memory task behavioral performance was not affected by either simulated altitude or exercise. However, P200 latency was slowed during exercise trials ($p = 0.02$) as well as during MA trials ($p < 0.01$). **CONCLUSIONS:** Acute exposure to simulated moderate and high altitudes may not significantly impact short term memory and auditory discrimination. On the other hand, an acute bout of moderate intensity cycling exercise may improve reaction time on oddball tasks, even though it does not seem to benefit short term memory. It is possible that these cognitive modalities were negatively affected by simulated altitude, as evidenced by some altered event-related potentials, but that these effects were either too small to translate into performance deficits or that there are as yet unknown compensatory mechanisms at work that preserve performance as one ascends to altitude, at least until 3900 m.

2039 Board #52 June 1 2:00 PM - 3:30 PM
Impact of Biological Attractiveness on Exercise Motivation and Physical Activity in Female College Students
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Waist-to-hip ratio (WHR) has been used as an indicator of biological attractiveness, which has been associated with reproductive potential, health, and youthfulness. Previous reports have shown that women with a WHR closer to 0.70 than 0.80 are found more biologically attractive (BA). Considering the potential health implications of biological attractiveness, exercise motivations in women may vary based on WHR. **PURPOSE:** To determine if differences existed in health pressure and appearance-related exercise motivations and physical activity between the BA group (WHR ≤ 0.74) and less biologically attractive group (LBA, WHR ≥ 0.75). **METHODS:** Full-time female college students (19.26 ± 1.37 yr) completed the Exercise Motivation Inventory-2 (EMI-2). Following the survey, waist and hip circumferences were measured, and WHR was calculated. Participants then wore an Actigraph accelerometer (GT3X, Pensacola FL) for seven consecutive days. A one-way MANOVA was used to determine if differences existed in exercise motivations and physical activity between groups. **RESULTS:** There was a significant multivariate main effect for biological attractiveness, Wilks' lambda = .815, $F(3, 43) = 3.247$, $p = .031$. Closer examination of the univariate results demonstrated a significant difference in health pressure-related motivation to exercise $F(1, 45) = 8.592$, $p = .005$ between BA ($n = 23$, 1.48 ± 1.34) and LBA ($n = 24$, 2.53 ± 1.41). There were no differences in appearance-related motivation (BA, $3.27 \pm .91$ vs. LBA, $3.76 \pm .93$) or physical

activity measured in average steps between groups (BA, 6437.64 ± 2633.76 steps/day vs. 6486.39 ± 3026.91 steps/day). **CONCLUSIONS:** Although the health pressure-related score was higher in the LBA group, it was not a strong enough motivator to result in greater physical activity in this group. This suggests that health pressures are not a major motivator for exercise in female college students regardless of WHR and BA group. Appearance-related motivation was scored similarly between groups and despite higher scores than health pressure-related motivation in both groups, both categories of women were classified as low-active based on their average daily step counts. More research is needed regarding motivating factors for exercise in traditional-age female college students.

2040 Board #53 June 1 2:00 PM - 3:30 PM
Reasons Why College-aged Women Perform Resistance Training

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Resistance training itself has many far-reaching benefits in regards to muscular strength and endurance, bone health, and metabolism. However, despite its importance women tend to participate in resistance training at an alarmingly lower rate than men. Previous research on resistance training participation focused primarily on male subjects. Limited research is available on the resistance training practices of both sexes. **PURPOSE:** To determine the reasons why college-aged women perform resistance training. **METHODS:** Thirty-seven college-aged women (18-24 yrs. old) participated in this study by completing an online survey. Means, standard deviations, and frequencies were calculated for all questions. **RESULTS:** Women perform strength training for a variety of reasons. Over 95% agreed that resistance training gives them a sense of accomplishment and they enjoy how it makes them feel. Ninety-four percent agreed that resistance training will make them healthier. The results showed that 90.91% agreed that resistance training relieves stress. Over 90% agreed that they resistance train with the goal of improving muscular strength and endurance. Maintaining body weight is why 69.69% of the respondent's resistance train. Half of the respondents (50%) resistance train because they have someone willing to do it with them. In regards to appearance, 84.38% resistance train because they feel that it will make them more attractive. Of the women who responded 65.65% resistance train because they know it won't make them bulk up. Approximately 84.38% resistance train because it makes them happy. In order to improve bone health 62.5% of the respondents said that they resistance train. In order to cope with depression 53.13% of respondents said they resistance train. Coping with stress and anxiety is one reason why 75.51% resistance train. **CONCLUSIONS:** These findings suggest that females who participate in resistance training are health and fitness focused. These findings also suggest that resistance training helps college-aged women improve mental, physical, and emotional health overall.

2041 Board #54 June 1 2:00 PM - 3:30 PM
Predicting Affective Responses To, And Enjoyment Of, High-intensity Interval Exercise: Comparison Of Two Tolerance Measures

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Individual differences have been explored with respect to predicting affective responses to exercise. As such, new measures are developed to further understand these relationships and old measures are constantly updated to be more accurate. **PURPOSE:** Compare two measures of exercise tolerance. **METHODS:** Participants ($N=268$; 154 f; 20.72 ± 1.33 yrs, $M \pm SD$) completed the Preference for and Tolerance of Exercise Intensity Questionnaire (PRETIE-Q) and the Physical Activity Acceptance Questionnaire (PAAQ) and then a 15-min high-intensity interval exercise (HIIE) session. Affective valence (Feeling Scale; FS) was assessed every 3-min during (average FS during used in analyses) and enjoyment (Physical Activity Enjoyment Scale; PACES) was assessed post exercise. **RESULTS:** A moderate relationship existed between the PAAQ and PRETIE-Q Tolerance (Tol; $r=0.45$; $P<0.001$). PAAQ was related to enjoyment ($r=0.21$; $P=0.001$), but not FS ($r=0.11$; $P=0.09$). Tol was related to both enjoyment ($r=0.31$; $P<0.001$) and FS ($r=0.22$; $P=.001$). Using hierarchical regression, PAAQ accounted for 3.8% unique variance in enjoyment ($\beta=0.199$, $P=0.003$), after accounting for age, sex and BMI; the addition of Tol explained an additional 6.8% unique variance in enjoyment ($\beta=0.297$, $P<0.001$). In a separate regression, Tol explained 10.0% unique variance in enjoyment ($\beta=0.332$, $P<0.001$), after accounting for age, sex and BMI; the addition of PAAQ did

not explain any additional variance ($\beta=0.088$, $P=0.21$). The PAAQ did not account for any variance in FS ($\beta=0.074$, $P=0.28$); Tol explained 4.2% unique variance in FS ($\beta=0.215$, $P=0.002$), after accounting for age, sex and BMI. **CONCLUSION:** Comparison of Tol and PAAQ with respect to explaining affective responses revealed a modest relationship. While both explained affective responses, Tol accounted for more variability in such responses. Further, Tol accounted for all variance explained by the PAAQ, while the PAAQ accounted for roughly one third of the variance explained by Tol; with respect to enjoyment. In order to maximize benefits and minimize adverse affective responses to exercise, understanding individual difference factors is crucial. As such, the PRETIE-Q appears to predict affective outcomes of HIIE to a greater extent than the PAAQ.

2042 Board #55 June 1 2:00 PM - 3:30 PM
Cognitive Processes Of The Stages of Changes for Healthy Exercise Practice According To The ACSM

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Within the Transtheoretical Model, the stages explain *when* and the process *how* the people change his problematic conducts. The stages involve the pre-contemplation (PC= inactive without any intention to change), contemplation (C= inactive with intention to change), preparation (P= active but not fulfilling the recommendations of the American College of Sports Medicine [ACSM]), action (A= has complied with the recommendations of the ACSM but for less than six months) and maintenance (M= has complied with the recommendations ACSM for more than six months). Meanwhile, the cognitive processes involve Increasing Knowledge (IK), Being Aware of Risks (BAR), Caring About Consequences to Others (CACO), Comprehending Benefits (CB) and Increasing Healthy Opportunities (IHO). **PURPOSE:** To analyze which cognitive process are most commonly used in the different stages to fulfill with the recommendations of physical exercise healthy of the ACSM. **METHODS:** A total of 533 subjects (48% female and 51.8% male; 33.22 ± 15.27 ; range = 11-76). A Mexican Spanish version of the Stages of Change Questionnaire, as well as items on cognitive processes from the Processes of Change Questionnaire, were applied. **RESULTS:** The internal consistency of the different CP ranged from .65 to .81. The results of One-Way ANOVA revealed significant differences in IK, BAR, CACO, CB and IHO in different stages ($F_{(4,525)} = 7.844 - 25.761$, $p < .001$). Tukey HSD post hoc indicated that the use of IK (PC<C, P<A, M), CACO (PC<P<A, C, M), CB (PC<A<C, P, M) and IHO (PC<C, P<A, M) increases through the stages, except the BAR process (PC<P, A, M, C) which was more emphasized in the use in C. **CONCLUSION:** All the CP contribute to the achievement of the recommendations of the ACSM, however, the BAR process had more relevance to generate the intention of being physically active.

2043 Board #56 June 1 2:00 PM - 3:30 PM
Motivators for Physical Activity in Older Latino Caregivers

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Alzheimer's disease (AD) and related dementia may affect 1.3 million people by 2050, and nearly 70% of people with AD live at home. Caregivers face challenging responsibilities, and experiences of enduring stress and frustration are common among family members caring for people with dementia. Physical activity (PA) can lead to reducing burden and stress, and a positive impact on well-being and quality of life in caregivers. **PURPOSE:** To determine the motivators for PA in older Latino caregivers. **METHODS:** Participants were 16 Latino caregivers, aged 50 years and older, who had been caring for a relative ($N=6$ for the mother, 4 for a husband, 3 for the wife, 2 for father, and 1 for both parents) with AD or related disorder for at least 6 months. The majority of caregivers were female (12). Interviews were conducted in English and Spanish about the caregiver role, family, and social support, coping strategies and PA. For the purposes of this study answers regarding PA were analyzed. **RESULTS:** Six caregivers (4 female and 2 male) did not mention motivators for PA. Of those who stated motivators for PA, the remaining two men indicated staying healthy and fit as primary motivators to exercise, as well as receiving social encouragement from their wives. Women stated the motivation for PA as resulting from social support (7), especially from their sons, daughters, brothers, friends and boss. The importance of facilities available for engagement in PA was also noted. Parks were the most cited environmental factors to motivate PA (3). **CONCLUSIONS:** A significant number of older Latino caregivers did not stress any motivators for PA. Men cited health-

related outcomes as their PA motivation. Among women, receiving support from family members was demonstrated as a relevant promoter of PA. Social support was a great motivating source for PA among older Latino caregivers. Future research and interventions should take into consideration the importance of social support to increase PA in this population. Funded by the Department of Kinesiology and Nutrition of UIC.

2044 Board #57 June 1 2:00 PM - 3:30 PM
Association between Baseline Fitness and Exercise Adherence during a 26-Week Supervised Exercise Program
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Few studies have examined the relationship between baseline fitness and exercise adherence in adults with overweight/obesity during a comprehensive behavioral weight loss program (BWLP). Differentiating individuals who adhere to an exercise prescription based on fitness level may improve future intervention approaches. **PURPOSE:** To examine the association between baseline fitness and exercise adherence during a 26-week supervised exercise program. **METHODS:** Data from participants enrolled in an 18-month BWLP combining a calorie-restricted diet and supervised exercise were used in this analysis. The 26-week supervised exercise intervention consisted of moderate intensity exercise (65-75% max HR), three supervised sessions/week, progressing from 20 to 60 min/session by week 13. Baseline fitness (VO₂ max) was categorized based on published age and sex norms. Logistic regression was used to examine the association between baseline fitness and a) attrition and b) exercise adherence (attended ≥80% of supervised sessions). The association with adherence was assessed over the entire program (weeks 1-26) and during discrete intervals (weeks 1-4, 5-8, 9-14, 15-20, and 21-26). **RESULTS:** 69 participants (age 41±9.7 kg/m², BMI 34±3.8 years, 87% female) were enrolled in the BWLP. Participants were classified based on baseline fitness level: 29% very poor (VO₂ max 21.8±4.2 mL/kg/min), 48% poor (24.2±3.1 mL/kg/min), 19% fair (26.4±2.4 mL/kg/min), 3% good (32.2±3.8 mL/kg/min), and 1% superior (38.2 mL/kg/min). 78% (n=54) completed the 26-week supervised exercise intervention. Baseline fitness category was not associated with attrition, nor was it associated with adherence over the entire program (weeks 1-26) or at weeks 1-4, 5-8, 9-14, and 15-20. However there was a positive association between baseline fitness category and adherence during weeks 21-26. Participants categorized as poor or above were 9.4 times more likely to attend ≥80% supervised sessions as compared to those categorized as very poor (95%CI: 1.1-78.5; p=0.039). **CONCLUSION:** Baseline fitness levels in our study population were surprisingly low. Those starting an exercise program with very poor fitness may struggle with adherence over time as the exercise volume reaches higher levels and may require more coaching during this phase of the program.

2045 Board #58 June 1 2:00 PM - 3:30 PM
Relationships between Physical Activity and Motivation in Early Secondary School Adolescents in Scotland
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PURPOSE: High prevalence of physical inactivity and sedentary behaviour (SB) in adolescents is a global issue with as few as 18% of adolescents meeting physical activity (PA) guidelines. Research has suggested that higher intrinsic motivation is positively related with higher levels of PA. The purpose of this study was to test this relationship in early secondary school adolescents. **METHODS:** PA/SB was measured using an adapted version of the survey used in the Health Behaviour in School Children study and motivation was measured using the BREQ-3 questionnaire (Mark & Tobin, 2004; Wilson, Rodgers, Loitz & Schime, 2006). Questionnaires were completed during class time by students aged 11-14 years. The Relative Autonomy Index (RAI) was calculated using the weightings provided for each subscale. Spearman's Rho was used to determine the relationship between number of days active and each subscale of the BREQ-3, as well as the RAI. **RESULTS:** Participants' (N = 94) mean age was 12.79 ± 0.95 yr and 55.3% of the sample were male (n = 52). Based on 7-day recall, participants spent an average of 3.77 ± 2.05 days active. Correlations between the BREQ-3 and number of days active were: amotivation (r_s = -.12, p = .27); external regulation (r_s = .27, p = .01);

introjected regulation (r_s = .01, p = .95); identified regulation (r_s = .17, p < .01); integrated regulation (r_s = .35, p < .01); intrinsic motivation (r_s = .35, p < .01). These results suggest there is no relationship between introjected regulation and PA in early adolescents. Total RAI scores were significantly positively correlated with days active (r_s = .25, p = .02). **CONCLUSIONS:** The strongest positive relationships with PA are for external regulation, integrated regulation and intrinsic motivation. The patterns of these correlations appear to support the sub-theory of Self-Determination Theory - Organismic Integration - that adolescents further along the continuum towards the intrinsic motivation end are likely to engage in more PA compared to those who are towards the amotivated end of the continuum. However, in this study, external regulation appears to have a stronger relationship than introjected or identified regulation. Overall, the total RAI indicates a positive relationship between autonomous motivation and PA.

2046 Board #59 June 1 2:00 PM - 3:30 PM
The Influence Of Attentional Focus Cueing On Jump-and-reach Performance
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Movement cueing involves the provision of verbal instructions to performers prior to movement execution. Research literature examining attentional focus cueing has clearly documented the performance advantages of adopting an external focus (e.g., focusing on the center of a basketball hoop) over an internal focus (e.g., focusing on flicking the wrist; Al-Abood et al., 2002; Wulf et al., 1999; Zachry et al., 2005). Most commonly, deviation from a target has been employed as the measure of objective success, across a variety of specialized sport skills (for a review, see Wulf, 2013). **PURPOSE:** Consistent with this body of research, it is reasonable to hypothesize that when cueing individuals performing a vertical jump-and-reach task, an external focusing cue would lead to a superior task performance compared to an internal focusing cue. Preliminary research has provided support for this assertion (i.e., Wulf & Dufek, 2009; Wulf et al., 2007); however, these preliminary quasi-experiments employed relatively small sample sizes (i.e., ns = 8-12 participants). The current experiment examined the effect of attentional focus cueing on performance of a vertical jump-and-reach task. **METHODS:** Sixty-five college-aged participants were randomly assigned to one of three cueing conditions: control (n = 21), external focus (n = 22), or internal focus (n = 22). A Vertec™ measurement device was used to measure jump height. **RESULTS:** Interestingly, and contrary to the attentional focus literature, results demonstrated similar jump-and-reach performances between the external- (Mexternal = 19.97in.; SD = 5.38) and internal-focus groups (Minternal = 18.91in.; SD = 5.31; p > 0.05), as well as similar performances between the external focus and control groups (Mcontrol = 21.55in.; SD = 4.88; p > 0.05). **CONCLUSIONS:** These findings question the applicability of the external focus effect on the performance of less complex motor skills, however, other possible explanations for the current results and future research suggestions are also offered.

2047 Board #60 June 1 2:00 PM - 3:30 PM
Validity Of The Multidimensional Outcome Expectations For Exercise Scale In Young Adults
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Though outcome expectation is considered an important element of the social cognitive theory (Bandura, 1977, 1986), it has received little attention in physical activity research, especially in younger populations (Hellsten & Rogers, 2009). Moreover, when measured, this construct is often unidimensional. **PURPOSE:** To determine the psychometric properties of the 3-factor (physical, social, and self-evaluative) 15-item Multidimensional Outcome Expectations for Exercise Scale (MOEES; Wójcicki, White, & McAuley, 2009) in a sample of young adult college students enrolled in a health-related fitness course. **METHODS:** Confirmatory factor analysis was used to examine the 3-factor MOEES model in 346 young adults (52% female, M_{age} = 20.59 ± 4.79) from a public university located in the Southwest United States. Participants completed questionnaires assessing physical, social, and self-evaluative outcome expectations, barrier self-efficacy (Dwyer et al., 2012), and self-esteem (Robins et al., 2001), as well as the FITNESSGRAM® health-related fitness assessment to measure their cardiorespiratory fitness, muscular strength and endurance, and body composition (Cooper Institute, 2013). **RESULTS:** Analyses supported the 3-factor measurement model of the MOEES in young adults, χ²(81) = 312.11, p < .01, RMSEA = .09, CFI = .95, SRMR = .04 (Hu

& Bentler, 1999). Using structural equation modeling, construct validity was further demonstrated by significant path coefficients from barrier self-efficacy and self-esteem to the outcome expectations, as well as significant variance explained by 3-factor MOEES model in cardiorespiratory fitness ($r^2 = .18, p < .01$), muscular strength and endurance ($r^2 = .09, p < .01$), and body composition ($r^2 = .10, p < .01$). **CONCLUSION:** The MOEES appears to be a reliable and valid measure of outcome expectations for exercise in this limited sample of young adult college students enrolled in a health-related fitness course. Further validation in alternative young adult and adolescent samples is warranted.

2048 Board #61 June 1 2:00 PM - 3:30 PM
The Relationship between Cell Phone Use, Physical Activity, and Sedentary Behavior In Adults above College-age

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While there is evidence of a positive relationship between cellular telephone (cell phone) use and sedentary behavior, but not physical activity in college-aged individuals (18-29 years old), these relationships have not been tested in individuals older than college age (≥ 30 years old). This research is warranted as cell phone use is inversely associated with age; thus these relationships may be different in older individuals. **PURPOSE:** To assess the relationship between cell phone use, physical activity and sedentary behavior in adults older than college age (≥ 30 years old). **METHODS:** Adults aged 30-63 years ($N = 69, 51 \pm 8$ years old) wore physical activity monitors (accelerometers) for seven days and completed surveys assessing daily cell phone use, physical activity, and sedentary behavior. Pearson's correlation analyses were performed to assess relationships between cell phone use and age, physical activity, and sedentary behavior. Participants were then split into tertiles based on total cell phone use (low, moderate, and high) and a MANCOVA (sex and age as covariates) was used to determine if there were group differences in physical activity and sedentary behavior. **RESULTS:** Cell phone use ($= 125.2 \pm 146.8$ minutes per day) was inversely associated with age ($r = -0.3, p = 0.005$). Cell phone use was not associated with objectively- or subjectively-measured physical activity or sedentary behavior ($r \leq 0.1, p \geq 0.3$ for all). There were also no significant differences in physical activity or sedentary behavior between the low, moderate, and high cell phone user groups ($F \leq 2.0, p \geq 0.12$ for all). **CONCLUSION:** Consistent with previous research, there was an inverse relationship between cell phone use and age. Unlike what has been reported in college-aged individuals, cell phone use was not associated with sedentary behavior in adults older than college age. Because younger individuals are "digital natives" who have been raised with near-constant access to cell phones this may be their sedentary activity of choice. Conversely, adults who are older may prefer other, more traditional forms of sedentary activities such as watching television and using a desktop computer. This may explain the lack of a relationship between cell phone use and sedentary behavior in adults beyond college age.

2049 Board #62 June 1 2:00 PM - 3:30 PM
Understanding Active Behaviors Among Insufficiently Active Adults During Experimental Studies: A Descriptive Analysis

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A recent study examined the impact of TV viewing during exercise on observable volitional behavior (i.e. treadmill endurance time) among insufficiently active adults (46 ± 15 years, 31 ± 5 kg/m²; 68% women). Participants completed two visits in a randomized order, with >48H separating them. Participants could sit or walk on the treadmill (moderate intensity) as desired within a 60-minute time frame. During one visit, participants were able to view TV during exercise and while sitting. During the other, TV viewing was allowed only when seated. Despite the average participant accumulating 63±58 minutes of moderate-to- vigorous physical activity (MVPA) per week, 24% of participants walked continuously for 60-min at both visits. **PURPOSE:** Determine differences in relevant physical, psychological, and behavioral characteristics between participants who walked 60-min in both conditions (WALK, n=6) compared to those who did not (WALK/SIT, n=19). **METHODS:** T-tests were used to compare physiological (BMI, %body fat, estimated VO₂max), psychological (preference for and tolerance of exercise, intrinsic and extrinsic motivation), and behavioral (MVPA/week) factors. **RESULTS:** Tolerance for exercise intensity was significantly higher in WALK relative to WALK/SIT (3.2 vs. 2.5 $p=0.04$). No other significant differences were observed (>0.05) between WALK and WALK/SIT, respectively (BMI=29.8 m/kg² vs. 31.6 m/kg², %body fat=34.0% vs. 36.0%,

estimated VO₂max =29.4ml/kg/min to 26.6ml/kg/min, intrinsic motivation=2.1 vs. 2.0, extrinsic motivation=1.04 vs.1.07, preference for exercise intensity= 2.6 vs. 2.6. Although not significantly different, WALK reported nearly twice the average minutes of MPVA (83.3 vs. 48.9 min/week, $p=0.20$). Anecdotally, several participants indicated that, because it was already scheduled, they used this time to exercise regardless of condition. **CONCLUSION:** The ceiling effect in volitional walking time noted for 24% of participants warrants further investigation. Preliminary descriptive analyses suggest that tolerance of exercise intensity may play a role, while anecdotal data indicate additional motivational factors (i.e. "making use" of experimental visits) should be accounted for. Future studies may consider implementing experimental time frames greater than 60 minutes.

2050 Board #63 June 1 2:00 PM - 3:30 PM
Competence Beliefs Mediate the Relation between Physical Activity and Motor Competence in Elementary School Children

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PURPOSE: Recent research has proposed that a lack of motor competence (MC) leads to physical inactivity during childhood as children lack the competence beliefs to participate in physical activities. Stodden and colleagues' conceptual model suggested children's physical activity (PA) will drive the development of MC during childhood, but this assumption has not been tested in the pediatric literature. This study, therefore, aimed to examine whether the changes of PA after an 8-week pedometer-based intervention would cause the changes of MC through competence beliefs in physical education (PE). **METHODS:** A pretest-posttest comparison group design was used with an 8-week pedometer-based intervention combined with a goal setting strategy (3 days/week for 24 sessions). Elementary school children were randomly allocated to three conditions: 1) an intervention group with a personalized pedometer weekly target, 2) an intervention group with the fixed pedometer target range, or 3) a control group. Children's PA in PE (steps/class), competency beliefs in PE, and MC (PE Metrics™) were measured at baseline and follow up after the 8-week intervention. Of 273 original participants, 259 (Mean_{age} = 10.88; boys = 131, girls = 128) were in the final data analyses. **RESULTS:** AMOS 22.0 was employed to assess the hypothesized mediation model using structural equation modeling (SEM). The model represented an acceptable fit ($\chi^2/df = 11.51/6$, RMSEA = 0.06, CFI = 0.98, NFI = 0.96). Standardized path coefficients indicated competence beliefs fully mediated the relationships between PA ($\gamma = .26$) and MC ($\gamma = .33$). The model accounted for 39% of the variance in MC. We then inspected the path coefficients between the same outcome variables across times. The magnitude of the path coefficients across intervention ranged between 0.14 and 0.56. Hence, there were some degrees of change in the relative rank ordering of participants on scores from the measures through the intervention. **CONCLUSION:** This study provided evidence from a randomized controlled intervention to test Stodden et al.'s conceptual model. The results supported that PA intervention results in increased MC through competency beliefs in PE, which highlighted the mediation role of competence beliefs in PA interventions designed to increase MC among elementary children.

2051 Board #64 June 1 2:00 PM - 3:30 PM
Is Playing Pokémon Go Associated With Increased Walking Behavior?

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PURPOSE: One of the latest advancements in the video gaming industry is the location-based, augmented, reality, mobile games (e.g., Pokémon GO). Different from other exergames, the location-based augmented reality games utilize GPS and camera compatible devices to create a fantasy setting in which the games take place. The users need to physically walk in the real world to participate in the game. It is expected that playing the Pokémon GO game will promote walking behavior by the users. The current study compared the walking behavior of the Pokémon GO users to the non-users. **METHODS:** 393 college students (Female=175, age M=19.03, SD=2.04) from a medium size college in the Northeast took an online survey that measured their user activity (how much time they played the APP in the last 7 days), whether they agree the APP makes them walk more (Likert scale from 1 strongly disagree to 5 strongly agree), as well as their walking behavior (recall their total walking time in the last 7 days). Based on the responses, 105 athletes were excluded from the study. The rest of participants were classified as non-users (n=227, 79.1%), regular-users (i.e., playing less than 30 min a day, n=24, 8.4%), and active-users (i.e., playing more than 30 min a day, n=36, 12.5%).

RESULTS: 25.6% of regular-users and 75.7% of the active-users strongly agreed or agreed that playing the APP made them walk more. Different from the hypothesis, ANOVA and Post Hoc analysis showed that regular-users and active-users walked significantly less than non-users, $M=4.73\text{hr/w}$ $SD=3.76$, $M=4.65\text{hr/w}$ $SD=3.67$, and $M=6.96\text{hr/w}$ $SD=4.76$, respectively, $F(2,247)=4.78$, $p<.001$.

CONCLUSIONS: Although most Pokémon GO players believed that playing the APP made them walk more, they still walked less than non-players in general. There may be pre-existing differences in the walking behaviors between players and non-players. There can be an assumption that video game users are more sedentary than non-users and therefore this is why there are differences in walking behaviors between the two groups. However, future studies would need to investigate this.

2052 Board #67 June 1 2:00 PM - 3:30 PM
Comparative Influence of Exercise Self-efficacy and Physical Activity on Depression in Older Adults

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There is currently research that suggests that physical activity level is a significant positive predictor of satisfaction with life (SWL) as well as a significant negative predictor of depression in older adults. The belief that an individual holds regarding their physical activity capabilities (exercise self-efficacy) has also been found to serve as a predictor of SWL and depression. It's currently unknown which of these two variables (physical activity or self-efficacy) is the better predictor of satisfaction with life and depressive symptoms in older adults. Thus, the **PURPOSE** of this study was to examine the relationships among physical activity level, exercise self-efficacy, age, SWL, and depressive symptoms in this population. We hypothesized that exercise self-efficacy would be the better predictor of SWL and depressive symptoms than physical activity level in older adults. **METHODS:** In 68 older adults (78.3±7.8y) we assessed depression (Geriatric Depression Scale, GDS), well-being (Satisfaction with Life Scale, SWLS), moderate-to-vigorous physical activity (MVPA, Community Healthy Activities Model Program for Seniors questionnaire), and exercise self-efficacy (SEFF). Hierarchical linear regression analyses were utilized to assess the predictive value of MVPA, SEFF, and Age for SWLS and GDS using two models (Model 1: Age and MVPA; Model 2: Age, MVPA, and SEFF). Significance was set to $p<0.05$. **RESULTS:** Only age was a significant predictor of GDS in model 1. In model 2, only SEFF was a significant predictor of GDS ($\beta=-0.34$, $p<0.01$). Neither age nor MVPA were significant predictors of SWLS in Models 1 and 2. SEFF was a significant predictor of SWLS in model 2 ($\beta=-0.33$, $p<0.05$). **CONCLUSIONS:** These preliminary data show that exercise self-efficacy is a stronger predictor of depressive symptoms and satisfaction with life compared to age and MVPA in older adults.

2053 Board #66 June 1 2:00 PM - 3:30 PM
Perceived Barriers to Physical Activity among Latino Caregivers

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The older Latino population will increase rapidly over the next four decades, from 7.3% in 2012 to a projected 18.4% by 2050. Latinos have twice the incidence of Alzheimer's disease (AD) compared to Non-Latino Whites. Caregivers face challenging responsibilities, stress and frustration are commonly experienced among family members caring for people with dementia. Physical activity (PA) can reduce familial caregiving burden and stress; however, caregivers often report barriers to being physically active. **PURPOSE:** To identify older Latino caregivers' barriers to engage in PA. **METHODS:** Interviews were conducted with Latino caregivers (N=16, 12 females; 4 males), 50 years and older, caring for a relative with AD or related dementia for a minimum of 4 hours daily, for the past 6 months. Eight interviews were conducted in Spanish and eight in English about the caregiver role, family, and social support, coping strategies and PA. For the purposes of this study only responses regarding barriers that prevent PA were analyzed. Interviews were recorded, transcribed, translated and coded according to directed content analysis. **RESULTS:** Fifteen caregivers cited many barriers that prevent them from participating in PA, and only one reported no barrier. Most obstacles cited involved the care recipient. The necessity to stay at home caring for the relative was the main barrier mentioned (8). Interestingly, this barrier was only mentioned by female caregivers. Women also reported laziness, lack of time due to work, illness, and necessity to take care of grandchildren as other barriers. Males pointed out the lack of time because of work, disability, and laziness as barriers. The most relevant barrier for PA was the impossibility of leaving the care recipient by him/herself or with other temporary

caregivers; however, this barrier did not seem to prevent males to engage in PA. **CONCLUSIONS:** Older Latino caregivers cited caring for the family member as the main obstacle to engage in PA. Gender differences seem important, as males are still able to participate in PA despite of caregiving. Future research and interventions should considerate the need of offering an alternative type of assistance to the primary caregiver to allow extra time to PA participation. Funded by the Department of Kinesiology and Nutrition of UIC.

2054 Board #67 June 1 2:00 PM - 3:30 PM
Exercise Preference Mode Related to Trait Anxiety in College Students

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Previous research has indicated that exercisers report lower levels of trait anxiety than non-exercisers regardless of age and gender (De Moor et al., 2006). Significant reductions in trait anxiety occur when aerobic exercise interventions exceed 10 weeks (Petruzzello et al., 1991). However, there is limited research examining the relations between trait anxiety and preferred mode of exercise in both population studies and exercise interventions. **PURPOSE:** To examine the association between trait anxiety and preferred mode of exercise during leisure time in health-conscious young adults. **METHODS:** Participants included 770 college students from 14 health-related fitness courses (416 male, 354 female, $M_{\text{age}} = 20.64 \pm 3.16$) who completed a measure of trait anxiety (Spielberger, 1983) and an item that assessed preferred mode of exercise during leisure time (i.e., no exercise, playing sports, strength training, aerobic training, or multiple modes). **RESULTS:** Descriptive statistics revealed 88 students preferred no exercise during their leisure time, whereas 140 students preferred playing sports, 158 preferred strength training, 129 preferred aerobic training, and 255 students preferred multiple modes of exercise during their leisure time. One-way ANOVA indicated there was a significant main effect for preferred mode of exercise on trait anxiety levels, $F(4,765) = 25.00$, $p < .01$, $r^2 = .12$, $\omega^2 = .11$. Hochberg's GT2 post hoc tests indicated that mean trait anxiety scores for students who preferred no exercise during their leisure time were significantly higher than students who preferred playing sports ($d = 0.86$), strength training ($d = 0.92$), aerobic training ($d = 0.84$), and multiple modes ($d = 1.16$). In addition, students who preferred multiple modes had a significantly lower mean trait anxiety scores than students who preferred playing sports ($d = 0.31$) and aerobic training ($d = 0.38$). **CONCLUSION:** These findings indicate that exercise preferences relate to trait anxiety in a collegiate sample. Specifically, participants that did not prefer to participate in any mode of exercise reported the highest levels of anxiety. These results are consistent with previous research indicating that exercise, in general, may lead to reductions in trait anxiety (Petruzzello et al., 1991).

2055 Board #68 June 1 2:00 PM - 3:30 PM
The Relationship Between Motivational Factors And High Intensity Functional Training (HIFT)

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INTRODUCTION: High Intensity Functional Training (HIFT) is characterized by varied weight training, gymnastic, and body weight movements performed at high intensity. HIFT presents participants with the opportunity to improve factors related to physiological and psychological health. Considering its global growth, it is important to recognize the motivational factors behind participation in this training modality. **PURPOSE:** We sought to examine what motivational factors were most important among participants engaging in HIFT at different frequencies throughout a week. **METHODS:** 732 adults (32.4 ± 8.2 years) with more than three-months of HIFT experience (<3 d/wk, N = 114; 3-5 d/wk, N = 413; >5 d/wk = 205) completed an online version of the Exercise Motivation Inventory (EMI-2) survey. **RESULTS:** Significant Spearman rho (ρ) correlations were seen between HIFT frequency and all EMI variables (p<0.01) except those related to health pressures (ρ = -0.036; p = 0.331), ill health avoidance (ρ = 0.011; p = 0.774), and appearance (ρ = -0.025; p = 0.506). Kurskal-Wallis H test and post-hoc comparisons showed that individuals training 3-5 and >5 d/wk scored higher in factors related to enjoyment, affiliation, and competition (p<0.001) compared to those training <3d/wk. Also, those training >5 d/wk scored higher in factors related to challenge, social recognition, strength and endurance, and nimbleness (p<0.001), and lower in factors related to weight management (p<0.001) than the other two groups. **CONCLUSIONS:** This is the first study to express differentiation of motivational factors in HIFT participants based on their weekly training frequency. Considering its growth and expansion, it is important to understand the psychological motives to successfully implement programs targeted towards an

individual's motivation. Future studies should look at how these motivational factors impact adherence based on the workout frequency, age of the participants, and number of years training.

- 2056 Board #69 June 1 2:00 PM - 3:30 PM
Correlates of Chinese College Student's Physical Activity Behavior: A Social Ecological Model Perspective
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Purpose: A recent report indicated that the number of Chinese college students reached 37 million in 2015, representing the world's largest college student population. Despite the well-known health benefits of regular physical activity (PA) participation, Chinese college students are less likely to engage in PA as compared to their counterparts in Western countries. Understanding the factors that relate to Chinese college students' PA would provide valuable insights for future PA interventions. Guided by the Social Ecological Model, this study examined the associations among personal, social, and environmental correlates of PA participation among Chinese college students. **Methods:** Chinese college students (N = 741) were recruited from East region of China. Demographic information was collected, and PA and Social Ecological Model-based correlates (values, efficacy, social support, media and social media, weather, and facilities) were measured via a previously validated questionnaire for Chinese college students. Multiple regression analysis was conducted using gender and social ecological factors as independent variables and PA as the dependent variable. **Results:** Regression analysis suggested that gender was a significant predictor ($\beta = .17, p < .01$) with male students being more physically active. For the social ecological factors, values ($\beta = .071, p = .03$), efficacy ($\beta = .40, p < .01$), social support ($\beta = .20, p < .01$), and weather ($\beta = -.18, p < .01$) emerged as significant predictors; while media and social media ($\beta = -.057, p = .083$) and facilities ($\beta = -.003, p = .913$) were not found to be significant predictors for college students' PA. The model accounted for 42.6% of the variances in college students PA participation. **Conclusions:** Strategies and interventions are needed to promote female college students' PA. Programs that specifically designed to develop or enhance college students' efficacies and values toward PA and to encourage social interaction among peers might be helpful for PA participation.

- 2057 Board #70 June 1 2:00 PM - 3:30 PM
Does Experience Matter? Enjoyment Of High Intensity Interval Exercise With Respect To Exercise History
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While post exercise enjoyment and affective responses to aerobic exercise are fairly well documented, only recently have they been investigated within high-intensity interval exercise protocols. Further, little is known regarding how exercisers compare to non-exercisers with respect to affective responses during, and enjoyment following, high-intensity interval exercise (HIIE). **PURPOSE:** With respect to individual exercise history, evaluate affect during and enjoyment post: (a) continuous moderate intensity aerobic exercise (MIA); (b) high-intensity interval exercise (HIIE); and (c) a sedentary control condition (SED). **METHODS:** Participants (N=269; 156 ♀; 20.60 ± 1.20 yrs, M±SD) were divided into "regular exercisers" (n = 194; 102 ♀) and "non-exercisers" (n = 75; 54 ♀) based on self-reported exercise history. All participants completed each of the randomly ordered 15-min conditions: MIA (walking), SED (quiet reading), and HIIE (2 min activity, 1 min recovery). Enjoyment (Physical Activity Enjoyment Scale) was measured post condition; affective valence (Feeling Scale; FS) was assessed pre and every 3 min during each condition. **RESULTS:** Regular exercisers reported greater enjoyment following HIIE [$M_{diff} \pm SE = 10.40 \pm 2.40; P < 0.001$] and reported more positively valenced affect during HIIE [$M_{diff} \pm SE = 0.96 \pm .26; P < 0.001$] relative to non-exercisers. Additionally, regular exercisers enjoyed HIIE more than the MIA condition [$M_{diff} \pm SE = 6.12 \pm 1.46; P < 0.001$], while non-exercisers showed no difference in enjoyment between the two active conditions [$M_{diff} \pm SE = 3.43 \pm 2.35; P = 0.15$]. No differences were observed in enjoyment post or affect during the MIA condition between regular and non-exercisers. **CONCLUSION:** This believed to be the first study comparing regular exercisers to non-exercisers with respect to enjoyment and affective responses to HIIE. These findings both extend previous research by adding to the limited work on affective responses to HIIE and highlight the importance of exercise experience with respect to HIIE. In order to maximize exercise enjoyment and affective responses, especially when prescribing exercise, more attention needs to be given to exercise history.

- 2058 Board #71 June 1 2:00 PM - 3:30 PM
The Physical, Psychological, and Behavioral Impact of Undergraduate Physical Education Courses Varies by Course Content

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BACKGROUND: Physical Activity (PA) rates are declining in college students, though many universities are moving to eliminate any Physical Education (PE) course requirements for undergraduates. Examining the impact and aspects of collegiate PE courses on health behaviors is crucial for the future implementation and support of collegiate PA. **PURPOSE:** To evaluate the impact collegiate PE classes have on undergraduate student's physical, psychological, and behavioral outcomes. **METHODS:** Participants, a volunteer sample of students enrolled in PE class at a large northeastern USA university, were asked to take an online survey at the beginning and end of their PE course. The survey examined current PA level, goal setting behaviors, self-efficacy, PA enjoyment, opinion of PE course, (whether) and demographic factors. Basic frequencies and descriptives described the sample. Independent sample T-Tests and One Way ANOVAs with Tukey's post-hoc were used to examine differences in end-of-semester and change-over-the-semester findings. **RESULTS:** The final sample (n=431) was 56.6% women, 83% Non-Hispanic White with an average age of 21.1±1.7y. PE Course was divided into seven types: Aerobic, Strength, Yoga, General Sport, Dance, and Aerobic/Strength with Lecture. There were significant differences between types for course impression (F=9.16, p=0.00), BMI Change (F=2.77, p=0.02), PA Enjoyment (F=2.33, p=0.04), PA Goal Setting Behavior (F=2.78, p=0.02). Additionally, positive course impression was significantly correlated (p<0.05) with increases in goal setting behavior (r=.36), self efficacy (r=0.21), and Vigorous PA (r=0.10). Higher goal setting behavior at the end of the semester was correlated with a pre-to-post increase in PA enjoyment (r=0.36) and self-efficacy (r=0.14). **CONCLUSIONS:** The current study offered insight on the impact and effectiveness of different types of collegiate PE courses. The differences found between sections and the relationships between certain behavior changes and health outcomes may prove very useful in determining how future PE course offerings and resource allocation may be optimized.

- 2059 Board #72 June 1 2:00 PM - 3:30 PM
Relations between Basic Psychological Needs and Health-Related Fitness Measures in Male and Female College Students
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INTRODUCTION: Self-determination theory (SDT; Deci & Ryan, 1985) is a prominent theoretical framework applied to assess exercise participation (Kirkland et al., 2011). SDT holds that satisfying the three basic psychological needs (BPNs; autonomy, competence, and relatedness) fosters self-determined motivation, personal growth, and psychosocial well-being (Deci & Ryan, 1985). Relations between BPNs and exercise participation may vary between sexes (Martinez et al., 2013). Given that exercise participation is highly related to health-related fitness (Blair et al., 2001) investigating whether the relations between BPNs and fitness outcomes also vary between sexes is warranted. **PURPOSE:** To investigate the relations between BPNs and fitness outcomes in male and female college students. **METHOD:** Participants were 564 male and 503 female college students ($M_{age} = 20.57 \pm 3.82$ years) enrolled in a health and wellness course. Students completed a survey assessing the BPNs (Vlachopoulos & Michailidou, 2006), as well as the FITNESSGRAM® test battery (Cooper Institute, 2013), which includes measures of cardiorespiratory fitness (Progressive Aerobic Cardiovascular Endurance Run [PACER]), muscular strength and endurance (curl-up and push-up), and body composition (body fat %). Correlation analyses were conducted by sex to examine bivariate relationships between BPN and fitness outcomes. **RESULTS:** Analyses revealed that BPNs were significantly correlated with each fitness outcome (p < .05). Correlation magnitudes were not statistically different between males and females based on Fisher's z tests (p > .05). In both genders, competence had significantly higher correlations with the fitness outcomes (excluding PACER) when compared to relatedness (p < .05), but did not significantly differ from autonomy (p > .05). **CONCLUSION:** Results indicated that all three BSNs related to components of physical fitness in men and women enrolled in a health and wellness course. Interestingly, competence had the strongest relationships with fitness outcomes. Based on this study and previous research, fitness instructors may want to promote competence by providing social support and constructive individualized feedback, believing in participants' abilities, acknowledging their improvements and successful experiences.

2060 Board #73 June 1 2:00 PM - 3:30 PM
Comparing Bmi With Health Related Quality Of Life In College Freshman: The Herd Study
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Obesity in the United States is significantly higher than it was in the previous generation. West Virginia's obesity rate currently exceeds 30% of its population. Previous literature has demonstrated an inverse relationship between BMI (body mass index) and health-related quality of life, however these associations rarely include college-aged adults. **PURPOSE:** To examine the relationship between BMI and health related quality of life in college aged freshman enrolled in the HERD (Higher Education Reducing Diabetes) Study at Marshall University in Huntington, West Virginia. **METHODS:** The HERD Study is a 4 year longitudinal, randomized study examining the effects of a freshman year, healthy lifestyle intervention on the reduction of student's risk factors for developing type 2 diabetes and cardiometabolic disease. Freshmen were recruited during the Fall 2016 Freshman Week of Welcome at Marshall University. Quality of Life was assessed at baseline using the Short Form-12 Questionnaire. The SF-12 is a 12 item, validated survey assessing participant's physical and mental quality of life.

RESULTS: To date, 76 freshman have enrolled into the HERD study [age= 18.5±2.36 years; female=60.5% (n=46); 85.5% Caucasian (n=65); BMI= 26.5±5.85 kg/m². Fifty-three percent (n=40) of the students were deemed overweight or obese (BMI > 25 kg/m²). Students with a BMI ≥ 25 kg/m² were significantly less likely to record their health as very good or excellent compared to those with a BMI < 25 kg/m² (p=0.002). Students with a BMI ≥ 25 kg/m² were more likely to record that over the past four weeks, their emotional health caused them to accomplish less than usual (p=0.017). Also, students with a BMI ≥ 25 were more likely to record that their health (physical and emotional) interfered with social activities (p=0.004).

CONCLUSIONS: The BMI of college-aged freshman appears to have an impact on health related quality of life with higher BMI contributing to reduced health quality, productivity and social factors. Future efforts will examine strategies for decreasing BMI to improve the physical and mental health of young adults.

2061 Board #74 June 1 2:00 PM - 3:30 PM
Cancer Survivors' Experiences Of Physical Activity: Exercise As A Vehicle For Recovery?
 Mairéad Cooney¹, Niall Moyna¹, Deirdre Walsh¹, Bróna Furlong¹, Lisa Loughney¹, Lorraine Boran¹, Sinead Smyth¹, Catherine Woods². ¹*Dublin City University, Dublin 9, Ireland.* ²*University of Limerick, Limerick, Ireland.*
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Physical activity (PA) can have benefits for individuals at each stage of the cancer journey, including improved fitness and quality of life. However, many cancer survivors are not meeting the physical activity recommendations.

PURPOSE: The aim of this study was to explore cancer survivors' experiences of PA across the cancer journey.

METHODS: Participants were recruited from a cancer support centre and a community-based exercise programme that caters for cancer survivors. To ensure that a variety of opinions and experiences of PA across the cancer journey were captured, purposive sampling methods were used to recruit male and female cancer survivors of all ages who were either currently active or inactive. The focus group discussions were transcribed verbatim and were analysed using a thematic analysis approach.

RESULTS: 7 focus groups were conducted with 41 cancer survivors. Each group consisted of 4-8 participants. Most cancer survivors reported a decrease in their PA levels during treatment which was commonly attributed to treatment-related side effects. Participants reported that a period of isolation and a decrease in wellbeing can be experienced after treatment completion. Participants identified the lack of PA advice and services throughout the cancer journey and the need for a holistic approach to rehabilitation. Many viewed exercise as a vehicle for recovery as it facilitates 'self-power' - taking ownership and control of one's PA to increase wellbeing. Some participants reported that engagement in PA after treatment was empowering and that it increased their self-confidence and belief in their physical capabilities. Other participants reported that PA was difficult to initiate and maintain for a number of reasons, including the negative impact of treatment-related side effects on the physical ability to be active. Individuals reported that exercising with other cancer survivors created an accepting and supportive environment for exercise.

CONCLUSIONS: These findings suggest that there is a gap in the cancer care pathway post-treatment completion. An exercise rehabilitation programme at this time could support cancer survivors to increase their physical and psychological well-being.

D-62 Free Communication/Poster - Cycling and Soccer

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2062 Board #75 June 1 3:30 PM - 5:00 PM
Effects of Beetroot Juice Supplementation and Hypoxia on Time Trial Performance in Well-Trained Cyclists

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Beetroot juice supplementation is known to improve endurance performance in untrained and moderately trained subjects. In well-trained subjects beneficial effects of supplementation are questionable in normoxia but may be promising in hypoxia. Therefore, effects on maximal and submaximal performance during normoxia and normobaric hypoxia should be further investigated. **PURPOSE:** To examine the effects of beetroot juice (BR) supplementation on cycling performance in well-trained cyclists during normoxia and normobaric hypoxia (15% O₂). **METHODS:** Five well-trained male cyclists (VO_{2max}, 69.1 ± 5.2 ml·min⁻¹·kg⁻¹, W_{max} 5.7 ± 0.3 W/kg) completed four exercise trials. Subjects consumed 140 ml BR (equivalent to 12.4 mmol nitrate) or placebo (PLA) (nitrate-depleted BR) for seven days in a double-blind, randomized crossover design. On day four and seven, subjects completed 3x6-min submaximal cycling at 70% lactate threshold and a 10-km time trial (TT) in either normoxia or hypoxia. Inspiratory conditions were randomized and single blinded.

RESULTS: BR did not affect TT performance in either hypoxia (BR: 253.8 ± 35.6; PLA: 252.8 ± 32.3 Watt; P=0.65) or normoxia (BR: 296.8 ± 45.4; PLA: 297.4 ± 44.8 Watt; P=0.83). However, average power output during the TT was higher in normoxia than in hypoxia (297.1 ± 45 vs. 253.3 ± 33.9 Watt; P=0.003). Average oxygen uptake during the TT was higher in normoxia than hypoxia (4411.4 ± 462.9 vs. 3959.0 ± 368.7 ml·min⁻¹; P=0.008). Similarly, peak oxygen uptake during the TT was higher in normoxia than hypoxia (4885.9 ± 483.9 vs. 4204 ± 395.3 ml·min⁻¹; P=0.003). During submaximal cycling BR did not affect average steady state oxygen uptake in neither hypoxic (BR: 3239.8 ± 320.5; PLA: 3158.8 ± 406.1 ml·min⁻¹; P=0.28) nor normoxic conditions (BR: 3167.7 ± 312.5; PLA: 3069.7 ± 249.3 ml·min⁻¹; P=0.55). Further, oxygen uptake during submaximal cycling was similar in hypoxic and normoxic conditions (HYP: 3199.3 ± 360.5; NORM: 3118.7 ± 241.2 ml·min⁻¹; P=0.47).

CONCLUSIONS: These preliminary results suggest that seven days of high dose BR supplementation do not enhance cycling performance in normoxia or moderate hypoxia in well-trained cyclists.

2063 Board #76 June 1 3:30 PM - 5:00 PM
A Single Night of Sleep Restriction Following Heavy Exercise Impairs Next-Morning 3-km Cycling Performance

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(No relationships reported)

Sufficient sleep (7-9 hr) is necessary for proper physiological function. Athletes are susceptible to sleep loss due to the physical demands of heavy training and the emotional stress of competition. A single night of sleep restriction does not appear to negatively impact next-morning performance. However, this has only been assessed with subjects in a well-rested training state. **PURPOSE:** The primary goal of this project was to examine recovery from of a single night of sleep restriction following heavy exercise on cycling time trial performance (TT) and skeletal muscle function in the morning. **METHODS:** Seven recreational cyclists (age, 24 ± 7 yr; VO_{2max}, 62 ± 4 ml/kg/min) completed two phases, each consisting of an evening (EX1) and next-morning (EX2) exercise session. EX1 and EX2 were separated by an assigned sleep condition; a full night of rest (SLP+, 7.1 ± 0.3 hr of sleep) or sleep restriction through early waking (SLP-, 2.4 ± 0.2 hr). EX1 consisted of baseline testing (muscle soreness, peak isokinetic torque at 120 deg/sec, a 20 min cycle ergometer warm-up, and subsequent 3-km TT performance) followed by heavy exercise that included 60 min of high intensity cycling intervals and resistance exercise. EX2 was performed to assess recovery from EX1, and included all baseline measures. Magnitude-based inferences were used to evaluate the effects of sleep condition on these measures.

RESULTS: SLP- had a 'very likely' negative impact (96% likelihood) on the change in 3-km TT performance compared to SLP+. Specifically, 3-km TT performance was 'very likely' (99% LH) slower during EX2 compared to EX1 following SLP- (-4.0%), whereas TT performance was 'possibly' (54% LH) slower during EX2 (vs. EX1)

following *SLP+*. Sleep condition did not influence the change in peak torque, as peak torque during EX2 was 'likely' lower than EX1 with both *SLP+* (89% LH) and *SLP-* (80% LH). Likewise, sleep condition did not impact the change in muscle soreness, as muscle soreness 'very likely' increased from EX1 to EX2 with both *SLP+* (97% LH) and *SLP-* (99% LH). **CONCLUSION:** A single night of sleep restriction following heavy exercise had marked consequences on 3-km TT performance the next morning. Strategies to ameliorate the consequences that sleep loss have on performance should be investigated.

2064 Board #77 June 1 3:30 PM - 5:00 PM
Validity of a Novel Staged Exercise Test for Measuring Maximal Steady State Lactate In Recreational Cyclist Using the Lactate Plus Analyzer(R)
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Several types of lactate threshold (T_{inc}) protocols have been developed over the years to maximize accuracy and reliability while maintaining ease of measurement and application to training and performance. **PURPOSE:** The purpose of this study was to determine the validity of a novel staged maximal lactate steady state exercise test (sMLSS) in predicting the MLSS using the Lactate Plus® (Nova Biomedical, Waltham, MA) analyzer. **METHODS:** Blood lactate concentration (BLC) was measured in duplicate for all tests. Seven trained cyclists (20 miles per week) performed a VO_{2max} test starting at 100W and increasing by 30W every three minutes until volitional fatigue. Lactate threshold was defined as the previous workload to a 2 mmol/L increase in BLC. Next, the sMLSS test was performed starting at the T_{inc} workload, determined previously, then increasing 10W every 15 minutes for a total of three stages. BLC was measured every 3 minutes. MLSS was predicted by visual inspection and defined as < 1.0 mmol/L increase in the final 6 minutes of the stage. Finally, cyclists then performed two to six MLSS exercise tests, adjusting by 5W depending on lactate response, to validate the sMLSS. MLSS was determined at the maximal workload with < 1 mmol/L increase in BLC in the final 20 minutes. Dependent t-test and Pearson correlation analysis was used to determine reliability between lactate trials. Bland-Altman plots, One-way ANOVA, and regression analyses were used to analyze differences between the types of exercise tests. **RESULTS:** There were no significant differences for duplicate BLC trials for all tests ($p=0.21$; $r=0.982$). Ninety-five percent confidence intervals for the sMLSS and MLSS were significantly correlated with the MLSS workload and percentage of max workload ($r=0.997$; $p=0.001$, $r=0.978$, $p=0.01$), respectively. There was no bias noted between sMLSS and MLSS protocols for predicting lactate accumulation. **CONCLUSION:** In conclusion, the sMLSS was a valid and reliable predictor of MLSS in trained cyclists.

2065 Board #78 June 1 3:30 PM - 5:00 PM
High-intensity Cycling Intervals Are Prescribed Accurately Using The 3-min All-out Exercise Test
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High-intensity interval training (HIIT) has been used to enhance critical power (CP) and the finite capacity for work (W'); yet, research on prescriptions using the CP concept is warranted. **PURPOSE:** We investigated the validity of interval prescriptions derived using CP and W' measures acquired from a 3-min all-out exercise test (3 MT). **METHODS:** Eight competitive cyclists completed a 3 MT, verification bout for determining peak oxygen uptake (VO_{2peak}), and subsequent HIIT bouts, noted numerically using the number of bouts by duration and % W' depletion riding on a cycle affixed to a CompuTrainer. Using expired gas exchange data, VO_{2peak} values from a verification bout subsequent to a 3 MT were compared with end-exercise values of HIIT schemes using 60 and 80% W' depletion for 180 and 300 s for each condition. The HIIT schemes were counterbalanced to avoid an order-effect. **RESULTS:** VO_{2peak} ($ml\ kg^{-1}\ min^{-1}$) values from the verification bout (58.7 ± 6.9), 4 X 180 s 60% W' scheme (57.4 ± 8.2), 3 X 180 s 80% W' scheme (58.3 ± 5.7), 4 X 300 s 60% W' scheme (54.3 ± 8.0), and the 3 X 300 s 80% W' scheme (55.7 ± 7.4) did not differ ($F=2.10$, $p=0.25$). Strong measurement agreement was observed for VO_{2peak} between measures (ICC = 0.85, typical error = 2.37 $ml\ kg^{-1}\ min^{-1}$, coefficient of variation = 4.6%). **CONCLUSION:** The 60% and 80% W' HIIT schemes for either 180 or 300 s durations evoked VO_{2peak} consistently, providing empirical support for the CP concept to standardize HIIT.

2066 Board #79 June 1 3:30 PM - 5:00 PM
Difference Of Anaerobic Capacity, Muscle Activity Of Lower Extremities In Win-gate Test According To Events Of Cyclists
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 (No relationships reported)

PURPOSE: This study examined anaerobic capacity, muscle activity of dominant lower extremities Gluteus maximus(Gmax), Rectus femoris(RF), Long head of biceps femoris(LBF), Tibialis anterior(TA), Gastrocnemius medialis(GM) with Standing start 10sec(SS-10sec) and Rolling start 30sec(RS-30sec) Wingate test between short distance cyclist group(SDC, 20±1 yrs) and long distance cyclist group(LDC, 21±2 yrs) total 12 elite cyclists to develop baseline data which can provide proper training program for each event through comparison and analysis of this experiment.
METHODS: Independent t-test was conducted to verify the differences of anaerobic capacity, lower extremities muscle activity, isokinetic muscle strength, and paired t-test was executed to verify anaerobic capacity, muscle activity differences within each group. All the statistical significance level was set as $\alpha=0.05$.

RESULTS:
 1. SDC group was identified as significant higher Peak/kg than LDC group during SS-10sec wingate test between the groups($p<0.05$).
 2. SS-10sec was identified as significantly higher than RS-30sec in Peak power and Peak/kg between SS-10sec and RS-30sec wingate test within SDC group($p<0.01$, $p<0.01$). SS-10sec was identified as significantly higher Peak power and Peak/kg than RS-30sec, within LDC group($p<0.05$, $p<0.05$), for Mean power and Mean power and Mean/kg, RS-30sec was identified as significantly higher result than SS-10sec($p<0.001$, $p<0.001$).
 3. SS-10sec was identified as significantly higher Peak and Mean muscle activity than RS-30sec in long head of biceps femoris during wingate test within SDC group($p<0.05$, $p<0.01$). Peak muscle activity within LDL group was identified as no significant difference between SS-10sec and RS-30sec in Peak muscle activity, for Mean muscle activity, SS-10sec was identified as significantly higher muscle activity than RE-30sec in tibialis anterior and gastrocnemius medialis($p<0.01$, $p<0.05$).

CONCLUSION: With the above results, it is identified anaerobic capacity and activated muscle groups during pedalling according to cycling events. Therefore, in the future study, it is considered that specialized training program application for specific event based on the current study could improve athletic performances.

2067 Board #80 June 1 3:30 PM - 5:00 PM
Preliminary Examination Of Stamina Sensor Device With Laboratory Testing Measures In Recreationally Trained Cyclists
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The availability of app based fitness technology has led users to a wide selection of devices to aid in their training regimes, however some do not accurately represent individual physiological characteristics. With an ever growing base of device choices, selecting a highly reliable and valid unit should be of utmost importance to the attentive athlete. **PURPOSE:** To determine the relationship of a stamina sensor device with traditional laboratory cardiorespiratory testing protocols to evaluate inter-individual physiological characteristics in trained cyclists. **METHODS:** Recreationally trained cyclists ($n=6$) completed a successive fixed work rate incremental cycle ergometer test to exhaustion. The testing protocol began at 85 W and increased by 15 W every 5 minutes. Inspired and expired gases were continuously recorded using a metabolic cart, heart rate (HR) using a stamina sensor device app; blood lactate levels utilizing a using a finger stick capillary sample (0.7 microliter (μL)) and a blood lactate analyzer and rate of perceived exertion (RPE) were obtained during the final 30 seconds of each stage. Individual physiological data were assessed to determine heart rate (HR), lactate threshold (LT), ventilator threshold (VT), and RPE responses between athletes. Delta values were calculated per dependent variable to assess the relationship between changes in physiological response to changes in the stamina levels. **RESULTS:** The stamina sensor device displaying stamina percentage, aerobic percentage, and anaerobic percentage has shown low correlation with laboratory testing measures such as VO_2 and blood lactate values. When correlations were run on VO_2 and stamina % change, stamina value, aerobic, and anaerobic values it produced r values of 0.616, -0.743, -0.861 and -0.664 respectively. When correlations were run on blood lactate values and stamina % change, stamina value, aerobic, and anaerobic values it produced r values of 0.509, -0.817, -0.914 and -0.761 respectively.

CONCLUSION: Though the stamina sensor device is not a direct replacement of laboratory testing to measure performance, the stamina sensor does appear to accurately represent the subjective output (RPE) of the individual athlete.

2068 Board #81 June 1 3:30 PM - 5:00 PM
The Impact of Cycling Cadence On Oxygen Consumption During Maximal & Submaximal Exercise

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The impact of cycling cadence on oxygen consumption has not been studied in detail but previous reports describe increased oxygen consumption at higher rates of muscle contraction, even when external work is similar. The majority of studies were performed during incremental exercise to exhaustion and there is little data on sub-maximal responses. One of the challenges is to determine the relative intensity to compare different cycling cadences during submax exercise as %VO_{2peak} will be influenced by the cadence during VO_{2peak} testing. **PURPOSE:** The purpose of this study was to determine if peak power output (PPO) could be used to compare the metabolic responses during submaximal exercise at different cycling rates. **METHODS:** Eleven young (21±1 yr) recreationally active males completed a continuous incremental exercise test to exhaustion (VO_{2peak}) on an electrically braked cycle ergometer at 65rpm and 95rpm. The power output corresponding to 55% PPO was calculated for each cycling cadence and, on two further occasions, participants cycled for 1-hr at 65-rpm and 95-rpm. Indirect calorimetry was used to monitor a number of metabolic variables during exercise. In addition, heart rate and blood lactate was measured during all trials. **RESULTS:** At VO_{2peak}, oxygen consumption (3182±230 vs 3348±318 ml/min, p=0.002), total ventilation, respiratory rate, heart rate and lactate were all significantly greater following the 95-rpm trial (p<0.05). There were no significant differences in peak power output or ventilatory threshold between trials. During sub-maximal exercise, VO₂ (2012±194 vs 2371±218 ml/min, p<0.001) and all other parameters were significantly greater at 95-rpm (p<0.05). **CONCLUSIONS:** As PPO does not change during maximal exercise it can be used to control external work and compare the metabolic responses while cycling at differences cadences. The mechanisms underpinning the increased metabolic demand at higher rates of muscle contraction need further examination.

2069 Board #82 June 1 3:30 PM - 5:00 PM
Adding Video Games or Music Videos to Stationary Cycling: Effects on Exercise Enjoyment.

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Various strategies designed to promote physical activity participation and enjoyment have been researched, but few studies have focused on exercising while playing video games. **PURPOSE:** To investigate whether playing a video game, or watching music videos while working out on an exercise cycle increases exercise enjoyment, decreases perceived exertion, and increases work output. **METHODS:** Using a randomized order within-subjects experimental design, college-aged males (n=24) participated in three conditions: cycling while playing an Xbox@ 360 video game console (VG), cycling while watching music videos (MV), and cycling with no external media (NM). Dependent measures were exercise enjoyment (PACES), perceived exertion (RPE), heart rate (HR), and total work output (kJ). Data were analyzed using paired t-tests with Holm's Sequential Bonferroni adjustments (SPSS v21). **RESULTS:** VG and MV PACES scores were statistically similar, but both were significantly higher than NM (NM: M = 3.33, SD = .85. VG: M = 4.31, SD = .44, p < .001, d = 1.14. MV: M = 4.32, SD = .56, p < .001, d = 1.15). RPE was significantly lower in the VG condition (M = 13.21, SD = 1.56) than both the MV (M = 14.46, SD = 1.71, p < .005, d = .73) and NM conditions (M = 14.25, SD = 1.62, p < .001, d = .64). A significantly higher total work output (in kJ) was observed in the MV condition over the VG condition and NM over the VG condition (VG: M = 113.12, SD = 29.21; MV: M = 128.11, SD = 30.17, p < .001, d = .51 and VG: M = 113.12, SD = 29.21; NM: M = 122.75, SD = 33.30, p < .005, d = .33). There were no statistically significant differences in HR between the three conditions. **CONCLUSION:** While there were moderate statistical differences in work output and RPE, the practical significance of these results may be most related to the large effect on exercise enjoyment in the VG and MV conditions compared to NM. With less than half of the US adult population currently meeting the 2008 Physical Activity Guidelines, an intervention that can make an exercise modality significantly more enjoyable may have important potential public health benefits via improved physical activity participation levels. Future research might investigate if these laboratory-based results can translate into improved volitional physical activity levels in free living adults.

2070 Board #83 June 1 3:30 PM - 5:00 PM

The Effect of Typical Power Variation on Cycle Time-trial Performance

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The manner in which power output is distributed during a time-trial (TT) can affect performance. However, previous studies that have compared the effect of constant and variable power outputs on performance have failed to consider the typical amplitude and period of power variations that competitive cyclists undertake. **PURPOSE:** To compare the time required to complete an indoor, self-paced 4 km TT following a 12 km constant and variable power "pre-load". **METHODS:** Eleven competitive cyclists (32 ± 10 years, 181 ± 4 cm, 78 ± 9 kg, VO_{2peak} 4.2 ± 0.7 L·min⁻¹) initially completed a self-paced 16.1-km TT. Participants then undertook two 16.1-km experimental TT whereby the initial 10 km was either at a constant (CT) or variable (VT) power output. Mean power (MP) during this time was equivalent to the mean power from the initial 16.1-km TT but in VT, power was varied in accordance with a previously determined template which was based on the typical power variation of competitive cyclists. For each trial, a 2 km normalisation period at MP preceded a maximal, self-paced final 4 km. **RESULTS:** There was no difference in the time to complete the final 4-km (CT: 362 ± 39 vs VT: 348 ± 43 s, t₁₀ = -1.38, P = 0.20) or average power (275 ± 42 vs. 287 ± 57 W, t₁₀ = 1.29, P = 0.23) between trials. Power output increased during the final 4 km compared to 12 km (P < 0.05); the increase in power during the final 4 km was accompanied by an increase in oxygen uptake which at 16.1 km (3.7 ± 0.5 L·min⁻¹) was greater (P = 0.05) than that at 12 km (3.6 ± 0.5 L·min⁻¹). Heart rate also increased continuously throughout the final 4 km (P < 0.001), though was not different between trials. **CONCLUSIONS:** In using the typically displayed amplitudes and periods of variation in power output that competitive cyclists undergo during TTs in order to define VT, this study sought to replicate the typical variations which are apparent during self-paced TT. The results of the present study suggest that this typical power variation does not adversely affect performance, at least during a 16.1-km TT. The similar performance was accompanied by similar physiological responses during the final 4 km of the trial.

2071 Board #84 June 1 3:30 PM - 5:00 PM

Relationships Between A Smartphone Stamina App With The Performance And Physiological Responses To Cycling

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In order to complete an event as fast as possible an endurance athlete must select a work rate that maximizes intensity and optimizes the rate of fatigue. This pacing strategy ensures a true maximal effort without premature exhaustion and can be conceptualized as an allocation of the athlete's stamina resources. The relationship between intensity and time to exhaustion is curvilinear and dependent upon the athlete's individual fitness characteristics and current fatigue state. Therefore, an athlete's stamina level and rate of allocation should be influenced by exercise intensity, duration, and individual fitness characteristics. **PURPOSE:** To determine the relationships between smartphone stamina sensor device and the performance and physiological responses to an incremental cycling test to exhaustion in trained cyclists. **METHODS:** 6 trained cyclists completed a successive, fixed work rate incremental cycle ergometer test to exhaustion. Testing began at 85 W and increased by 15 W every 5 minutes. Inspired and expired gases were continuously recoded using a metabolic cart and HR using the smartphone app. RPE was obtained during the final 30 seconds of each stage. Individual physiological data were assessed to determine the individual VO₂ and metabolic cost per stage and the ventilatory thresholds. Bivariate correlations were conducted between the following variable: stamina and total mechanical work (J), stamina percent change and stage RPE, stamina and energy expenditure (kcal.), and stamina and percentage of total kcal. to exhaustion. **RESULTS:** Stamina had statistically significant correlations with J, r(140) = -.81, p < .01, RPE, r(140) = -.62, p < .01, kcal., r(140) = -.79, p < .01, and percentage of kcal. to exhaustion, r(140) = -.83, p < .01. **CONCLUSIONS:** The stamina variable is highly related to performance and physiological responses to an incremental cycling test to exhaustion. Stamina is able to respond to the dynamic nature of exercise to exhaustion and may prove to be a valid variable to assess endurance performance.

2072 Board #85 June 1 3:30 PM - 5:00 PM
Time Deception Affects Performance But Not Metabolic Variables In Cyclists

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PURPOSE: Previous investigations have found that various types of deception (ie. unknown task endpoint) could alter perception and consequently affect performance. We investigated whether time deception influenced performance and metabolic variables in cyclists. **METHODS:** Ten semi-professional male cyclists (age 36±5, years; height 173±6 cm; weight 76.7±265 kg; with 2 years of experience) completed three 60 min cycling time trials (roller trainer) after 2 familiarization sessions. Visual feedback of elapsed time was provided, but the chronometer was manipulated to display either real (NOR), 10% slower (SLO) or 10% faster time lapse (RAP). Total distance covered and heart rate (HR) were recorded at each 10 min interval. Ratings of perceived exertion (RPE) were assessed with the 20-point Borg scale. Blood samples were collected before and immediately after each time trial, and analyzed for blood glucose, serum creatinine, serum urea, and serum urate. Data were analyzed with repeated measures ANOVA. Significant main effects were further analyzed using pairwise comparisons with Bonferroni post hoc tests. Statistical significance was set at the p ≤ 0.05 level of confidence. Statistical analysis was completed using SPSS v20.0 for Windows (LEAD Technologies). **RESULTS:** Distance completed at any 10 min time point was similar between conditions, but total distance covered over the 60 min differed among conditions (NOR = 20.7±4.1; SLO = 25.7±7.1; RAP = 23.7±5.2 Km) (p < 0.05). Post-hoc analyses indicated that both RAP (p = 0.001) and SLO (p = 0.027) covered a greater total distance than NOR, with no difference in distance covered between SLO and RAP (p=0.458). RPE (NOR = 17±3; SLO = 16±4; RAP = 18±1) and HR (NOR = 171±12; SLO = 172±17; RAP = 180±12 bpm) were similar (p = 0.145) among conditions. Blood glucose increased during the time trial for all conditions, however increases in blood glucose (NOR = 7.4±10.7; SLO = 5.2±8.6; RAP = 6.8±13.3 mg·dl⁻¹) were similar among all conditions. Serum creatinine, serum urea and serum urate were stable and did not differ among conditions. **CONCLUSION:** These results indicate that deception (±10%) consisting of either a slower or more rapid perception of elapsed time can increase performance in a time trial, but does not affect RPE nor the measured metabolic variables in semi-professional cyclists.

2073 Board #86 June 1 3:30 PM - 5:00 PM
The Effect Of Acute Versus Accumulated Soccer Training On Postprandial Dysmetabolism

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Playing soccer has shown to have short and long term health benefits. Whether a dose response relationship exists for soccer training over a short period (1 week) is unknown. **PURPOSE:** The aim of the present study was to examine the effects of acute versus accumulated soccer match play on postprandial dysmetabolism in recreational players. **METHODS:** Fifteen participants were recruited and preliminary data was collected for body composition and cardiorespiratory fitness. There was no significant difference between the groups at baseline and the groups did not differ in their pre intervention triglyceride (TG) incremental area under the curve (iAUC) response to the fat load meal. On day 1, pre intervention (control(C)) blood samples were collected at 0 (fasted) and 0.75, 2, 4, 6hrs post a high fat load. Participants were randomly allocated to an experimental group (soccer (S)) of 1xpw or 3xpw small sided games training over a week period. The final session for the 3xpw was on the same day as the 1xpw training. Participants returned the next day, after completing the S, to the laboratory for post intervention blood samples. Repeated measures ANCOVA was used to compare differences and iAUC/AUC, confidence intervals (CI) and effect sizes (ES) were calculated. **RESULTS:** TG iAUC was significantly lower in the 1xpw from pre to post measures (p=0.04; 95%CI=-3.45 to -0.04; ES=-1.02), but not in the 3xpw. The average TG response was lower at all time points for the S compared to the C for both groups. There was no significant delta change for 2hrs insulin iAUC in both groups. **CONCLUSION:** Playing soccer can improve the PP TG response compared to no exercise but 3 consecutive days will not attenuate the response more than 1 session per week.

2074 Board #87 June 1 3:30 PM - 5:00 PM
Iron Deficiency And Physical Performance In Elite Female Soccer Players

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Introduction: Iron deficiency is a prevalent condition among athletes especially in women. Iron is a key element for biological functions including oxygen carrying and oxidative phosphorylation among others. This has led to the idea that its deficit may impact physical performance. In Chile approximately 5% women have Anemia and over 10 % may have iron deficiency without anemia. There is ongoing research about this subject but none of it has been conducted on Chilean female athletes. **Purpose:** to determine the prevalence of iron deficiency with and without anemia in Chilean elite female soccer players and to evaluate if there is an association between iron deficiency and VO2 max or anaerobic power and fatigability. **Subjects and methods:** Twenty five female athletes from the Chilean National Soccer team where included in this study. After informed consent, blood samples to determine Hemoglobin and Ferritin levels were taken from them. They participated in a clinical evaluation, ergo spirometry to determine VO2 max, and RAST test for anaerobic capacity and fatigability. Data were analyzed with Pearson correlation, ANOVA and Kruskal-Wallis tests. **Results:** No cases of anemia were detected. Among these athletes, 25% had Ferritin levels over 50 mcg/ml and 28% under 15 mcg/ml. No correlation or association was found between hematological variables and VO2max, maximal anaerobic capacity or fatigue index. **Conclusion:** The prevalence of iron deficiency was high in Chilean female elite soccer players as compared to the Chilean female population, and most participants of this study had ferritin levels that would prompt supplementation in our center. In this group we found no impact of iron deficiency or ferritin level in physical performance. This results may have been influenced by different training levels of the participants prior to participating on this study. More research is needed in this area to determine the influence of iron in performance in female athletes.

2075 Board #88 June 1 3:30 PM - 5:00 PM
Regulatory Fit: Impact On Anxiety, Arousal, And Performance In College-level Soccer Players

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Sport behavior may be regulated through a desire to win (promotion) or a desire to avoid losing (prevention), which differentially impacts cognitive tasks. Performance facilitation may also stem from a match between an individual's self-regulatory focus and her chronic regulatory strategy, possibly due to "feeling right". This notion of regulatory fit may impact pre-performance anxiety and arousal which may impact sport performance. **PURPOSE:** To determine the impact of regulatory fit on anxiety, arousal, and performance of college soccer players. **METHODS:** Twenty-five female soccer players were randomly assigned to a regulatory match (M) or mismatch (MM) condition. Participants received a task-framing phrase in which their performance goal either matched (M) or mismatched (MM) their chronic regulatory strategy. Anxiety, measured by the Competitive State Anxiety Inventory-2 Revised (CSAI-2R) and arousal, measured by pre-ejection period (PEP), heart rate (HR), and heart rate variability (e.g. high frequency variability (HF), and the square root of the mean squared differences of successive NN intervals (RMSSD)) were determined pre- and post-manipulation. Performance, the number of successful penalty kicks out of 10, was measured post-manipulation. The impact of regulatory fit on performance and on anxiety and arousal variables were determined by ANOVA and RM ANOVA, respectively. **RESULTS:** There was no difference between M (3.0 + .95) and MM (2.5 + 1.8) on performance (p>0.05). Pre (32.6 + 4.8) to post (34.5 + 5.4) CSAI-2R for M was not different than MM pre (35.0 + 4.6) to post (35.4 + 6.3) (p>0.05). Arousal variables ln HF, HR, and ln RMSSD in M were not significantly different pre (6.2 + .99; 76.4 + 15.0 bpm; 3.6 + .54) to post (6.3 + .99; 75.1 + 17.5 bpm; 3.6 + .53) compared to MM pre (6.6 + 1.0; 75.3 + 12.3; 3.8 + .49) to post (6.9 + .85; 74.6 + 10.5; 4.0 + .36), respectively (p>0.05). There was an interaction effect for PEP (p<0.05). Post-hoc testing indicated M post (0.14 + 0.01 msec) was greater than pre (0.13 + 0.01 msec) (p<0.05) but MM did not change pre (0.15 + 0.02 msec) to post (0.15 + 0.02 msec) (p<0.05). **CONCLUSION:** PEP is an indicator of the sympathetic nervous system (SNS), thus regulatory fit may impact pre-performance arousal through SNS activation. Supported by a Hollis Grant, ASPiRE program, Ball State University.

2076 Board #89 June 1 3:30 PM - 5:00 PM
Readiness To Perform, Sprint Ability, and Reaction Time Following A 2-hour Nap In Soccer Players.

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Athletes' performance may improve by increasing their sleep duration. This would typically be achieved by increasing time in bed at night, but this may not always be possible. One potential solution is to nap during the day, however the time taken to reach optimal performance after waking from a nap is not known. **PURPOSE:** To examine readiness to perform, sprint ability, and reaction time 30, 60, 90 and 120 min after waking from a daytime nap. **METHODS:** Twelve soccer players (18.3±1.0 yrs) completed two conditions in a randomised order. In one condition, participants had 9 hours time in bed (22:00-07:00h) without napping the next day and in the other condition, participants had 7 hours time in bed (00:00-07:00h) with a 2-h nap the next day (14:00-16:00h). Sleep was assessed using polysomnography. Each day, participants completed four 30-min test sessions (every 30 min starting at 16:15h) that included a visual analogue scale for readiness to perform, a 7-min warm up, two 10-m sprints, and a 90-s reaction time task. Total sleep time was compared between conditions using a paired t-test. The effect of condition (no nap vs. nap) and test session (30, 60, 90, 120 min) on readiness to perform, fastest 10-m sprint, and mean reaction time were assessed by separate repeated ANOVAs. **RESULTS:** Total sleep time was similar between conditions (no nap 8.1±0.7 h vs. nap 8.0±1.0 h, p=0.87). There were main effects of condition (p<0.01) and test session (p<0.05) on readiness to perform, but no interaction between condition and session (p=0.09). Readiness to perform was lower in the nap condition (68.2±20.1) vs. the no nap condition (82.4±15.4), and at 30 min (68.0±20.8) vs. both 60 min (80.0±15.3, p=0.01) and 90 min (77.8±17.9, p=0.03). There was a main effect of test session (p=0.02) on reaction time, but no effect of condition (p=0.84) and no interaction between condition and session (p=0.26). Reaction time was faster at 120 min (211.3±20.0 ms) vs. 30 min (219.5±20.5 ms, p=0.01) and 60 min (219.8±20.8 ms, p=0.01). There were no main effects of condition (p=0.17) or time (p=0.37), and no interaction between condition and session (p=0.84) on sprint ability. **CONCLUSIONS:** The findings suggest that a daytime nap will not affect subsequent sprint ability or reaction time. However, athletes may feel less ready to perform after napping compared with not napping.

2077 Board #90 June 1 3:30 PM - 5:00 PM
Physiological Variables to Detect Training Distress in Collegiate Soccer Players

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Non-invasive and measureable techniques to identify training distress may be useful to adjust training volume. Traditionally, questionnaire data examining psychological domains have been relied on to detect training distress. **PURPOSE:** To examine running performance (shuttle run), resting heart rate and heart rate recovery throughout a soccer season to determine if these physiological parameters can be used to detect training distress in collegiate soccer players. **METHODS:** 26 women and 17 men were enrolled in the study. Data were collected at four time points throughout the season (beginning, twice during season and during post-season play). Shuttle run time, heart rate recovery time, resting heart rate values, and multi-component training distress scale (MTDS) questionnaire at each time point. Multivariate analyses were performed with the dependent variable, with time, grade in school and gender as independent variable. **RESULTS:** Shuttle run times were prolonged in the beginning and end of season compared to the two mid-season tests (p<0.001); heart rate recovery improved throughout the season (p=0.003); freshmen deviation from baseline MTDS was greater compared to all other grades (p=0.001). Although not statistically significant, resting heart rate values trended up at the end of the season for both genders. MTDS correlated most with shuttle run time and resting heart rate. **CONCLUSIONS:** Shuttle run time and resting heart rate appear to be possible variables that could serve as physiological measures for training distress, although it appears higher physical fitness serves as a protective effect against training distress.

2078 Board #91 June 1 3:30 PM - 5:00 PM
Workload, Energy Expenditure, and Biomarker Differences in Division I Male and Female Soccer Players

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Differential physical demands and physiological responses between males and females in the same sport have rarely been explored. **PURPOSE:** To compare work load and biomarker changes in male and female Division I college soccer players through preseason and the first half of the competitive season. **METHODS:** Male (N=24; M_{age} = 19 ± 1.1 yrs; M_{%BF} = 11.9 ± 3.2 %) and female (N=26; M_{age} = 19 ± 1.3 yrs; M_{%BF} = 20.9 ± 3.4 %) DI college soccer players participated in blood draws prior to preseason (T1), two weeks into the regular season (T2) and at season's midpoint (T3). The athletes arrived fasted in the morning. T2 and T3 draws occurred ~18 h after a game. Creatine kinase (CK), free cortisol (FC), total cortisol (TC), iron (Fe), growth hormone (GH), and IGF-1 were assessed. Workload (km and kcal/kg) was monitored using the Polar Pro system. **RESULTS:** There were no significant changes in TC over time. FC increased from T1 to T2 (Δ FC = 0.34 + 0.1 mcg/dL, P<.05) and remained elevated, particularly for females. There were significant Time x Sex interactions for Fe, GH, and IGF-1 (P<.05). Fe decreased from T1 to T2 (Δ Fe = -29.6 + 7.8 mcg/dL, P<.05) before returning to baseline at T3 in females. CK increased from T1 to T2 (Δ CK = 204.9 + 90.3 U/L, P<.05) before returning to baseline for females and increased from T1 to T3 (Δ CK = 141 + 57.1 U/L, P<.05) for males. GH decreased from T1 to T2 (Δ GH = -2.1 + 0.8 ng/mL, P<.05) and remained below baseline in females. IGF-1 decreased from T2 to T3 in females (Δ IGF-1 = -51 + 14.4 ng/ml, P<.05) while males increased from T2 to T3 (Δ IGF-1 = 50.8 + 12.5 ng/ml, P<.05). Females had greater total work load (T1-T3) than males (227.6 + 58.6 km vs. 183.2 + 49.2 km; 645.1 + 84.5 kcal/kg vs. 501.1 + 110.5 kcal/kg, P<.05, respectively). **CONCLUSIONS:** The increase in FC indicates an elevated stress response, which was particularly pronounced for females. Higher workloads for females in preseason were consistent with earlier elevations in CK compared to males. Additionally, only females had GH changes, suggesting a sex-dependent response. There were also differential changes in IGF-1 across sex. Significant changes in Fe were seen only in females, suggesting unique dietary needs during periods of increased work load. These results suggest differences in training demands and physiological responses for male and female college soccer players.

2079 Board #92 June 1 3:30 PM - 5:00 PM
Biomarkers of Endocrine, Muscle, and Inflammatory Health Track Training Load of a Collegiate Soccer Season

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Blood biomarkers signal health and performance concerns in athletes. However, serial comprehensive biomarker measurement to detect overtraining in elite soccer athletes remains unstudied. **PURPOSE:** To determine if comprehensive biomarker assessment of endocrine, muscle, and inflammatory health change with training progression in collegiate soccer players. **METHODS:** A comprehensive panel of 14 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean±SD; height 181±6cm, body mass 77.9±6.2kg, BF% 11.9±2.4%, VO_{2max} 52.9±6.1 mL·kg⁻¹·min⁻¹) at 5 time points: prior to the start of preseason (PS), and in season at week 1 (W1), W4, W8, and W12. Blood samples from W1-W12 were obtained 32-34 hours post-match. PlayerLoad (PL) was recorded daily with GPS units. Significant changes in biomarkers over time were assessed via repeated measures ANOVA (α < 0.05) and the degree to which biomarkers explained PL were examined using stepwise regression. **RESULTS:** Total testosterone (T, mean±SD; ng·dL⁻¹) was lower at W1 (588±151) vs PS (665±198, p= 0.029) and W8 vs W4 (565±147, 645±170, p= 0.034). Free T (ng·dL⁻¹) was also lower at W1 (103±24) and W12 (99±33) vs PS (127±35, p< 0.025). Free T at W1 (103±24) and W12 (99±33) were decreased vs W4 (125±32, p< 0.022). No differences over time occurred for free cortisol (FC) and total cortisol (TC); however, FC (μg·dL⁻¹) was elevated at PS, W1, and W4 (1.02±0.41, 1.09±0.17, 0.94±0.35) compared to the reference range (ref.) (0.07-0.93 (μg·dL⁻¹) and TC was elevated W1 (22.1 ± 2.1) vs the ref. (4.6-20.6 μg·dL⁻¹). Growth hormone (GH), lactate

dehydrogenase, SHBG, IGF1, and TSH remained unchanged over time. Creatine kinase (CK) was elevated at W1 ($820 \pm 899 \text{ U}\cdot\text{L}^{-1}$; ref. $44\text{-}196 \text{ U}\cdot\text{L}^{-1}$) and exhibited a main effect for time ($p=0.001$) while myoglobin did not change. IL-6 ($\text{pg}\cdot\text{mL}^{-1}$) was increased W8 vs W1 ($1.61 \pm .87, 0.83 \pm 0.20, p=0.007$), however IL-1 β remained unchanged over time. Changes in PL were explained by T4, A1C, Free T, glucose, GH, and CK ($R=0.39, \beta=-0.490, p=0.001$). **CONCLUSION:** Comprehensive biomarker testing detected reduced FT, elevated TC, and increased CK after PS, consistent with a net catabolic state after PS, without apparent overtraining. Variation (39%) in PL was explained by routine monitoring indicating that these biomarkers track training progression.

2080 Board #93 June 1 3:30 PM - 5:00 PM
Monitoring Markers of Nutrition Status Throughout a Collegiate Soccer Season

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Monitoring of nutritional markers is being used to optimize performance, improve overall health, and enhance recovery of athletes. **PURPOSE:** To analyze changes in nutritional biomarkers over the course of an athletic season. **METHODS:** A comprehensive panel of 23 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean \pm SD; height: $181 \pm 6\text{cm}$, body mass: $77.9 \pm 6.2\text{kg}$, BF%: $11.9 \pm 2.4\%$, $\text{VO}_{2\text{max}}$: $52.9 \pm 6.1 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) at 5 time points: prior to the start of preseason (PS), and during season at week 1 (W1), W4, W8 and W12 of the season. Blood samples from W1-W12 were obtained 32-34 hours post-match. Significant changes in biomarkers over time were assessed via 1×5 (group \times time) repeated measures ANOVA ($\alpha < 0.05$) with Bonferroni correction. **RESULTS:** **CONCLUSION:** Comprehensive nutritional, vitamin, and mineral biomarker monitoring detected significant changes over the season in 60% of biomarkers obtained. Although all markers remained within normal reference ranges, future research examining the ability of non-clinical but statistically significant changes in these nutritional biomarkers to explain changes in training volume throughout a competitive soccer season is warranted. Optimization may result in improved health, performance, and recovery. Funding for this study in part by Quest Diagnostics Inc. Characters=1,036/2000

Biomarker	Units-10 ³	Ref. Range	PS		W1		W4		W8		W12		Season
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Chromium	ng-dL	<3.5	0.2	0.0	0.2	0.0	0.2	0.2	0.2	0.0	0.2	0.0	0.4
Cobalt	ng-dL	<11	2	5	2	1	2	2	2	2	2	2	0
Zinc	ug-L	60-130	91	8	84.9	10	91.25	8	102.1	15	101.1	13	86
Selenium	ug-L	88-160	745	24	131	11	128.5	15	144	34	144	11	148
Total Vitamin D	ng-L	80-100	79	12	26	8	19	8	14	8	21.7	8	30
Ferritin	ng-L	15-172	51	28	49	11	52	33	56	39	53	35	31
Serum Folate	ng-mL	>8.0	16.5	5.3	14.7	4.6	15.9	4.4	17.3	3.6	15.4	5.2	15.9
Vitamin B12	pg-mL	200-1000	600	198	678	228	791	304	681	250	686	194	676
Vitamin E (Alpha)	ug-L	5.7-16.9	9.1	2.1	1.8	0.8	9.8	2.0	9.4	2.1	9.8	2.1	9.5
Vitamin E (Beta-Gamma)	ug-L	>4.8	1.1	0.4	1.1	0.3	1.3	0.5	1.4	0.4	1.3	0.4	1.4
Sodium	mmol-L	135-146	139	2	136	2	140	2	142	1	142	1	140
Chloride	mmol-L	96-110	101.6	2.3	105.5	1.8	102.6	1.5	103.6	2.2	103.1	1.6	102.4
Magnesium	ug-L	1.5-2.5	2.0	0.1	2.1	0.3	2.0	0.1	2.1	0.1	2.5	0.1	2.1
Calcium	mg-dL	8.8-10.4	9.8	0.4	9.6	0.3	9.5	0.2	9.8	0.3	9.5	0.3	9.7
Uric Acid	mg-dL	4.0-8.0	5.1	0.8	5.7	0.9	5.3	0.8	5.3	0.7	5.1	0.8	5.3
Total Iron	ug-L	37-144	83	16	90	16	76	23	98	40	80	18	81
TIBC	ug-L	271-448	309	29	313	28	317	32	333	33	337	30	322
Saturation	%	9-12	28	10	28	11	24	8	30	12	25	11	22
Omega-3 Index	%	1.4-4.9	2.5	0.7	1.6	0.4	1.8	0.2	1.7	0.3	2.3	0.5	2.0
Omega-3/Omega-6 Ratio	Ratio	5.7-21.3	7.5	2.2	12.8	1.7	13.8	1.7	14.3	2.3	13.1	2.8	12.2
DHA	%	0.2-1.5	0.4	0.1	0.3	0.1	0.4	0.1	0.4	0.2	0.5	0.3	0.4
EPA	%	1.2-3.9	1.6	0.6	1.2	0.3	1.4	0.2	1.3	0.2	1.8	0.4	1.6
Carotene	ug-L	4-11	28	16	11.3	3.1	17	13	16	10	23	5	23

TIBC=Total Iron Binding Capacity; EPA=docosahexaenoic acid; DHA=docosahexaenoic acid; NE=Not Established
 * Different (p<0.05) than PS; † Different (p<0.05) than W1; ‡ Different (p<0.05) than W4; § Different (p<0.05) than W8; ¶ Different (p<0.05) than W12

2081 Board #94 June 1 3:30 PM - 5:00 PM
Inspiratory Performance is Significantly Related to Isokinetic Knee Power in Collegiate Women Soccer Players

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Sport specific tasks (SST) and exercise training are known to elicit specific changes in peripheral skeletal muscles (PSM), but adaptations to inspiratory muscles (IM) are poorly understood. **PURPOSE:** To examine the relationship of the PSM and IM in Division I collegiate women soccer players (DICWSP). **METHODS:** Thirteen DICWSP underwent maximal tests of PSM and IM via isokinetic dynamometry (ID)

and the Test of Incremental Respiratory Endurance (TIRE), respectively. Standard ID measurements were obtained during maximal extension (EXT) and flexion (FLEX) of the dominant knee at 60, 180, and 300 deg/sec as well as an endurance (ENDUR) test of repeated EXT and FLEX at 180 and 300 deg/sec. TIRE testing provided maximal inspiratory pressure (MIP), measured from residual volume (RV), and sustained maximal inspiratory pressure (SMIP), measured from RV to total lung capacity. **RESULTS:** The mean \pm SD age, height, and weight of the DICWSP was 19.5 ± 1.0 years, 172 ± 5 cm, and 63.5 ± 5 kg, respectively. The mean \pm SD peak torque of EXT and FLEX at 60, 180, and 300 deg/sec were 115 ± 17 and 75 ± 13 , 85 ± 9 and 55 ± 10 , and 65 ± 8 and 47 ± 10 ft-lbs, respectively. The mean \pm SD power of EXT and FLEX at 60, 180, and 300 deg/sec were 99 ± 13 and 65 ± 11 , 175 ± 18 and 114 ± 26 , and 170 ± 27 and 113 ± 34 watts, respectively. The mean \pm SD slope of ID ENDUR for EXT and FLEX at 180 and 300 deg/sec were -12 ± 7 and -8 ± 7 and -16 ± 5 and -11 ± 9 , respectively. The mean \pm SD MIP and SMIP were 88 ± 23 cm H₂O and 420 ± 132 PTU, respectively. Significant negative correlations were observed between MIP and slope of ID ENDUR for EXT at 180 and 300 deg/sec ($r = -.61$ and $-.58$, respectively; $p < 0.05$). Significant positive correlations were observed between SMIP and peak torque of EXT and FLEX at 60 deg/sec ($r = .51$ and $.55$, respectively; $p < 0.05$) and SMIP was significantly correlated in a positive direction to mean power of EXT and FLEX at 180 and 300 deg/sec ($r = .59$ and $.70$ and $r = .71$ and $.68$; $p < 0.05$, respectively). **CONCLUSIONS:** The significant positive relationships of SMIP to knee EXT and FLEX power at 180 and 300 deg/sec highlights the role that greater IMP appears to have in the development of greater power for both knee EXT and FLEX. SST appear to elicit similar adaptations in the PSM and IM highlighting the specificity of exercise especially as it relates to soccer.

2082 Board #95 June 1 3:30 PM - 5:00 PM
Starters and Non-Starters Require Separate Load Monitoring and Analyses Throughout a Collegiate Soccer Season

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Measures of internal and external load are used to quantify training volume and stress in athletes, however, differences in loads experienced between starters and non-starters is not well quantified in collegiate soccer. **PURPOSE:** To compare differences in measures of load between starters (S) and non-starters (NS) throughout a collegiate soccer season. **METHODS:** Twenty NCAA Division I male soccer players (mean \pm SD; age 20 ± 1 yrs, height 181 ± 6 cm, body mass 77.9 ± 6.2 kg, BF% $11.9 \pm 2.4\%$, $\text{VO}_{2\text{max}}$ $52.9 \pm 6.1 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) were monitored over specific intervals aligning with major time periods throughout the season; preseason to week 1 (PS-W1), W1-W4, W4-W8 and W8-W12. Mean session time (ST), PlayerLoad (PL), distance (DST), max velocity (Vel_{max}), velocity load (VL), heart rate (HR), time spent $>95\%$ HR ($\text{HR}>95\%$), and sprint efforts (SP_{E}) were recorded daily with GPS units. Players were placed into groups, S ($n=10$) and NS ($n=10$) based on total playing time in matches. A group \times time repeated measures ANOVA with Tukey-HSD post hoc test was used to assess differences between S and NS ($\alpha, p < 0.05$). **RESULTS:** Significant group by time interactions were found for ST ($F_{3,27}=5.398, p=0.005$), DST ($F_{3,27}=4.607, p=0.010$), PL ($F_{3,27}=3.183, p=0.050$), Vel_{max} ($F_{3,27}=8.918, p=0.001$), VL ($F_{3,27}=7.257, p=0.001$), $\text{HR}>95\%$ ($F_{3,27}=5.296, p=0.005$), and SP_{E} ($F_{3,27}=7.137, p=0.001$). Independent of group, ST was longer during PS-W1 (Mean \pm SE; 100 ± 9.7 min) than W1-4 (82.9 ± 1.4 min, $p=0.001$), W4-8 (81.8 ± 1.0 min, $p=0.001$), and W8-12 (76.5 ± 1.3 min, $p=0.001$). Furthermore, $\text{PL}\cdot\text{min}^{-1}$ was higher during W4-8 (7.19 ± 0.27 AU, $p=0.001$) and W8-12 (7.18 ± 0.18 AU, $p=0.001$) than PS-W1 (5.85 ± 0.26 AU). Vel_{max} was lower W1-4 ($6.56 \pm 0.10 \text{ m}\cdot\text{s}^{-1}$) and W8-12 ($5.90 \pm 0.20 \text{ m}\cdot\text{s}^{-1}$) than PS-W1 ($7.06 \pm 0.12 \text{ m}\cdot\text{s}^{-1}$, $p=0.025$, $p=0.006$). HR was elevated W4-8 (145 ± 2 bpm) than PS-W1 (135 ± 2 bpm, $p=0.004$) and W1-W4 (133 ± 2 bpm, $p=0.001$). **CONCLUSION:** Measures of load differed between various time intervals throughout the competitive soccer season, independent of match playing time, however significant differences between S and NS were present. These data suggest that load measures be analyzed separately for S and NS throughout the season due to influences of match play. This is particularly relevant when monitoring, periodizing, and prescribing training loads.

THURSDAY, JUNE 1, 2017

2083 Board #96 June 1 3:30 PM - 5:00 PM
Comparison between Anthropometry and Bioelectrical Impedance in Estimating Fat and Muscle Masses in Soccer Players

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Anthropometry-based models are broadly used to indirectly estimate body fat and muscle masses. Bioelectrical impedance analysis is an advanced method for indirect measurement of the main components of body composition. **PURPOSE:** This study intended to evaluate agreement in assessing body fat and muscle masses in soccer players between an anthropometry-based model and the bioelectrical impedance analysis.

METHODS: Data from 46 male competitive soccer players were analyzed (Age = 25.6 ± 3.5 yr, Body mass = 75.8 ± 6.7 kg, BMI = 24.9 ± 1.6 kg·m⁻²; mean \pm SD). The anthropometry-based estimations of fat and muscle masses were obtained by means of the four-compartment model of De Rose and Guimaraes (1980) (DRG). This model was modified using the regression equation of Withers *et al.* (1987, cited by Norton, 1996) to estimate body density, and Siri formula (1961) to compute the percentage of body fat. Fat and muscle masses were also assessed by means of bioelectrical impedance analysis (BIA). The paired *t*-test was used to evaluate the differences between the two measurement techniques. The Bland-Altman approach was applied to estimate 95% limits of agreement. The statistical significance level was set at $p < 0.05$.

RESULTS: Significant differences were observed in fat and muscle masses between DRG and BIA (respectively: 8.71 kg vs. 10.13 kg, $p < 0.001$; and 36.80 kg vs. 37.85 kg, $p < 0.001$). The 95% limits of agreement were from -5.13 kg to 2.29 kg for fat mass, and from -4.67 kg to 2.58 kg for muscle mass. On a percentage scale, the results were as follows: 11.36 % vs. 13.16 % ($p < 0.001$) for fat mass, and 48.63 % vs. 50.04 % ($p < 0.001$) for muscle mass; the 95% limits of agreement were, respectively, from -6.80 % to 3.20 %, and from -5.97 % to 3.16 %. The difference between methods revealed negligible to low sample correlations with the range of measurement for the two variables, both in absolute and percentage scales.

CONCLUSIONS: The anthropometry-based model on average underestimated the fat and muscle masses compared to BIA, in both cases in a quantity less than 1.5 kg (and less than 2 %). The bias between the methods had a harmful effect on the limits of agreement. Additional testing would be necessary to confirm these results.

2084 Board #97 June 1 3:30 PM - 5:00 PM
FIFA 11+ Warm-up: Effects On Movement Control And Performance In Young Female Soccer Athletes

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In an effort to reduce soccer injury rates, the Fédération Internationale de Football Association (FIFA) developed the 11+ warm-up. Widespread uptake of this program remains a challenge despite its effectiveness, but may be increased if positive impacts on physical performance as well as injury risk factors such as neuromuscular control are shown. Effects of the program on physical performance measures and movement control have not been investigated in young female soccer athletes. **PURPOSE:** To determine the effect of the FIFA 11+ program, compared to a standard warm-up, on movement control, agility, vertical jump (VJ), and core stability in young female athletes after a 5 month indoor soccer season.

METHODS: Forty-seven girls from the U10 and U11 divisions of a developmental soccer club were randomized by team to the intervention group (IG) or the control group (CG). IG teams were taught the 11+ warm-up, consisting of 15 exercises broken into 3 sections: 1) slower running drills, 2) strength and plyometric exercises, and 3) faster sprints. The CG continued with their previously planned warm-up. Teams practiced and played 2-3x/week. Blinded assessors conducted pre- and post-season testing of movement control (Landing Error Scoring System), and physical performance (T-test, VJ, and static plank). Two-way Repeated Measures ANOVA analyses were used to compare movement control and physical performance of the groups over time. **RESULTS:** The IG demonstrated a significantly greater increase in static plank hold time compared to the CG (26.1 ± 38.5 vs. 2.1 ± 37.1 seconds, $p = .047$). All athletes, regardless of group, improved their LESS score (pre- 6.8 ± 1.6 ; post-season 6.2 ± 1.4 , $p = .005$) and agility T-test time (pre- 14.2 ± 1.2 ; post-season 13.8 ± 1.0 seconds, $p = .001$). No differences were found for the VJ.

CONCLUSIONS: The 11+ program, performed over a 5 month indoor soccer season by 9-11 year old soccer players, resulted in improved core stability compared to a regular warm-up, but this did not translate into a significantly greater change in LESS score in the IG. The 11+ program may not be more effective than other dynamic warm-ups at improving neuromuscular control and agility. However, time and space limitations inherent in the indoor soccer environment may have negatively impacted the program's ability to reach its full potential.

2085 Board #98 June 1 3:30 PM - 5:00 PM
Implication Of Dynamic Balance In Change Of Direction Performance In Young Elite Soccer Players Is Angle Dependent?

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PURPOSE: Team sports require rapid whole body change of direction (COD) in order to regain, maintain possession of the ball or to avoid opponent. These actions are often performed through unilateral process, with the contralateral leg incurring no ground contact. As a result, maintaining unilateral dynamic balance remains important. The aim of this study was to examine the relationship between dynamic balance (DB) and COD performance in young elite soccer players.

METHODS: 20 right-footed young elite soccer players (age= 16.42 ± 0.55 year, height= 176 ± 2.5 cm; leg length= 95.70 ± 3.34 cm, body-mass= 67.03 ± 5.20 kg) participated in this study. All players performed star excursion balance test (SEBT) with dominant (DL) and nondominant leg (NDL). 10m sprint with COD of 45°, 90°, 135° or 180° after 5m were also assessed with COD on both right and left sides.

RESULTS: Correlations analysis showed significant negative relationships between COD tests (with DL and NDL) and SEBT. Stepwise multiple regression analysis showed that DB performance explained between 20% and 75% of the variance of COD tests. Likewise, dynamic balance contribution was dependent upon the angle of COD and the leg used to turn.

CONCLUSIONS: Dynamic stability performance was significantly correlated with COD's performance in young elite soccer players which, possibly due to similarities in movement demands and muscle recruitment. Furthermore, the contribution of dynamic balance on COD performance was angle dependent. Individualized specific dynamic stability exercises may be required to compensate players' deficit in each COD angle.

2086 Board #99 June 1 3:30 PM - 5:00 PM
Relationship Between Physiological Load, Body Composition, And Performance Across Season In Female Soccer Athletes

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 (No relationships reported)

Body composition has been widely recognized as one of the many factors that could affect performance in the collegiate athlete, including body fat percentage and its changes across the competitive season. Zephyr Performance Systems have been used as a tool to measure physiological load in competitive athletes. Changes in body composition and fitness measures have been reported in female soccer athletes, but few have examined the relationship between them across the season, and their potential effect on post-season fitness measures. **PURPOSE:** The purpose of this study was to determine the relationship between physiological load and body composition across the season on the post-season performance of the Yo-Yo Intermittent Recovery Test 2 in Division I Female Soccer Athletes.

METHODS: Thirty female soccer athletes, age (19.4 ± 1 year) with pre-season body fat percentage ($22.7 \pm 5.3\%$), participated in the Yo-Yo Intermittent Recovery Test 2 (YYIR2) prior to their fall pre-season conditioning period. Body fat percentage was assessed pre and post-season using BodPod assessment. Zephyr Performance Systems were worn during home season games to quantify and record the athletes' physiological load, which was averaged over the season (AVEPL). Athletes completed a second YYIR2 at the conclusion of their post-season play and the change in the distance covered on this assessment from pre to post-season was recorded (ChangeDist).

RESULTS: No differences were observed in YYIR2 or body fat percentage between pre and post-season. However, AVEPL was negatively correlated with pre to post-season change in distance covered (ChangeDist), $r = -0.489$, $p = 0.040$. Linear regression analysis also revealed ChangeDist was inversely related to AVEPL ($\beta = -0.448$, $p = 0.048$). When adjusted for age and pre to post-season change in body fat percentage (ChangeBF), AVEPL remained inversely related to ChangeDist ($\beta = -0.446$, $p = 0.037$).

CONCLUSIONS: Athletes with higher average physiological load across the season exhibited a decrease in performance on the post-season Yo-Yo Intermittent Recovery Test 2 when compared to pre-season, regardless of change in body fat percentage.

Further research should be done to determine whether these results are due to a true decline in fitness levels or a decline in motivation to perform on the post-season assessment.

2087 Board #100 June 1 3:30 PM - 5:00 PM
The Effect of a Concurrent Strength and Conditioning Program in Female Soccer Players

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(No relationships reported)

BACKGROUND: Due to the high metabolic and physical demands involved in soccer, an optimal strength and conditioning program for female high school soccer players essential. The benefits of resistance training and high intensity interval training in young athletes has been well documented; however, the effect of a concurrent strength and metabolic conditioning program on female athletes in specific sports has yet to be investigated. **PURPOSE:** To examine the effects of an 8-week concurrent strength and metabolic conditioning program on body composition, flexibility, speed, agility, anaerobic capacity, strength, and power in female soccer players. **METHODS:** Body composition and performance testing measures were recorded in female soccer players ($n = 14$, age = 16 ± 1.0 yrs) before and after an 8-week sports performance camp that combined concurrent high intensity interval training methods and periodized resistance training. Performance testing included 3-site skinfolds, sit and reach, pro agility test, 40yd sprint, 300yd shuttle run, and vertical jump. Strength testing included a 5-repetition maximum back squat, shoulder press, and bench press, and a 3-repetition maximum power clean. Comparisons were made using a paired samples t-test, and Pearson's correlations between variables were calculated. **RESULTS:** Significant improvements were made in vertical jump ($p < 0.05$), pro agility test ($p < 0.05$), 40yd sprint ($p < 0.05$), squat ($p < 0.05$), shoulder press ($p < 0.05$), bench press ($p < 0.05$), and power clean ($p < 0.05$). There were significant correlations between increases in power with agility and speed, as well as correlations between power and strength. **CONCLUSION:** An 8-week concurrent strength and conditioning program was effective for improving measures of fitness and performance in female soccer players. Overall, power and strength increased, as well as a significant decrease in time to complete the agility and speed testing.

2088 Board #101 June 1 3:30 PM - 5:00 PM
Physiological Performance Measures in Female Collegiate Soccer Players

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(No relationships reported)

Although participation in women's soccer has increased dramatically in the last two decades, the research into the physiological demands and physical characteristics of players is limited.

PURPOSE: To compare anaerobic and aerobic power in female intercollegiate soccer players with a reference group of elite international players.

METHODS: Subjects were 28 members of a division I university women's soccer team. Maximal aerobic power (VO_{2max}) was determined during an incremental treadmill run using a MOXUS metabolic measurement system. The Margaria-Kalamara power test was timed using switch mats to determine anaerobic power. Bone mineral density and percent body fat were determined by dual-energy X-ray absorptiometry (DEXA). Anaerobic power comparisons were made by converting literature values for vertical jump heights to watts by the Lewis formula.

RESULTS: VO_{2max} was similar between the collegiate players and the reference group of international players (52.7 ± 5.8 vs 51.5 ± 3.3 ml/kg/min for collegiate and reference players respectively). Similarly, anaerobic power was not different between the collegiate and the international players (841.2 ± 112.4 vs 808.8 ± 109.5 watts). Height (165 ± 6 vs 169 ± 2 cm) and mass (61 ± 7 vs 61 ± 2) were similar between the two groups; however the collegiate players had a higher percent body fat than the reference players (25.9 ± 5.2 vs 17.5 ± 2.6 %).

CONCLUSION: These results suggest that the female collegiate players have aerobic and anaerobic power comparable to that reported for international (primarily European) elite female soccer players. Although the collegiate players were of similar height and body mass as the international players, the collegians had considerably higher percent body fat.

2089 Board #102 June 1 3:30 PM - 5:00 PM

Effect of Ages and Jump Types on Lower Limb Explosiveness in Elite Female Soccer Players

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BACKGROUND: Explosiveness of lower limbs is an important skill as to be a quality soccer player. A few studies have been performed to investigate explosiveness using male soccer players; however, it is not well studied in females, especially during their growth process and different jump types.

PURPOSE: To compare explosiveness of lower limbs in three different age categories of national level female soccer players in three types of jumps.

METHODS: A total of 49 female national level soccer players of three age categories (U15 = players under 15 years $N = 17$, U17 = players under 17 years $N = 16$, U19 = players under 19 years $N = 16$) were tested using a two force platforms in three types of jumps: countermovement jump free arms (CMJFA), countermovement jump (CMJ), squat jump (SJ). The following parameters were evaluated: jump height (JH), maximum take-off force (F_{max}) and force difference between preferred and non-preferred leg (F_{diff}). All parameters were processed using MANOVA and Bonferroni post-hoc test, effect size (η^2).

RESULTS: Players achieved the following values: (U15: CMJFA = 32.58 ± 3.25 cm, CMJ = 28.19 ± 3.81 cm, SJ = 25.38 ± 3.33 cm, U17: CMJFA = 34.26 ± 4.22 cm, CMJ = 29.64 ± 3.34 cm, SJ = 28.05 ± 3.19 cm, U19: CMJFA = 37.20 ± 5.80 cm, CMJ = 31.89 ± 5.47 cm, SJ = 29.98 ± 5.17). Bonferroni's post hoc test revealed significant differences in explosiveness between U15 and U17 as well as U15 and U19 ($p < 0.05$). The MANOVA analysis revealed a significant age effect on JH ($F_{2,147} = 12.61$; $p < 0.01$, $\eta^2 = 0.16$) and F_{max} ($F_{2,147} = 4.19$; $p < 0.05$, $\eta^2 = 0.06$). Also, significant effect was detected by different type of jump on JH ($F_{2,147} = 33.28$; $p < 0.01$, $\eta^2 = 0.33$) and F_{max} ($F_{2,147} = 24.2$; $p < 0.01$, $\eta^2 = 0.26$). We also found significant effect of jump types on F_{diff} ($F_{2,147} = 6.49$; $p < 0.01$, $\eta^2 = 0.09$). Players achieved significantly higher F_{diff} in CMJ = 9.59 ± 6.79 % compare to SJ = 5.56 ± 3.89 cm ($p < 0.01$). Thirteen players (26.5 %) had a F_{diff} higher than 10% during take-off.

CONCLUSION: Explosiveness is different by ages in youth elite female soccer players. Jump types influence jump height and maximum take-off force as well as force difference between preferred and non-preferred leg. The study revealed significant differences F_{diff} with respect to the type of jump. More than 25% of female soccer players had F_{diff} greater than 10%.

2090 Board #103 June 1 3:30 PM - 5:00 PM

The Lower Extremity Strength, Bilateral And Ipsilateral Strength Asymmetries In Elite Female Soccer Players

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BACKGROUND

Soccer frequently involves one-sided activities such as kicking, tackling and passing, which may lead to strength asymmetries (SA), and effect of the age is not well studied.

PURPOSE

The aim was to investigate effect of limb-dominance and ages through relative strength measures of knee extensors (KE), knee flexors (KF), bilateral strength ratio (QQ, HH), and ipsilateral strength ratio (HQ) in youth elite female soccer players.

METHODS

National level female soccer players of three age categories (Under 16 years =17, Under 17 years =16, Under 18 years =16 players) performed isokinetic strength testing for KE, KF at three velocities (60, 180, 300 °.s⁻¹) for the dominant (DL) and non-dominant leg (NL). Mean peak torque of extensors (PTE) and flexors (PTF) values were calculated in Newton-meters relatively to body weight (N-m.kg⁻¹) and strength ratios were derived from peak torques. Three-way Mixed-design ANOVA with two between subject effect (age, limb dominance) and one within subject effect (angular velocity) were used. Bonferroni's *post-hoc* test was employed due to the multiple comparisons. Effect size was assessed using the η_p^2 coefficient.

RESULTS

Significant age effect was observed in PTE and PTF (PTE: $F_{2,91} = 4.60$, $p = 0.013$, $\eta_p^2 = 0.09$, PTF: $F_{2,91} = 11.31$, $p = 0.001$, $\eta_p^2 = 0.20$). Conversely, age did not indicate significantly effect on bilateral strength ratio (QQ, HH) ($F_{2,91} = 2.00$, $p = 0.141$, $\eta^2 = 0.04$) a HQ (HQ: $F_{2,90} = 1.03$, $p = 0.361$, $\eta^2 = 0.02$). Significant limb dominance effect was not identified in PTE, PTF and HQ (PTE: $F_{1,91} = 0.06$, $p = 0.810$, $\eta^2 = 0.01$, PTF: $F_{2,91} = 0.30$, $p = 0.587$, $\eta_p^2 = 0.00$, HQ: $F_{2,91} = 3.50$, $p = 0.065$, $\eta^2 = 0.04$). We found significantly higher strength asymmetries in KF compare to KF ($F_{1,91} = 15.89$, $p =$

0.000, $\eta^2=0.15$). Post-hoc analysis showed a significant difference in PTE between U15 vs. U19 and in PTF between U16 vs. older age category (U17, U19). The higher bilateral strength differences ($QQ > 10\%$) we found in following age categories (U16 = 53%, U17 = 50%, U19 = 56%). Moreover in knee flexors ($HQ > 10\%$) were even higher strength asymmetries (U16 = 71%, U17 = 75%, U19 = 79%).

CONCLUSIONS

The current results indicated effect of age on PTE, PTF but not in limb dominance. More attention should be paid to knee flexors where higher occurrence of strength asymmetries were found.

2091 Board #104 June 1 3:30 PM - 5:00 PM
Multicomponent Training Distress Scale (MTDS) Questionnaire to Detect Training Distress in Collegiate Soccer Players
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It may be helpful for coaches and trainers to understand risk factors that predict training distress in collegiate athletes. Recognizing who is at risk can assist in the detection of early symptoms so that training adjustments can be made and overtraining avoided. Subjective measurements of subjects' psychological state can be collected with simple questionnaires and are useful for determining training distress. **PURPOSE:** To utilize the Multicomponent Training Distress Scale (MTDS) questionnaire to examine athletes' mood and physical states for determination of training distress risk. Gender, season duration, and grade in school were considered variables of interest for predicting training distress. **METHODS:** 17 male and 26 female collegiate soccer players were enrolled in the study. The MTDS was administered at four time points throughout the season (at the beginning, twice during the season, and once during post-season play). Questionnaires were given to all athletes at the end of their training sessions. Multivariate analyses were performed with the dependent variables of the MTDS across time, grade in school and gender. Only the composite MTDS score is reported in this abstract. **RESULTS:** The overall multivariate was significant ($p < 0.05$); the main effects for gender, time, and year in school were also significant ($p < 0.05$). Overall, female scores were higher than males. Males exhibited less training distress throughout the season while females had increasing scores throughout the season, then declined at the end ($p = 0.042$). Post-hoc analysis for year in school showed that freshman and sophomores had higher training distress scores compared with juniors and seniors ($p = 0.001$). **CONCLUSIONS:** MTDS identified gender and year in school as possible variables that could serve as indicators for risk of training distress. College coaches and trainers should consider applying different training loads to men and women as well as underclassmen and upperclassmen.

2092 Board #105 June 1 3:30 PM - 5:00 PM
Stress and Mood Affect Sleep Quality and Quantity in Collegiate Female Soccer Players
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Despite a growing number of studies indicating that reduced sleep duration and quality have a negative influence on recovery and performance in many sports, data regarding the sleep habits of collegiate athletes is lacking. Highlighting factors that have a negative influence on sleep in collegiate athletes could lead to interventions that may increase sleep duration and quality, which could lead to increased performance and reduced injuries. College level athletes balance many physical and mental stressors, in order to be successful as student-athletes, and given the close relationship between mental states and sleep, these stressors may interfere with their sleep. **PURPOSE:** To explore associations between stress, mood, sleep quality, and sleep duration in a college female soccer team across an entire season. **METHODS:** Twenty-one Division I female soccer players (18.9±1.28 years; 167.5±4.91 cm; 63.8±6.9kg) participated in this study. Each participant was asked to record their levels of stress, mood, and sleep quality using a 7-point scale into a smartphone application, every day for an entire competitive season. Stress was rated from -3: Very anxious to 3: Very Calm; mood was rated from -3: Very Unpleasant to 3: Very Pleasant; and Sleep Quality was rated from -3: Very Restless to 3: Very Restful. Subjects were also asked to record the duration of their sleep. Pearson's correlations were conducted to test associations between stress, mood, sleep quality, and sleep quantity. **RESULTS:** There was a positive relationship between mood and sleep quality ($r = -0.230, p < 0.01$), and stress and sleep quality ($r = -0.305, p < 0.01$). There was also a correlation between mood and sleep duration ($r = -0.052, p < 0.05$), and stress and sleep duration ($r = 0.076, p < 0.01$).

CONCLUSIONS: Both sleep quality and sleep duration are negatively affected by increased stress and also by a perceived low mood. Interventions that could help players better manage their stress and elevate their mood could result in increased sleep quality and duration in college soccer players.

2093 Board #106 June 1 3:30 PM - 5:00 PM
Monitoring Markers of Oxygen Transport Throughout A Collegiate Soccer Season
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Consistent tracking of oxygen transport blood biomarkers may help inform coaching decisions to help reduce risk of overtraining. **PURPOSE:** To characterize changes in oxygen transport markers over the course of a collegiate soccer season. **METHODS:** A panel of 9 biomarkers was assessed in blood samples from 20 NCAA Division I male soccer players (mean ± SD; height 181 ± 6cm, body mass 77.9 ± 6.2kg, BF% 11.9 ± 2.4%, VO_{2max} 52.9 ± 6.1 mL·kg⁻¹·min⁻¹) at 5 time points: before preseason (PS) and during season at week 1 (W1), W4, W8, and W12. Blood specimens from W1-W12 were obtained 32-34 hours post-match. Significant changes in biomarkers over time were assessed via repeated measures ANOVA ($\alpha < 0.05$, Bonferroni post hoc). **RESULTS:** Post season VO_{2max} (53.9±5.3 mL·kg⁻¹·min⁻¹) was similar to PS ($p = 0.064$). Hematocrit (HCT) levels were lower at W1 vs PS (mean±SD, 45±1%, 47±1%, $p = 0.015$). Total iron binding capacity (TIBC) was higher W12 (314±26µg·dL⁻¹) vs PS (339±30µg·dL⁻¹, $p = 0.006$), W1 (315±6µg·dL⁻¹, $p = 0.004$) and W4 (320±7µg·dL⁻¹, $p = 0.005$). TIBC W8 (333±8µg·dL⁻¹) and W12 (339±7µg·dL⁻¹) were higher than W1 (315±6µg·dL⁻¹, $p < 0.048$). Total 25-hydroxy vitamin (VitD) decreased throughout the season. VitD at W12 (31±2ng·mL⁻¹) was lower than PS (39±2ng·mL⁻¹, $p = 0.004$), W1 (36±2ng·mL⁻¹, $p = 0.007$), W4 (35±2ng·mL⁻¹, $p = 0.028$), and W8 (35±2ng·mL⁻¹, $p = 0.007$). Percent saturation, total iron, red blood cells, ferritin, and vitamin D2 did not change significantly over time throughout the season. **CONCLUSION:** Select measures of oxygen carrying capacity (HCT, TIBC) were reduced after PS. However, assessment of the panel in a more inclusive approach determined that there was no consistent evidence of reductions in oxygen carrying capacity. Assessment of VitD as part of a panel assessing oxygen transport capacity is novel, given the putative role of VitD in VO_{2max} . Ongoing research aims to further characterize any relationship of oxygen carrying capacity biomarkers to performance during long training seasons. Funding for this study in part by Quest Diagnostics Inc.

2094 Board #107 June 1 3:30 PM - 5:00 PM
Body Composition Changes In Female Collegiate Soccer Athletes From Preseason To Postseason
 Paul A. Burkett, Shawn D. Felton, Mitchell L. Cordova, FACSM. *Florida Gulf Coast University, Fort Myers, FL.*
 (Sponsor: Mitchell L. Cordova, FACSM)
 (No relationships reported)

Previous studies have suggested that percent body fat (%BF) and lean mass do not change from pre- to postseason in female collegiate soccer athletes even though changes may be seen in athletes competing in other sports. **PURPOSE:** To document changes from pre- to postseason in body mass, %BF, fat distribution, and lean mass in female collegiate soccer athletes using readily available skinfold measures. **METHODS:** Twenty-four healthy female collegiate soccer athletes with a mean age of 19.6 ± 1.2 years participated. Participants were screened pre- and postseason using standard anthropometric measurements that included: height, weight, and skinfold measure of the triceps, suprailiac, and thigh areas. The measurements were conducted by an exercise physiologist with 25 years of experience and the skinfold technique was selected for collection convenience. The measurements allowed for calculation of the BMI, lean body mass, lean body mass index (LBMI), and %BF, and for comparison from pre- to postseason. The individual skinfold sites were also compared from pre- to postseason. **RESULTS:** There were no differences between the measurements obtained on the two testing dates for body mass (62.18 & 62.26 kg; $t = -2.29$; $p \geq 0.05$), BMI (22.07 & 22.35; $t = -1.96$; $p \geq 0.05$), lean body mass (46.94 & 46.57 kg; $t = 1.65$; $p \geq 0.05$), LBMI (16.75 & 16.62; $t = 1.44$; $p \geq 0.05$), and %BF (24.38 & 25.25; $t = -1.79$; $p \geq 0.05$). There were differences in skinfold thickness at the triceps (19.5 & 20.5 mm; $t = -2.102$; $p < 0.05$) and suprailiac (15.98 & 17.70 mm; $t = -2.57$; $p < 0.05$) assessment sites. The covariate of field position was not a significant factor in the changes noted in triceps [$F(1,22) = 0.55$ $p = 0.47$] and suprailiac [$F(1,22) = 0.55$ $p = 0.47$] thickness.

CONCLUSION: These results suggest that female collegiate soccer athletes did not experience changes in %BF or lean mass from pre- to postseason. However, there may be small increases in fat accumulation at specific sites. Monitoring of individual athletes for these types of changes might also be important.

2095 Board #108 June 1 3:30 PM - 5:00 PM
Heart Rate and Energy Expenditure in Division I College Soccer Players during a Competitive Season
 Shane F. O'Riordan, Gavin Connolly, Tomas Barrett, Emmi Lawless, Marina Hartmann, Mikaela Gabler, Paul L. O'Connor. *Central Michigan University, Mount Pleasant, MI.*
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 (No relationships reported)

PURPOSE: The use of monitoring systems (e.g. Global Positioning Systems (GPS), heart rate monitors) to determine metabolic and physiological requirements within different sports is increasing in popularity. However, little to no information exists on the metabolic and physiological needs during Division I women's soccer. The purpose of this project was to measure heart rate data and energy expenditure in Division I college soccer players during the regular competitive season. **METHODS:** 12 college female soccer players (19.3 ± 1.6 yrs, 167 ± 3.0 cm, 62.4 ± 4.9 kg) were included based on playing time criteria (>60%). Measures recorded for all players included average heart rate (AvHR), average heart rate percentage (AvHR%), peak exercise heart rate (HR_{peak}), percentage of time spent in predetermined zones (%TM1, %TM2, %TM3) and energy expenditure per kilogram (EE). Differences between positions, center backs (CB), full backs (FB), midfielders (MF) and forwards (FW), were assessed.

RESULTS: Significant differences (p≤0.05) were observed across positions for parameters measured. AvHR for CB and MF was significantly lower than FW (168.9 ± 5.8 vs. 179.6 ± 6.9 bpm, 172.7 ± 7.8 vs. 179.6 ± 6.9 bpm). CB AvHRs were also significantly lower than FB (168.9 ± 5.8 vs. 177.3 ± 5.9 bpm). MF HR_{peak} was significantly lower than all groups. CB HR_{peak} was also significantly lower than FW (195.5 ± 3.6 vs. 200.2 ± 5.0 bpm). AvHR% was significantly lower and %TM1 was significantly higher for CB compared to all groups. For %TM2, MF were significantly higher than CB (81.7 ± 12.7 vs. 68.7 ± 20.0%) and FW (81.7 ± 12.7 vs. 68.3 ± 16.0%). FW were significantly higher than MF for %TM3 (27.7 ± 17.4 vs. 11.1 ± 14.3%). EE was significantly higher for MF compared to all groups.

CONCLUSIONS: Results identified positional differences for metabolic and physiological needs during competitive DI college soccer. This information could contribute to the understanding of the game and implementing specific training regimens.

2096 Board #109 June 1 3:30 PM - 5:00 PM
Workload-related Psychological And Physiological Changes In Female College Soccer Players During A Competitive Season
 Bridget A. McFadden, Alan J. Walker, David J. Sanders, Morgan Hofacker, Marissa Bello, Anthony Poysick, Nicholas Mackowski, Christopher Ordway, Brittany Bozzini, Shawn M. Arent, FACSM. *Rutgers University, New Brunswick, NJ.*
 (No relationships reported)

Adequate recovery from stressors is an essential aspect of an athletes training program. Insufficient recovery can present itself in the form of psychological and physiological changes that manifest as performance decrements. **Purpose:** To assess the influence of training demands on mood, sleep, biomarkers, and performance in D1 collegiate female athletes during a competitive season. **Methods:** Female D1 college soccer players (N=25; M_{age}=19.4 ± 1.4 yrs; M_{weight}=66.1 ± 1.3 kg) participated in blood draws prior to pre-season (T1), and at weeks 2 (T2), 6 (T3) and 10 (T4) of the regular season. Athletes arrived for blood draws fasted and euhydrated. T2, T3, and T4 draws occurred ~18 hours after a game. Creatine Kinase (CK), Free Cortisol (CF), Total Testosterone (TT), Estrogen (E), and Growth Hormone (GH) were analyzed. The Multi-Component Training Distress Scale (MTDS; Main & Grove, 2009), the Pittsburgh Sleep Questionnaire Index (PSQI; Buysse et al., 1989), and vertical jump (VJ) were also assessed at each time-point. Workload per session (km and kcal/kg) was monitored using the Polar Pro system. **Results:** Workload was at its highest from T1-T2, decreased from T2 to T3 (Akm=-36.9 ± 2.0 km, P<.05; Δ kcal=-7903.9±436.2 kcal, P<.05), and remained stable through T4. VJ remained consistent from T1-T3, before beginning to modestly decline (ΔVJ=-0.87 ± 0.59 cm) at T4. CK increased from T1-T2 (ΔCK=206.2 ± 94.1 U/L, P<.05), then returned to baseline. CF increased from T1-T2 (ΔCF=0.32±0.1 mg/dL, P<.05) and returned to baseline by T4. TT increased from T1 to T2 (Δ TT=39.5±17.3 ng/dL, P<.05) and returned to baseline by T4. No differences in E were seen (P>.05). GH decreased from T1-T2 (ΔGH=2.1±0.8 ng/mL, P<.05) and remained depressed. Total mood disturbance increased from T2-T3 (ΔMood=6.4 ± 1.9, P<.05) and remained elevated. Sleep quality (SQ) did not change from T1-T4 (P>.05), but sleep duration (SD) increased from T3-T4 (ΔSD=0.4±0.1, P<.05). **Conclusion:**

Biomarkers showed the greatest change following the period of highest workload. Mood disturbances occurred after observed biomarker changes despite increased SD. SQ may be more important for full recovery than SD, as increased SD did not mirror GH or VJ changes. Changes in biomarkers preceded decrements in mood, suggesting that they may be the earlier indicators of performance status.

2097 Board #110 June 1 3:30 PM - 5:00 PM
Range Of Motion In Lower Limbs: Comparison Between Dominant And Non-dominant Side In Young Soccer Players
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BACKGROUND: The mechanics of sports abilities in professional soccer development requires extensive bilateral joint control of the lower limbs. The differences in the range of motion (ROM) from side to side in the lower limbs could imply a risk of musculoskeletal injury, especially for young athletes who are still during growing period. **PURPOSE:** The purpose of this study was to describe the range of motion and muscle length of the lower limbs, and to identify side to side differences, in young soccer players who belong to Rosario Central soccer club, Argentina. **METHODS:** Twenty young and healthy males soccer players participated in a cross-sectional cohort study (age: 14.18 ± 0.61 yr; weight: 58.74 ± 6.73 kg; height: 170.38 ± 6.20 cm). We included asymptomatic subjects, with no history of lumbar spine, hip, knee or ankle injuries. Three tests were performed for the active range of movement (hip flexion and extension, and knee flexion), and three tests for muscle length (iliopsoas, rectus femoris and hamstrings). Mean and standard deviation (SD) values were calculated by dominant and non-dominant leg, for all ROM measurements. We applied paired t-test differences to determine statistical differences (sd) between dominant and non-dominant leg at p<0.05 level. **RESULTS:** Analyzing ROM we have found sd (p≤ 0.01) for active hip flexion between dominant (111.73 ± 5.72) and non-dominant (108.55 ± 6.97) limb values. No sd were found in ROM for active knee flexion between dominant (138.00 ± 4.03) and non-dominant (138.18 ± 4.67) limb; active hip extension between dominant (17.98 ± 7.11) and non-dominant (16.23 ± 6.69) limb; muscle length for dominant (8.08 ± 4.50) and non-dominant (7.88 ± 4.82) iliopsoas, dominant (133.40 ± 4.84) and non-dominant (131.68 ± 5.87) rectus femoris and dominant (55.28 ± 7.47) and non-dominant (52.53 ± 8.11) hamstrings. **CONCLUSIONS:** Based on the results of the present study, we have found symmetrical ROM and muscle lengths of the lower limbs for young soccer players, with the exception of active hip flexion. In view of these results, it is recommended that professionals who work with this population assess symmetry of mobility, especially of the lower limbs, in order to guide active-passive stretching programs that maintain joint dynamic balance.

2098 Board #111 June 1 3:30 PM - 5:00 PM
The Impact of Two Games in One Weekend on Soccer Performance in DI Female College Athletes
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 (No relationships reported)

PURPOSE: Women's college soccer requires athletes to play two games in one weekend. Insufficient recovery due to the close proximity of the games may lead to an increased risk of injury, fatigue and decreased performance. To date, no study has investigated the effects of playing two games within a 48 hour period on measures of performance in women's college soccer. The purpose of this project was to investigate changes in performance parameters from Friday to Sunday games during a competitive playing season. **METHODS:** 12 NCAA Division I female soccer players (19.3 ± 1.6 yrs, 167 ± 3.0 cm, 62.4 ± 4.9 kg) were included based on playing time criteria (>60%). Global positioning system (GPS) data was collected for Friday (Game 1; (G1)) and Sunday (Game 2; (G2)) games over 5 weekends during the competitive season. Total distance (TD), high speed distance (HSD; 15.5km-19.9 km/h), sprint distance (SD; >20 km/h), meters per minute (m/min), high speed distance per minute (HSD/min), sprint distance per minute (SD/min), percentage HSD (%HSD), percentage SD (%SD), high-intensity efforts/min (HIE/min) and bodyload per minute were analyzed. **RESULTS:** : There was a significant decrease (p<0.05) in m/min from G1 to G2 for weeks 1, 2, 3 and 4. A significant decrease was observed for TD, HSD and HSD/min from G1 to G2 for weeks 1 and 2. There was also a significant decrease in SD and SD/min from G1 to G2 in week 2. SD/min and %SD were significantly greater during G2 compared to G1 in week 5. There were no significant differences between G1 performance parameters across the five weeks.

CONCLUSIONS: There was a significant decrease in a number of performance parameters during the second game when two games were played in one weekend. There were no changes in performances during G1, played one week apart over the five weeks.

Table1. Performance parameters.

	Week 1		Week 2		Week 3		Week 4		Week 5	
	Game		Game		Game		Game		Game	
	1	2	1	2	1	2	1	2	1	2
Distance (m)	8609*	7912	9109*	7734	8770	8543	9294	9374	8492	7577
HSD (m)	727*	563	843*	670	708	608	640	673	731	707
SD (m)	214	225	308*	212	254	227	170	146	247	280
M/min (m)	114*	107	119*	110	118*	114	120*	113	113	100
HSD/min (m)	9.9*	7.8	11.4*	9.8	9.8	9.1	8.8	8.5	10.0	10.5
SD/min (m)	3.0	3.1	4.5*	3.2	3.7	3.3	2.6	1.9	3.5	4.3*
%HSD	8.6	7.2	9.4	8.8	8.1	7.9	7.1	7.4	8.6	9.4
%SD	2.7	2.9	3.7	2.9	3.1	2.9	2.1	1.7	3.1	3.9*
HIE/min	1.3	1.1	1.7	1.6	1.3	1.2	1.3	1.4	1.4	1.5
Bodyload/min	2.0	1.9	2.0	2.0	1.9	1.8	1.9	1.7	1.8	1.7

Significant difference (p<0.05).

*denotes significant difference between games 1 and 2 within a week.

2099 Board #112 June 1 3:30 PM - 5:00 PM
Acute Effects Of Custom Orthotics On Sprint Power And Steady State Cycling

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 (No relationships reported)

Orthotic insoles are used to correct foot and knee position for better mechanics of movement and acute orthotic use in runners reported improved economy. However, acute usage of customized orthotics (O) have not been evaluated acutely in competitive cyclists. **PURPOSE:** The purpose of this study was to examine the acute effects of custom insoles on steady-state (SS) cycling physiological variables as well as sprint power output. **METHODS:** Eight competitive cyclists (6 males, 2 females) performed four bouts of cycling at 65-70% VO_{2max} for 10 min (two trials with standard insoles (S) and two with O) in randomized order. SS cycling VO₂, heart rate (HR) and respiratory exchange ratio (RER) were evaluated in minutes 2-7. In addition, peak power was determined to two 6 sec sprints 30 seconds apart at the end of SS bout on a Lode cycle ergometer. A repeated-measures ANOVA with an a priori alpha level of 0.05 was used to compare the differences in O vs S using SPSS. **RESULTS:** Steady state %VO₂ (S=66.70±1.33; O=67.13±1.41) HR bpm (S= 151.6±2.29; O=153.6 ±2.33; RER (S=.91±0.02; O=.90±0.01) with no difference with condition (p = > .6). Peak power was also not significantly different (S= 1109±54.9; O=1115± 47.6 W) in the sprints. **CONCLUSION:** Acute use of custom orthotics did not alter VO₂, HR or RER during steady state cycling nor peak power. It is suggested that follow-up to orthotic usage should be analyzed as it usually takes time (several weeks) to alter the mechanics with orthotic usage.

D-63 Free Communication/Poster - Energy Metabolism and Expenditure

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2100 Board #113 June 1 2:00 PM - 3:30 PM
A Study On The Status And Factors Of Energy Deficiency In Japanese Collegiate Rhythmic Gymnasts

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 (No relationships reported)

PURPOSE:Energy deficiency affects many physiological aspects. The purpose of this study was to examine the status of energy deficiency in Japanese female collegiate rhythmic gymnasts and the factors that affect energy deficiency. **METHODS:**The subjects were Japanese female collegiate rhythmic gymnasts (RG group: n=7, age : 20.4±1.1yr, height : 159.0±5.9 cm, body weight : 48.6±3.4kg, BMI : 19.3±1.6 kg/m², fat free mass : 37.7±2.9kg, percent body fat : 22.4±2.9%). As a control group, Japanese female collegiate sprint runners (CON group: n=8, age

: 19.4±0.8yr, height : 162.8±5.8cm, body weight : 53.7±6.2kg, BMI : 20.2±1.1 kg/m², fat free mass : 44.8±4.7kg, percent body fat : 15.8±2.5%). The evaluation index of energy deficiency was energy balance (EB), which was calculated by subtracting the total energy expenditure (TEE) from energy intake (EI). TEE was determined by using the double-labeled water method, and the physical activity level (PAL) was TEE divided by resting energy expenditure (REE), which was measured by using a gas analyzer. Physical activity energy expenditure (PAEE) was calculated by subtracting REE plus dietary-induced thermogenesis from the TEE. EI was determined by using self-reported dietary records; and body composition, by using the dual-energy x-ray absorptiometry scan method.

RESULTS:The EB was -2065 ± 598 kcal/day in the RG group and -1230 ± 1003 kcal/day in the CON group. Therefore, both groups had a large negative balance, and the EB in the RG group was lower than that in the CON group. PAL was higher in the RG group (3.2 ± 0.4) than in the CON group (2.5 ± 0.8; p < 0.05). Although the EB in both groups did not correlate with REE, it negatively correlated with PAL and PAEE (p < 0.01). Therefore, high PAL and PAEE can be considered factors of energy deficiency. **CONCLUSION:**Our results indicate that the status of the energy deficiency of the Japanese female collegiate rhythmic gymnasts was severe because the EB in the group was lower than that in the CON group. Furthermore, high PAL and PAEE affected the energy deficiency status of the Japanese female collegiate rhythmic gymnasts.

2101 Board #114 June 1 2:00 PM - 3:30 PM
Cerebral Energy Metabolism And Executive Function After Repeated High-intensity Interval Exercise With Decreased Lactate Concentration

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 (No relationships reported)

PURPOSE: We previously found that cognitive function was not impaired during prolonged exercise, despite a conflict between an increase in cerebral metabolism and a decrease in cerebral blood flow (CBF), and suggested that improved cognitive function during exercise may be due to the augmented cerebral neuronal activation and metabolism associated with exercise, rather than cerebral perfusion. On the other hand, previous studies have demonstrated that during heavy exercise, compensatory increases in the uptake (the difference between arterial and venous concentration) of lactate, glucose and oxygen support elevated brain neuronal activity and metabolism. The purpose of this study was to examine the relationship between cerebral metabolism (e.g., lactate, glucose, oxygen) and executive function (EF) to a repeated high-intensity interval exercise (HIIE), which decreases systemic lactate concentration and post-exercise EF in a later HIIE session. **METHODS:** 14 healthy male subjects performed two HIIE protocols (4 sets of high-intensity exercise for 4-min with 3-min active recovery) separated by a 60 min resting period. Blood samples were obtained from the bulb of the right internal jugular vein and a brachial artery to determine concentration differences (a-v diff) for lactate, glucose, and oxygen across the brain. Transcranial Doppler determined middle cerebral artery blood flow velocity (MCA V_{mean}) as an index of regional CBF. Cerebral metabolic rates of lactate (CMR_{lactate}), glucose (CMR_{glucose}), and oxygen (CMRO₂) were calculated as MCA V_{mean} × a-v diff, respectively. To evaluate EF, color-word Stroop tasks were performed. **RESULTS:** Post-exercise EF improvement, a-v diff_{lactate}, and CMR_{lactate} analyses showed a significant main effect for condition (P < 0.05, respectively), indicating that both EF improvement and brain lactate uptake were attenuated after 2nd HIIE compared to 1st HIIE. While a-v diff_{glucose}, CMR_{glucose}, and a-v diff_{oxygen} were no significant main effects for condition, chronological reduction in a-v diff_{lactate} and EF after HIIE were associated with decrease in CMRO₂ (P < 0.05, respectively). **CONCLUSION:** These results suggest that the reduction in brain lactate uptake concomitant with the decrease in CMRO₂ after repeated HIIE might be involved in the decline in EF improvement.

THURSDAY, JUNE 1, 2017

2102 Board #115 June 1 2:00 PM - 3:30 PM
Accuracy of Indirect Calorimetry and Predictive Equations for the Measurement of Resting Metabolic Rate

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Indirect calorimetry is used to measure oxygen consumption for the purpose of accurately estimating resting metabolic rate (RMR). Laboratory devices are available for the measurement of RMR, such as the BodyGem® indirect calorimeter and the Vacumed VO₂ Lab metabolic measuring system. Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris-Benedict (HB), and Fleisch, can also be used to provide an estimate of RMR.

PURPOSE: The purpose of this study was to compare the RMR of college-aged participants measured using a BodyGem® indirect calorimeter, a Vacumed VO₂ Lab metabolic cart, and the aforementioned prediction equations.

METHODS: Each participant (male = 15; female = 15; age = 22.7 ± 3.3 yrs; wt = 77.5 ± 14.5 kg; ht = 173.5 ± 9.6 cm) completed a thirty-minute supine resting session in a quiet environment. Five minutes of resting data were then collected using the Vacumed while in the supine position. Immediately thereafter, five minutes of resting data was collected using the BodyGem® indirect calorimeter while in the seated position. The RMR values for the HB and Fleisch prediction equations were calculated using the proprietary software utilized by the Vacumed metabolic system, while the MSJ estimate of RMR was hand-calculated.

RESULTS: A repeated measures ANOVA showed a significant difference among the measurement methods (BodyGem® = 1995.0 + 540.5 kcal; Vacumed = 1520.9 + 452.5 kcal; MSJ = 1669.3 + 242.9 kcal; HB = 1749.0 + 275.1 kcal; Fleisch = 1690.3 + 220.7 kcal) ($p < .001$). A *post hoc* paired samples t-test showed that the BodyGem® measured RMR significantly higher than the Vacumed, HB, Fleisch, and MSJ ($p < .01$). The HB estimation of RMR was greater than that of the Vacumed measurement ($p < .025$). For the equations, the RMR estimate of the Fleisch was higher than the MSJ ($p < .025$), while the HB was greater than both the Fleisch and the MSJ ($p < .01$).

CONCLUSION: The Vacumed VO₂ Lab metabolic cart measured RMR closer to the prediction equation estimates compared to the BodyGem® indirect calorimeter. Further research needs to be conducted comparing laboratory instruments to established prediction equations, on various populations, before the estimative methods can be deemed accurate for measuring RMR.

2103 Board #116 June 1 2:00 PM - 3:30 PM
The Comparison Of Energy Expenditure Between Continuous And Intermittent Exercise During And Post Exercise

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PURPOSE: Intermittent training has been applied in athlete training for 100 years more. In the last 10 years, it attained additional application in the enhancement of physical fitness and the rehabilitation of multiple chronic diseases. Moreover, many evidence suggests that when compared with steady state exercise, intermittent training can result in comparable or greater improvement in heart failure, diabetes, obesity and other chronic diseases. However, due to the differences of exercise workload (exercise duration, intensity and pattern) in most of researches, it is hard to assert which one is better between continuous and intermittent exercise when faced to some certain of health issues. Therefore, this study aimed to compare the energy consumption and substrate utilization between continuous and intermittent exercise with equal workload during and post exercise, and analyze their relationship with the activity of autonomic nervous system.

METHODS: 12 male students (24.2 ± 1.2 years old), randomly performed 3 tests with 1 week interval: Control (C; rest), continuous exercise (CE; 65% VO_{2max}, 40 min), and intermittent exercise (IE; 85% VO_{2max}, 4min; 45% VO_{2max}, 4min; 5 sessions). Exercise is performed on treadmill with equal workload. In the period of pre- (30 min), during- (40min) and post-exercise (every 1 hour for 8 hours), respiratory metabolism, heart rate variability (HRV), blood pressure, and body temperature were monitored. Paired simple t-tests were used for statistical analysis. This study was funded by two fund from Guangdong (2013B031600003) and Guizhou (2014-7455) Science and Technology Department.

RESULTS: The energy expenditure (EE) and substrate utilization during exercise showed no significant difference between IE and CE. However, IE had higher total 8-hour's EE during post-exercise (1.1-fold, $p < 0.05$, ES=1.85) with much fat oxidation

(1.2-fold, $p < 0.05$, ES=2.63) and significant rising value of LF/HF of HRV analysis (1.7-fold, $p < 0.01$, ES=4.34). The total energy consumption (during exercise plus post-exercise) in IE is higher than CE (1.05-fold, $p < 0.05$, ES=2.17).
CONCLUSIONS: High intensity intermittent exercise can induce much fat oxidation during the period of post-exercise and raise total exercise consumption, which is probably relevant to enhanced sympathetic regulation.

2104 Board #117 June 1 2:00 PM - 3:30 PM
Measurement Of Daily Energy Expenditure In Humans Using A Body-worn Calorimeter

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 (No relationships reported)

PURPOSE: Previous approaches using body-worn devices to measure free-living daily EE in humans using direct calorimetry have been limited by the inability to accurately measure evaporative heat loss. The Personal Calorie Meter (PCM) is a device that uses a heat flow gauge embedded in a permeable membrane, permitting the measurement of both dry and evaporative heat loss. Total heat flux and estimated body surface area are then used to estimate minute by minute EE. In this ongoing study, we are comparing daily EE measured using the PCM with simultaneous measurements using whole-room indirect calorimetry (WRC). **METHODS:** Subjects were studied on two separate days under low and high physical activity levels (PAL, ~1.4 and 1.7 x resting metabolic rate, respectively) in the WRC. During the low PAL condition, subjects performed 20 minutes of various housecleaning activities. During the high PAL condition, subjects performed 30 minutes of walking on a treadmill, 30 minutes of stationary cycling, and resistance exercises using dumbbells. Daytime EE was calculated as the total EE from the time the subject entered the WRC until bedtime. **RESULTS:** 14 subjects (10 F/4 M, 44±18 yrs., body mass index=26±6 kg m², mean±SD) have completed at least one study visit in the room calorimeter. During the low PAL condition (N=11), average daytime EE measured by the PCM (1369±220 kcal, mean±SD) did not differ from WRC (1304±757 kcal), but the range of intra-individual differences was large (-899 to +452 kcal). Five measurements were within ±150 kcal, and the minute-to-minute values corresponded closely in these cases. During the high PAL condition (N=9), average daytime EE measured by the PCM (1834±344 kcal) did not differ from WRC (1880±757 kcal), but there was a wider range of intra-individual differences than during the low PAL condition (-1188 to +1075 kcal). **CONCLUSION:** These preliminary data demonstrate the feasibility of measuring EE in humans using portable direct calorimetry. Further studies and refinements are needed to improve the accuracy of the PCM on an individual level.

2105 Board #118 June 1 2:00 PM - 3:30 PM
Determination of Metabolic Pathway in Response to Cycling Versus Vinyasa Yoga

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PURPOSE: The purpose of this experiment is to determine whether there is a difference in metabolic response to Cycling & Vinyasa Yoga.

METHODS: Six male and six female participants aged 19-35 participated in two exercise sessions spaced 1 week apart. The participants fasted 12 hours prior to a one hour Vinyasa yoga session, and again prior to a 1-hour session of stationary cycling the following week. Heart rate was collected at predetermined time points during the Vinyasa yoga session. In order to normalize the level of intensity in both exercise bouts, participants pedaled at a pace that matched their individual heart rate during the yoga session. Urine samples were collected from participants before and immediately after the yoga and cycling exercise bouts. Urine samples were frozen at -80 Fahrenheit, and later analyzed using a Bruker 600 ¹H-NMR running TopSpin 2.0 software. We were able to determine the identity of 13 metabolites with certainty. These metabolites are as follows: phylalalanine, creatinine, creatine, creatine/creatinine, glycine, choline, taurine, dimethylamine, citrate, pyruvate, alanine, lactate, and beta hydroxybutyrate. The data was analyzed using a combination of analytical techniques, including paired t-test, a bucketing strategy, and MetaboAnalyst 2.0.

RESULTS: We found no significant difference in the metabolites excreted in the urine between different exercise regimens.

CONCLUSION: Exercise intensity and/or lack of adequate sampling may have influenced the lack of significant differences with regard to urine metabolite levels in this study. Although our study did not find any significant change in metabolites, the application of this methodological approach has merit. For example, this methodology

could be used to study changes in metabolic pathways in many different environments that include logistical and/or cultural considerations, where urine samples could be collected and then transported for analysis via ¹H-NMR. Self-supported by Colin Campbell.

2106 Board #119 June 1 2:00 PM - 3:30 PM
Pre-hydration Status, Fluid Intake, And Sweat Rate Of Males Participating In Hot Yoga

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(No relationships reported)

Populations who participate in recreational exercise in hot and humid environments such as hot hatha yoga are at an increased risk for dehydration. Hot yoga continues to grow in popularity.

Purpose: This study investigates the pre-exercise hydration status, fluid balance, perception of sweat loss, of 13 male Hot Hatha Yoga participants. **Methods:** Male participants (n=13, 34 ± 12.7yr, 182.0 ± 9.8cm; 85.2 ± 10.0 kg) were examined during a one hour hot hatha yoga class (39.7 °C ± .53°C, 34.3 ± 2.4% rh). Pre-exercise urine specific gravity (USG), hydration status, body mass changes, and fluid intake were recorded and sweat rate was calculated. After the hot hatha yoga session, participants were asked to perceive their sweat loss. A paired sample t test was used to identify significance between measured sweat loss and perceived sweat loss and body mass loss. **Results:** Forty seven percent of the Participants began the session in a dehydrated state (USG <1.020). Sweat rate was 1.3 ± 0.6 L-h⁻¹, and although replacement fluid was available, consumption was low (0.4 ± 0.3 L-h⁻¹) and 32% did not consume any fluids. Mean percent body mass loss was 1.1 ± 0.7% from pre-exercise body mass, and about half the participants lost at least 1% of body mass. There was a considerable difference between perception of sweat loss and actual sweat loss (p=1.02). Mean perceived sweat loss was 0.8 ± 0.46 L-h⁻¹ and mean actual sweat loss was 1.05 ± 0.6 L-h⁻¹. **Conclusion:** These findings highlight the variability in hydration management among male hot yoga participants supports the notion that hydration guideline must be personalized and education would be beneficial.

D-64 Free Communication/Poster - Ergogenic Aids IV

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2107 Board #120 June 1 3:30 PM - 5:00 PM
Omega-3 Fatty Acids Supplementation did not Improve Cardiometabolic Benefits of 16 Weeks of Exercise Training

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PURPOSE: To determine if supplementation with omega-3 polyunsaturated fatty acids (omega-3 PUFA) either as enriched milk or capsules would improve the benefits of an aerobic exercise training program in the health of metabolic syndrome (MSyn) patients.

METHODS: Four groups of MSyn patients were enrolled, in a 16-week high intensity interval training program combined with n3-PUFA supplementation administered in a double-blind randomized design. Thirty six MSyn patients ingested during the training program 500 mL of milk daily, either enriched with 275 mg of omega-3PUFA or, semi-skim milk as placebo. Another 40 MSyn patients received capsules containing either 846 mg of omega-3PUFA or soybean oil as placebo. Before and after intervention, MSyn components (i.e., waist circumference, blood pressure, blood glucose, triglycerides and HDL concentrations), composite MSyn Z-score, cardiovascular risk factors (total cholesterol (TC) and LDL), glucose metabolism markers (HbA1c and HOMA), body weight and composition, and cardiorespiratory fitness (peak oxygen consumption; VO_{2PEAK}) and maximal rate of fat oxidation (FO_{MAX}) were assessed. Data was analyzed using split plot ANCOVA (Time x Treatment) controlling for body weight loss.

RESULTS: From the MSyn components, only blood pressure decreased significantly (P<0.001) after the exercise program without further benefit from omega-3 PUFA in any ingestion modality (P=0.340). MSyn Z-score, TC and LDL decreased significantly after training (P<0.001, P=0.016 and P=0.003, respectively) without differences among groups (P= 0.091, P=0.095 and P=0.156, respectively). HbA1c, HOMA and body weight did not change in any group (P=0.087, P=0.762, and P=0.203, respectively). However total fat mass decreased in all groups (P<0.001) without differences among treatments (P=0.942). VO_{2PEAK} and FO_{MAX} improved (P<0.001) in a similar fashion among experimental groups (P=0.651 and P=0.333, respectively).

CONCLUSIONS: Sixteen weeks of dietary omega-3 PUFA supplementation either administered as functional food (enriched skim milk) or at a higher dose provided in capsules, did not further enhance the benefits of high intensity interval training in a group of metabolic syndrome patients.

2108 Board #121 June 1 3:30 PM - 5:00 PM
Carbohydrate Mouth Rinse Does Not Affect 60-min Running Performance In Females

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(No relationships reported)

Mouth rinsing with carbohydrate may improve 60-min endurance cycling or running performance in males. However, no data exist regarding the effect of mouth rinsing on endurance performance in females. **PURPOSE:** To examine the effect of mouth rinsing with a carbohydrate solution on endurance running performance in females. **METHODS:** Fifteen female recreational endurance runners (30-57 years) ran 2 races of 1-hour duration on an indoor track after an 8 h post-prandial period with a 7 days interval between races. This time period corresponded to the 3rd-10th day of each runner's menstrual cycle, for the eumenorrhoeic premenopausal runners, or any time for the runners who were at menopause. Following a double-blind process and random order, participants rinsed their mouth, before the initiation of exercise and at 15, 30 and 45 min of exercise with 25 ml of either a 6.4% carbohydrate (RCHO) or a placebo solution (0% carbohydrate) (RP). Pre-race euhydration was insured by ingestion of 6 ml·kg⁻¹ water. No fluids were ingested during exercise. Races started at 18:00 hours. **RESULTS:** There was no difference between treatments in runners hormonal status prior to each race for serum 17β-Estradiol [median (inter-quartile range)], RCHO: 50.2(5; 74.1) pg·ml⁻¹ vs RP: 26.0(5; 61.1) pg·ml⁻¹, z= -0.533, (p= 0.59) and Progesterone (RCHO: 0.75(0.61; 1.64) ng·ml⁻¹ vs RP: 0.74(0.64; 0.9) ng·ml⁻¹, z= -0.938, (p= 0.35) . Percent body mass loss due to exercise was similar between treatments (mean ± SE, RCHO: 1.9% ± 0.1% and RP: 1.9% ± 0.1%). There was no difference in 1-hour running performance, neither by treatment (RCHO: 10621.88 ± 205.98 m vs. RP: 10454.00 ± 206.64 m; t= 1.784, p= 0.096), nor by race order (1st race: 10549.13 ± 213.67 m vs. 2nd race 10526.75 ± 201.16 m; t= 0.215, p= 0.833) (mean ± SE). Furthermore, the mean percentage effect (±99%CI) of RCHO relative to RP, 1.67% (-1.1% to 4.4%), and Cohen's effect size (d = 0.21) support a trivial outcome effect of RCHO for total distance covered. In addition, there was no difference between treatments in the rate of perceived exertion (p= 0.14) and heart rate (p= 0.06). **CONCLUSION:** Carbohydrate mouth rinsing did not improve 1-h running performance in female recreational runners competing in a low ovarian hormone condition, following an 8 h fast and when no fluid was ingested during exercise.

2109 Board #122 June 1 3:30 PM - 5:00 PM
Influence Of Carbohydrate Intake On Pacing Changes During Prolonged Cycling

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(No relationships reported)

PURPOSE: The effects of carbohydrate intake on temporal changes in power output during cycling were examined.

METHODS: Eight male cyclists (VO_{2max}: 62 ± 6 mL·kg⁻¹·min⁻¹) completed two trials consisting of 120 min of constant load cycling at 55% W_{max}, followed by a simulated 30 km time trial (TT). Subjects consumed 150 ml of a glucose-fructose solution (CHO) or a non-caloric placebo (PL) every 15 minutes during the constant-load portion of the trial, and at 7.5 km intervals during the TT. Average power output during the TT was compared between treatments, and changes in power output within trials were examined across four segments of the TT (S1 = 0-7.5 km, S2 = 7.5-15 km, S3 = 15-22.5 km, and S4 = 22.5-30 km). Power output was also averaged for three minutes immediately before and after each feeding, to determine if changes in pacing between treatments were influenced by the proximity to CHO feedings. Magnitude-based qualitative inferences were used to evaluate differences between treatments and/or time-points.

RESULTS: Average TT power output during the CHO trial (242 ± 30 W) was 'likely' greater than PL (217 ± 40 W). In the PL trial, cycling power 'almost certainly' decreased between S1 (235 ± 41 W) and S2 (223 ± 38 W), and 'likely' decreased further during S3 (201 ± 41 W). Subsequently, cycling power 'very likely' increased

between S3 and S4 (219 ± 43 W), but remained lower than S1 levels. By contrast, power output during the CHO trial showed no clear changes from S1 (246 ± 41 W) to S2 (242 ± 28 W). Thereafter, power output 'possibly' decreased during S3 (232 ± 27 W), followed by a 'likely' increase in power during S4 (249 ± 32 W), resulting in power levels during S4 that were similar to S1. Power output during the period immediately following each PL ingestion (210 ± 40 W) was not clearly different from the period prior to PL ingestion (213 ± 39 W); whereas power output immediately following CHO ingestion (244 ± 27 W) was 'possibly' increased versus pre-ingestion (236 ± 31 W).

CONCLUSIONS: CHO ingestion increased average power output during a cycling TT and attenuated declines in power output over the duration of the trial, compared to PL. In addition, improvements in power output with CHO were possibly greater in the periods immediately following each feeding, potentially due to effects of CHO on the central nervous system.

2110 Board #123 June 1 3:30 PM - 5:00 PM
The Effects Of Pre-exercise Protein Vs. Carbohydrate Consumption On Energy Expenditure After High-volume Resistance Exercise
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 (No relationships reported)

During the recovery period following a bout of resistance exercise, oxygen consumption remains elevated for a variable timeframe, reflecting an acute enhancement in resting energy expenditure. What remains uncertain is whether pre-exercise nutrient consumption further promotes these acute metabolic responses to a bout of resistance exercise and if the type of nutrient influences these effects. **Purpose:** Therefore, the objective of this study was to determine, in college-age, resistance trained male subjects, the extent by which pre-exercise supplementation of whey protein or carbohydrate modulates metabolic and substrate oxidation rates following a bout of high-volume, total body resistance exercise. **Methods:** In a randomized, placebo controlled, cross-over study, healthy, resistance trained male ($n=10$) subjects initially underwent baseline testing for resting energy expenditure and maximum strength. Subjects were familiarized with the resistance exercise protocol during the subsequent visit. Afterwards, across 3 separate subsequent visits, subjects consumed whey protein (PRO), carbohydrate (CHO), or no nutrients (CON) prior to a bout of high-volume resistance exercise. After exercise, subjects were tested for energy expenditure (EE), oxygen consumption (VO_2), respiratory exchange ratio (RER), and heart rate (HR). **Results:** PRO (+23.5%; $p=0.003$), CHO (+12.8%; $p=0.001$), and CON (+9.5%; $p=0.005$) increased EE from resting baseline with concomitant changes to VO_2 , RER, and HR. PRO ($p=0.019$) and CHO ($p=0.003$) demonstrated equivalently greater post-exercise EE than CON. Post-exercise VO_2 was significantly greater in PRO vs. CON ($p=0.034$) while CHO did not differ from PRO or CON. **Conclusion:** Overall, nutrient consumption prior to resistance exercise may augment the post-exercise elevation in EE. Consumption of whey protein pre-exercise may enhance excess post-resistance exercise oxygen consumption (i.e. EPOC) to a greater extent than carbohydrate intake.

2111 Board #124 June 1 3:30 PM - 5:00 PM
The Effects of Carbohydrate Mouth Rinse Concentration on Cycling Time Trial Performance
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 (No relationships reported)

Mouth rinsing with a carbohydrate (CHO) solution during exercise has been shown to improve endurance exercise performance. Research suggests that the sensation of CHO in the oral cavity may stimulate neural pathways that attenuate the drop in motor output during exercise. However, it is unclear if performance is improved to a greater extent with different CHO concentration mouth rinses. **Purpose:** The purpose of this study was to determine if there is a dose-response effect of CHO mouth rinse concentration on endurance performance during a one-hour cycling time trial. **Methods:** Fifteen male participants, aged 18-45 years old, who cycled a minimum of 30 miles per week, were recruited for this study. Participants completed five, one-hour time trials on a cycle ergometer, each separated by at least five days. During the first visit, participants completed a familiarization trial during which they rinsed with 25ml of water every 15 minutes of the time trial, beginning at time zero. In a randomized, double-blind fashion, participants then completed trials during which a 0%, 3%, 6%, or 12% CHO solution was rinsed for five seconds in 15-minute intervals during each of the four experimental time trials. Average power (W), work completed (kcal), heart rate (HR), and rating of perceived exertion (RPE) were recorded during each trial and compared at each 15-minute time point using a repeated

measures ANOVA. **RESULTS:** A total of 14 participants completed all five time trials. Participants had 7.6 ± 5.9 years of cycling experience and rode 111 ± 66 miles per week in the six months prior to study participation. The results indicated that there were no significant differences ($p > 0.05$) between 0%, 3%, 6%, or 12% CHO solutions in total work performed (777 ± 182 , 766 ± 187 , 767 ± 159 , 752 ± 187 kcal, respectively), average power (236 ± 56 , 233 ± 56 , 233 ± 48 , 226 ± 53 W, respectively), average HR (155 ± 14 , 155 ± 13 , 152 ± 12 , 153 ± 14 BPM, respectively), or RPE (8.3 ± 1.1 , 8.4 ± 1.3 , 8.1 ± 1.5 , 8.4 ± 1.2 , respectively). **CONCLUSIONS:** The results of this study revealed that there is no ergogenic benefit of a CHO mouth rinse for a one-hour cycling time trial. Furthermore, there was no dose-response effect of CHO mouth rinse concentration on time trial performance.

2112 Board #125 June 1 3:30 PM - 5:00 PM
Carbohydrate Mouth Rinse Improves Mean Power During Multiple Sprint Performance
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 (No relationships reported)

Multiple investigations have confirmed carbohydrate mouth rinse (CMR) enhances high intensity endurance performance lasting under 1 hour, but the effects of CMR on high intensity intermittent exercise have received little attention. **Purpose:** To determine the effect of a CMR on high intensity multiple sprint performance. **Methods:** Competitive, male, athletes ($n=8$) (31.1 ± 7.1 years, 185 ± 9 cm, 87.4 ± 15.3 kg, VO_2 peak 49.9 ± 7.8 ml/kg*min-132) completed two, 48 min high intensity intermittent cycling protocols that consisted of 6 bouts of 5 min cycling at 50% VO_2 peak followed by sets of three, 10-s Wingate sprints with 50 s of recovery between sprints. Prior to each set of Wingate sprints, either a 6.4% carbohydrate solution (CMR) or placebo (PLA) were rinsed for 10 s using a counterbalanced crossover design. **Results:** There was a significant main effect (CMR 912 ± 168 , PLA 896 ± 161 W; $p < 0.05$ ES=0.10) for mean power, but post hoc tests only revealed significant performance improvement with CMR during the 6th bout (CMR 912 ± 167 , PLA 885 ± 153 W; $p < 0.05$ ES=0.17). No treatment effect was exhibited for peak power, fatigue index, rate of perceived exertion, or blood glucose. Most team based sport provide multiple opportunities for access to carbohydrate beverages. **CONCLUSIONS:** Based on the 1.9% increase in performance with a CMR on mean power observed in the current study, a CMR may serve as a practical ergogenic option for high intensity intermittent sports. Supported by Master's Research Grant from Central Washington University's School of Graduate Studies and Research

2113 Board #126 June 1 3:30 PM - 5:00 PM
The Impact of Glucose Supplementation on Barbell Velocity and Fatigability in Weightlifters: A Pilot Study
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 (No relationships reported)

Purpose: Fatigue has been shown to decrease velocity in training, decrease repetitions able to be performed while lifting weights, and increased fatigue level from weight training. This study investigated the changes in velocity and performance of weightlifters during training sessions with glucose supplementation. **Methods:** Three competitive Olympic weightlifters, aged 25.7 ± 4.0 yrs, participated in two trials; placebo (PL), and glucose supplement (GL). Every Minute On the Minute (EMOM) sets were used to simulate a training sessions. At the start of each minute, the subject performed a lift at 70% of their respective One repetition Maximum, and they continued these sets for 10 min. The snatch (ST) and Clean & Jerk (CJ) were performed for 10 sets at each. A pretest (PRE) consisted of both of the lifts 10 min EMOMs where peak velocity (PV), average velocity (AV), heart rate (HR) and rate of perceived exertion were recorded for each lift. A posttest (POST) mimicked the PRE and the recorded differences were compared between the PL and GL. Blood lactate (BL) and glucose (BG) were also recorded prior to trial testing (BASE), PRE, after 15 min recovery (REC), and POST. **Results:** BG increased 29% in GL (PRE: 98.0 ± 11.1 mg·dL⁻¹, REC: 125.3 ± 23.2 mg·dL⁻¹) and BL decreased 12% in GL (PRE: 4.2 ± 1.7 mmol·L⁻¹, REC: 3.2 ± 0.5 mmol·L⁻¹, $p=0.001$) and 20% in PL (PRE: 3.5 ± 1.2 mmol·L⁻¹, POST: 2.9 ± 1.8 mmol·L⁻¹). PV of ST increased 4% in GL (PRE: 1.51 ± 0.10 m·sec⁻¹, POST: 1.56 ± 0.11 m·sec⁻¹) and decreased 3% in PL (PRE: 1.72 ± 0.18 m·sec⁻¹, POST: 1.66 ± 0.08 m·sec⁻¹). PV of CJ increased 1% in GL (PRE: 1.56 ± 0.51 m·sec⁻¹, POST: 1.61 ± 0.69 m·sec⁻¹) and decreased 4% in PL (PRE: 1.65 ± 0.45 m·sec⁻¹, POST: 1.57 ± 0.47 m·sec⁻¹). HR of ST increased both PL (5%, PRE: 102.1 ± 29.8 beats·min⁻¹, POST: 107.8 ± 33.4 beats·min⁻¹) and GL (3%, PRE: 115.1 ± 30.4 beats·min⁻¹, POST: 118.2 ± 32.1 beats·min⁻¹). HR of CJ decreased both PL (1%, PRE: 124.5 ± 39.1 beats·min⁻¹, POST: 122.6 ± 37.7 beats·min⁻¹) and GL (4%, PRE: 135.4 ± 36.3 beats·min⁻¹, POST: 131.7 ± 40.7 beats·min⁻¹).

CONCLUSIONS: The results show that glucose supplementation intake in weightlifters is associated with exercise performance such as barbell velocity and may reduce their fatigue level. A larger sample size should be required to confirm the significance of these findings.

2114 Board #127 June 1 3:30 PM - 5:00 PM

The Repercussion of Expectorations: When a Carbohydrate Rinse Becomes Detrimental to Performance

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(No relationships reported)

Amongst dietary strategies for performance enhancement a carbohydrate (CHO) mouth rinse is unique in that it may promote an increased rate of CHO oxidation without ingestion. Therefore, the possibility exists that a CHO mouth rinse may lead to a premature cessation of exercise due to a more rapid depletion of glycogen stores.

PURPOSE: To calculate the time course of when CHO mouth rinsing may begin to be detrimental to performance.

METHODS: Eight trained, competitive cyclists [age (mean \pm SEM) = 24 \pm 2 y; VO_{2max} = 64.5 \pm 2.8 ml/kg/min] completed three simulated 40-km time trials comprised of a familiarization trial, glucose mouth rinse trial (GLC), and placebo trial (PLA). A mouth rinse was administered prior to onset of exercise, and every 5-km throughout the time trial. CHO oxidation rates were calculated based on the equation: g/min = 4.210 VCO_2 - 2.962 VO_2 (Jeukendrup 2005) and then applied to previously established values of CHO stores in glycogen loaded individuals (Rapaport 2010) in order to estimate when stores would be exhausted.

RESULTS: Time to completion was statistically faster ($P < 0.05$) for GLC (67.1 \pm 1.1 sec) compared to PLA (67.9 \pm 1.0 sec). CHO oxidation rates were not statistically different ($P = 0.06$) between the GLC (3.43 \pm 0.80 g/min) and PLA (2.98 \pm 0.18 g/min) groups. Assuming a 70 kg man is fully glycogen loaded at a wet weight of 200 mmol/kg muscle and that 22% of his body mass is leg muscle, glycogen stores would roughly equal 570 g in leg muscle. There was no statistical difference ($P = 0.06$) between conditions in the time to deplete these stores. According to calculated oxidation rates, a 70-kg man would deplete leg stores in 175 \pm 17 min when using a CHO mouth rinse and 196 \pm 11 min when rinsing with a noncaloric sweetener.

CONCLUSIONS: Rinsing the mouth with a CHO solution prior to and during exercise does not result in a more rapid depletion of muscle glycogen stores despite improved performance. However, when using a CHO rinse glycogen stores will be depleted in approximately 3 h and recommending this ergogenic approach for longer duration exercise should therefore be approached with caution.

2115 Board #128 June 1 3:30 PM - 5:00 PM

Six Grams of Fish Oil Supplementation Mitigates Perceived Muscle Soreness Following Acute Resistance Exercise

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(No relationships reported)

High-intensity eccentric exercise is known to cause skeletal muscle damage and microstructural changes to muscle tissue with an associated inflammatory response. Previous research demonstrates increased pro-inflammatory cytokine and prostaglandin concentrations are linked with perceived muscle soreness. The omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), commonly found in fish oil supplements, exhibit anti-inflammatory properties that have been reported to attenuate the overall perception of muscle soreness. **Purpose:** To investigate the dose-response effect of fish oil (FO) supplementation on the magnitude and time-course of post-eccentric resistance exercise muscle soreness. **Methods:** Thirty-two, college-aged, resistance-trained males (n = 16; 23.8 \pm 2.7 years, 81.5 \pm 9.9 kg, 175.7 \pm 4.5 cm, 16.3 \pm 3.6 %) and females (n = 16; 23.4 \pm 3.1 years, 61.7 \pm 7.2 kg, 170.4 \pm 6.2 cm, 23.6 \pm 5.0 %) completed a double-blind placebo controlled 7-week supplementation period of either: 2.0, 4.0, or 6.0 g·d⁻¹ FO or placebo (PL). Subsequently, participants completed a muscle damaging resistance exercise protocol (10 sets of 8 four-second eccentric squats at 70% one-repetition maximum and 5 sets of 20 split-squat jumps). Perceived muscle soreness (PS; 0–10 cm scale) was measured pre-exercise (PRE), immediately post (IP), as well as 1, 2, 4, 24, 48, and 72 hours (h) post-exercise.

Results: Repeated measures analysis of variance revealed a group \times time interaction for PS ($p < 0.001$), where compared to PL, lower PS scores were observed at IP for 6 g·d⁻¹ (mean difference: 4.0 cm, $p = 0.024$), at 1h for 6 g·d⁻¹ (mean difference: 2.74 cm, $p = 0.046$), at 24h for 4 g·d⁻¹ (mean difference: 2.38 cm, $p = 0.023$), and 6 g·d⁻¹

(mean difference: 3.45 cm, $p < 0.001$), at 48h for 6 g·d⁻¹ (mean difference: 4.45 cm, $p < 0.001$), and at 72h for 6 g·d⁻¹ (mean difference: 3.0 cm, $p = 0.003$). Other group differences were variable by time point. **Conclusions:** These data indicate that supplementation with 6 g·d⁻¹ of FO is effective at attenuating PS following damaging eccentric resistance exercise for up to 72h. Supported by the International Society of Sports Nutrition and MusclePharm Grant

2116 Board #129 June 1 3:30 PM - 5:00 PM

The Potential Of Omega 3 Supplementation To Reduce Muscle-inflammation After Muscle-damaging Exercise

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(No relationships reported)

Muscle inflammation which follows exercise-induced muscle damage (EIMD) relates to strength loss, muscle-soreness and impaired recovery (Lynn and Morgan, 1994). It remains unclear whether omega-3 fatty acids (O-3) supplementation blunts the exercise-induced inflammation associated with EIMD.

PURPOSE: Following supplementation with O-3, indirect markers of muscle damage were examined after EIMD to determine if supplementation had any beneficial effect in reducing muscle inflammation. **METHODS:** Eight healthy, recreationally active caucasian males (28.13 \pm 3.4 yrs) were randomly allocated to a supplementation group (SUP, n = 4) to receive 2.85g/day O-3 supplementation or a placebo group (CON, n = 4) for three weeks. After three-weeks, participants performed a bout of EIMD, which consisted of performing 10 sets of 15 repetitions of leg extension on a Rating of Perceived Exertion (RPE) of 7/10 (Borg, 1982). Creatine Kinase (CK) from venous blood samples, isometric right-leg strength, squat-jump test and perceived soreness were determined, as indirect markers of muscle-damage at Baseline, immediately after EIMD (POST) and 48 hours after EIMD to coincide with the delayed muscle inflammatory response. **RESULTS:** No differences were found between Baseline and POST. There was a trend for smaller increase of CK levels (pre vs 48-h post EIMD) on the SUP group (38.8% increase) compared with the CON group (105.6% increase; $P = 0.051$). There was no significant effect (baseline vs. 48-h post EIMD) on muscle strength between SUP and CON group ($P > 0.05$), however, CON showed a larger decrease in strength compared to SUP (>6.3% vs SUP). No differences in jump height were found between SUP and CON ($P > 0.05$). There was no significant difference in muscle soreness at 48-h post EIMD between SUP and CON group ($P = 0.171$).

CONCLUSION: Three weeks of O-3 supplementation decreased exercise-induced muscle inflammation after eccentric exercise. The encouraging results from this pilot study have led to designing further work related to this topic. The lack of statistical significance may be added to the limitations of the study design. Supplementation with O-3 can be beneficial in sedentary individuals re-starting physical activity and in athletes undergoing heavy exercise regimes, decreasing the exercise related muscle inflammation.

2117 Board #130 June 1 3:30 PM - 5:00 PM

Fish-oil Supplement and Eccentric Exercise on Lipid Profiles during Different Phases of Menstrual Cycle

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(No relationships reported)

Fish oil supplement has been widely recognized as a wholesome regimen, which may positively affect blood lipid and lipoprotein profiles and muscle damage caused by eccentric exercise. **PURPOSE:** To examine the effects of dietary fish oil supplement and acute eccentric exercise on blood lipids and lipoproteins including (TC, HDL-C, Lp(a), LDL-C, and VLDL-C) during two different phases of menstrual cycle (mid-follicular vs. mid-luteal phase). **METHODS:** As a randomized, double-blind design, 22 college-aged women (fish oil = 11, placebo = 11, age = 20.86 \pm 1.39 years) participated in the study. Participants in the fish oil group ingested 6 capsules of fish oil per day (total 6g; containing 2.4g eicosapentaenoic acid and 1.8g docosahexaenoic acid), while the placebo group took 6 capsules of safflower oil per day for 3 weeks. All participants performed an acute eccentric leg exercise (10 sets of 10 repetitions with 3-min rest between sets at an isokinetic speed of 30°/sec) during both mid-follicular (MF) and mid-luteal (ML) phases. The leg exercised for the MF phase was randomly selected and the opposing leg exercised during the ML phase. Blood samples were collected at baseline, 6-hr post-exercise, and 24-hr post-exercise for each phase. Data were analyzed by a 2 \times 2 \times 3 analysis of variance with repeated measures along with the Sidak's multiple comparisons for any significant interactions to compare means differences ($p < .05$).

RESULTS: There were no significant differences in blood lipids and lipoproteins between fish oil and placebo groups or baseline, mid-, and post-exercise. However, HDL-C was significantly higher ($p = 0.041$) during the ML (61.66 \pm 2.44 mg/dL)

phase than that of the MF (54.53 ± 2.44 mg/dL) phase. **CONCLUSION:** Although overall lipid and lipoprotein profiles tended to improve with a short-term fish oil supplement, it didn't reach a statistical significance. In addition, acute eccentric exercise did not negatively affect blood lipids and lipoproteins. However, HDL-C was significantly influenced by the different phases of menstrual cycle, where HDL-C increased during the mid-luteal phase possibly due to elevated estradiol levels. It is recommended that an extended period of fish oil supplement be implemented in different sample groups including both pre- and post-menopausal women for the future studies.

2118 Board #131 June 1 3:30 PM - 5:00 PM

Five Grams Of Fish Oil Supplementation Improves Vertical Jump Performance Following Acute Eccentric Resistance Training

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(No relationships reported)

A damaging bout of eccentric resistance exercise is known to hinder athletic performance. Fish oils are rich in omega-3-polyunsaturated fatty acids and have been purported to modulate the inflammatory response to exercise. It is possible that regular fish oil supplementation may assist in maintaining athletic performance following eccentric resistance exercise, but little is known regarding the optimal dose for stimulating benefits. **PURPOSE:** To examine the effect of fish oil (FO) supplementation dosing on athletic performance recovery following a muscle-damaging bout of eccentric exercise. **METHODS:** Thirty-two college-aged, resistance-trained males ($n = 16$; 23.8 ± 2.7 years, 81.5 ± 9.9 kg, 175.7 ± 4.5 cm) and females ($n = 16$; 23.4 ± 3.1 years, 61.7 ± 7.2 kg, 170.4 ± 6.2 cm) supplemented with 2.0, 4.0, 6.0 g·d⁻¹, FO or placebo (PL) for 7 weeks. Following 7 weeks of supplementation, participants completed pre-exercise (PRE) assessments of vertical jump (VJ) height, maximal voluntary contraction of the knee extensors, 40-yard sprint time, and T-test agility followed by a muscle damaging resistance exercise protocol (10 sets of 8 four-second eccentric squats at 70% one-repetition maximum, 5 sets of 20 split-squat jumps). All PRE-assessments were repeated immediately post (IP), 1, 2, 4, 24, 48, and 72 hours (h) post-exercise. **RESULTS:** Repeated measures analysis of variance indicated a treatment x time interaction ($p < 0.001$) for VJ. Although VJ was decreased from PRE (53.8 ± 8.7 cm) at IP (47.4 ± 9.3 cm) for all groups, VJ returned to PRE-values at 1h for the 6 g·d⁻¹ supplementation group (51.8 ± 6.5 cm, $p = 0.112$), while no other groups returned to baseline until 48h. No other differences were observed. **CONCLUSIONS:** These data indicate that supplementation with 6 g·d⁻¹ of FO is effective for enhancing recovery in jump performance following a damaging bout of exercise. Supported by the International Society of Sports Nutrition and MusclePharm Grant

D-65 Exercise is Medicine®/Poster - EIM - Chronic Health Conditions

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2119 Board #132 June 1 2:00 PM - 3:30 PM
Mobility Outcomes From Resistance Training Delivered via Flash Drive to Overweight/obese Patients In A Clinical Setting

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Elastic and isotonic resistance training can improve health and fitness. Little is known about the impact of a home-based, structured program delivered via flash drive videos to weight management patients in a clinical setting. **PURPOSE:** To measure functional fitness/mobility after 12 weeks of a home-based, video led resistance-training program (Mini BIRST) designed as short interval workouts using dumbbells or Theraband CLX elastic resistance bands. **METHOD:** Overweight/obese participants ($n=21$, 51.5 yrs, BMI 33.2 kg·m⁻²) enrolled in the Health Management

Resources (HMR) weight management program, self-selected to join the study and were assessed for baseline health and mobility. They were randomized into 2 groups: 3 weeks of isotonic resistance followed by 3 weeks of elastic resistance (10-20 min/day, 2-3 days/wk, 6 wks) using a cross-over design. Participants then performed full body CLX-only circuit exercises (20 min/day, 2-3 days/wk, 6 wks). Both home-based programs were delivered via written handouts and flash drive videos. Functional fitness/mobility was assessed using standardized tests. Repeated measures ANOVA were conducted and a p-value of <0.05 was used to indicate significant changes. An opinion survey was conducted to determine attitudes about the program and delivery. **RESULTS:** Participants exercised 3 days/wk for 12 weeks with 83% compliance. Mobility improved for chair stand (26%), arm curl (35%), aerobic endurance (25%), and flexibility in both legs (4% right, 2% left). Participants showed no changes for weight or BMI, but successfully maintained "weight neutral" during the 12-week. Participants trended toward an increase in physical activity (9%), over baseline. Participant opinions revealed they "Liked" the program overall" (75%), said they "Felt good" (70%), was "Convenient to do" (85%), "Liked the flash drive delivery" (85%) and would "Continue the program" (85%). **CONCLUSIONS:** Participants complied to and enjoyed the home-based, dumbbell and CLX resistance band short-burst workouts delivered via flash drive videos and illustrated handouts, resulting in improved mobility and aerobic endurance. Further study is needed to determine long-term impact on adherence, weight and health. **Support for this study provided by Performance Health, Akron, OH.**

2120 Board #133 June 1 2:00 PM - 3:30 PM

A Two-minute, Energy-surge Exercise For Weight Loss: A Randomized, Controlled Trial

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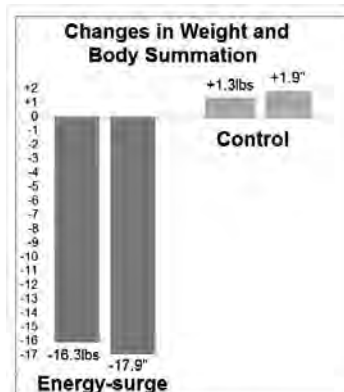
The Center for Disease Control has reported that 70% of the US population are overweight and almost 40% are categorically obese, based on Body Mass Index (BMI). There are numerous programs, diets, and exercise regimens, but these are inadequate because of the continuous rise in obesity. A unique 2-minute Energy-surge exercise routine was developed for metabolism acceleration.

PURPOSE of this study was to determine if the Energy-surge protocol (performed four times/day) reduces subjects' weight and girth sizes. **METHODS:** Fifty-four subjects (mean age 39 ± 8) with BMI of >30 , and were recruited for this 60-day study. Subjects were randomly assigned to either the Experimental group which performed the 2-minute, Energy-surge exercises, four times a day or the Control group who were instructed to "exercise more." No dietary changes were required for either group.

The Experimental group were shown how to make many movements such as climbing stairs or curling dumbbells into an Energy-surge exercise in subjects' aerobic threshold for two minutes. Experimental subjects recorded their exercises and send daily to a research assistant via text or email. The dependent variables were weight (pounds) and Body Summation of 10 girth measurements. A 2x2 ANOVA was used to calculate differences.

RESULTS: There was a significant difference between groups ($P < 0.0001$). The change of the groups were as follows: Experimental ($N=24$) mean reductions = -15.2 lbs and -16.0 " vs. Control ($N=23$) mean changes = $+2.2$ lbs and $+2.5$ ".

CONCLUSION: The 2-minute Energy-surge exercise protocol performed four times a day was effective in reducing subjects' weight and body circumferences. Isolated tests of body composition showed that experimental subjects change were primarily in fat reductions. Future studies should measure this protocol for longer durations, including other variables such as diet changes (portion size and frequency) with body composition testing as the dependent variable.



2121 Board #134 June 1 2:00 PM - 3:30 PM
Insulin Resistance Response to a Treadmill's High Intensity Interval Training in Postmenopausal Women

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PURPOSE: Considering that high-intensity interval training (HIIT) might offer faster and/or more efficient results in improving insulin sensitivity and glycemic control than low-intensity exercise, we conducted a study to analyze the response of insulin resistance to a HIIT.

METHODS: 24 post-menopausal individuals were selected among those enrolled in our existing Lifestyle Modification Program (Move for Health). Physical activity level, socio-demographic characteristics, and health status were identified through the International Physical Activity Questionnaire (version 8 - long form). Fitness performance was determined by trunk flexibility, handgrip test, cardiorespiratory fitness on treadmill. After an overnight fast (8-12 hours), plasma or serum was used for glucose and insulin assays. For the intervention protocol the patients were subjected to 43 minutes of supervised exercise twice weekly for 10 weeks. The HIIT included 10 minutes of warm-up at 70% of HR max, followed by 4 series of 4 minutes each on 90% HRmax with 3-min intervals between series for active recovery at 70% of FCmax, ended with 5 minutes backing to calm. Results were expressed as mean, standard deviation, frequency and percentage. Chi-square test (χ^2), ANOVA repeated measure and the range model repeated measures were used with a 5% significance level.

RESULTS: The sample consisted of low-income post-menopausal women with intermediate education referring self-perception of good health, although overweight and with good weekly physical activity and grip strength fitness but poor trunk flexibility. After 10 weeks of HIIT, the values changed for cardiorespiratory fitness markers by increasing 23.8% (time on treadmill test). The 37.5% unfit flexibility (<P25) were reassigned either to P25-P75 (33.3%) or >P75 (11.1%). Regarding the insulin-resistance status, the HIIT resulted in normalization of 50% of the former hyperglycemics (25% at baseline) and also in 16.7% of the hyperinsulinemics with altered HOMA-IR. Nevertheless, there was no reclassification for body or abdominal obesity.

CONCLUSIONS: The protocol was shown to be effective in improving aerobic fitness and flexibility, additionally to discrete effects on insulin sensitivity although ineffective in reducing abdominal adiposity and overweight.

2122 Board #135 June 1 2:00 PM - 3:30 PM
Effect Of Aerobic Exercise Intensity On Glycated Hemoglobin, Fitness, And Adiposity In Individuals With Type 2 Diabetes: Results From HART-D

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PURPOSE: To examine changes (Δ) in HbA1c, CRF, strength, and adiposity in individuals with T2DM while retrospectively categorizing AER by intensity.

METHODS: 196 men (n=74) and women (age=57.1±8.1y; BMI=34.4±5.8kg/m²; mean±SD) from the HART-D study (NCT00458133) were randomized to 9 months of AER, RES, or combined training (COMB) or to a non-exercise control (CON). Compliant participants (>70% of AER sessions) with complete baseline and follow-up data for HbA1c, CRF (maximal METS), isokinetic strength, and anthropometry (weight, waist circumference (WC), and fat mass) were included. AER intensity was determined using residuals (positive=HI; negative=LO) for average training intensity (%MET-R) adjusted for baseline CRF, age, and sex. **RESULTS:** Δ HbA1c was greater in COMB-HI, COMB-LO, and AER-HI (-0.53%, -0.82 to -0.18; -0.39%, -0.70 to -0.07; -0.48%, -0.82 to -0.14, resp; mean, 95%CI) compared to CON (0.18%, -0.12 to 0.49; all P<0.01) and COMB-HI compared to AER-LO (-0.00%, -0.36 to 0.35; p<0.04). A trend for greater Δ HbA1c was noted between AER-HI and AER-LO (P=0.05). Δ CRF was higher in COMB-HI and AER-HI (1.2 METs, 0.8 to 1.5; 1.3 METs, 0.9 to 1.6) compared to all other groups (range Δ CRF= -0.2 to 0.5 METs; all P<0.007). Δ strength was higher in COMB-HI and RES (14.0N, 5.8 to 22.2; 16.2N, 10.6 to 21.8) compared to AER-LO and AER-HI (-2.0N, -10.6 to 6.6; -4.2N, -12.3 to 3.8; all P<0.008). Significant change in weight was only observed in

COMB-HI (-1.6kg, -2.9 to -0.2) compared to CON (0.4kg, -0.8 to 1.6, P=0.03). WC was significantly reduced in all groups (range -1.7 to -3.1 cm; P≤0.03 for all) except AER-LO (P=0.07) compared to CON. COMB-HI, COMB-LO, and RES reduced fat mass (-2.1kg, -3.1 to -1.0, -1.5kg, -2.5 to -0.6; -1.3kg, -2.0 to -0.6, resp) compared to CON (0.0kg, -0.9 to 1.0; P≤0.02 for all). **CONCLUSION:** Our analysis suggests that individuals with T2D who conduct their AER at an intensity above age, sex, and CRF average responses may see greater improvements in glucose control, CRF, strength, and adiposity.

2123 Board #136 June 1 2:00 PM - 3:30 PM
The Effect of Exercise and Diet Interventions on Type-2 Diabetic Patient

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Purpose: This study probes into intervention of exercise and diet for type-2 diabetic patient, in order to provide scientific basis for diabetic prevention. **Methods:** The research object is selected from the healthy people aged above 50. There are 160 type-2 diabetic patients in walking group; 186 in walking & strength exercise under diet control group; 56 in control group. Their disease course in 2-8 years and have a 3 months comprehensive intervention. Intervention plans: (1) Walking group: Add 20% of walking steps (at a speed of above 60 m/min) on basis of average daily exercise quantity, people in this group exercise for 3-5 times a week; (2) Comprehensive intervention group: On the basis of walking, resistance training is added, which includes 3 sets of press-up, sit-up and back extension, and people shall do more than 10 for each set of above exercise or a maximum number according to personal ability. At the same time, the diet intervention is carried out. First, determine a daily total heat, Then calculate the required daily food exchange list and make proper distribution by a proportion of one-fifth, two-fifths and two-fifths or equally one-third for breakfast, lunch and supper respectively. (3) Detection indexes: (1) Personal information, state of disease, daily physical exercise condition, medication condition and diet habits. (2) Blood glucose: FBG and HbA1C. (3) Blood fat: TC, TG, HDL-C and LDL-C. **Results:** (1) The FBG of intervention group is reduced from 8.67mmol/L to 7.32mmol/L, walking group reduced from 7.45mmol/L to 7.25mmol/L (p>0.05); however, the FBG of control group increases from 8.79mmol/L to 10.26mmol/L (p<0.05). (2) The HbA1C of comprehensive intervention group is reduced from 8.05% to 7.66% (p<0.05); walking group is reduced from 7.04% to 7.01% (p>0.05); control group increases from 8.63% to 9.07%. (3) The HDL-C of comprehensive intervention group is increased from 1.32mmol/L to 1.55mmol/L (p<0.01); walking group is increased from 1.41mmol/L to 1.54mmol/L (p<0.01); while, control group falls from 1.52mmol/L to 1.24mmol/L (p<0.01). **Conclusions:** Comprehensive intervention of exercise and diet is more effective.

2124 Board #137 June 1 2:00 PM - 3:30 PM
Methods To Evaluate An Introductory Motivational Interviewing Workshop For Healthcare Professionals That Promote Weight Management

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PURPOSE: To evaluate the effect of a behavior change counseling training intervention on clinician proficiency.

METHODS: In this observational study, a self-selected group of 13 female clinicians (62% physicians/mid-levels) were evaluated before and after an introductory training in motivational interviewing (MI). Two experienced trainers conducted a standard 2-day workshop that focused on weight management. The clinicians were evaluated with the CARE Measure for 4-wks before and 6-wks after the workshop. This confidential 10-item questionnaire assessed relational empathy from the patient perspective on completion of clinical visits (n=531). The CARE Measure was scored on a 1-5 Likert scale. The clinicians provided an audio-taped recording of a clinical visit of their choice pre and post workshop (PW). The recording was anonymously analyzed by a coding expert. The MITI 4.2 Coding Instrument scored the visits on global ratings that used a 1-5 scale and an objective behavioral count to determine MI proficiency. A pre and PW clinician self-evaluation measured perceived proficiency and intent to use MI.

RESULTS: The overall mean score for the CARE Measure was 48.8 (SD=3.1) out of a maximum of 50 at baseline (BL) and 48.9 (SD=3.0) PW (p>0.05). The overall mean global rating for the MITI was 3.6 (SD=1.2) out of a maximum 5 at BL and 3.8 (SD=0.9) PW (p>0.05). For the behavioral count, the mean reflection-to-question ratio was 0.4 (SD=0.3) at BL and 0.5 (SD=0.3) PW (p>0.05). The mean MI adherent behavior count was 7.5 (SD=6.6) at BL and 8.3 (SD=3.8) PW (p>0.05). The mean MI

non-adherent behavior count was 1.4 (SD=0.6) at BL and 0.2 (SD=0.6) PW ($p < 0.05$). The mean persuasion behavioral count with and without permission was 6.8 (SD=3.5) at BL and 2.9 (SD=1.5) at PW ($p < 0.05$). The mean overall self-perceived proficiency and intent to use MI was 7.6 (SD=1.1) at BL and 8.8 (SD=0.7) PW ($p < 0.05$).

CONCLUSIONS: Preliminary findings of this pilot study did not identify significant change in MI proficiency. However, trainees used significantly less persuasion, patient evaluations remained high and clinician self-evaluation scores improved significantly. Short-term measures from these varied methods of evaluation may provide useful feedback to clinicians for ongoing MI skill development.

2125 Board #138 June 1 2:00 PM - 3:30 PM
Results Of An Eim Based Lifestyle Modification Program On Clinical Outcomes In Obese, Pre-diabetic Patients

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Purpose

To determine if an Exercise Is Medicine (EIM) modeled, lifestyle modification program, including nutrition education and support, exercise programming and health coaching would produce enhanced clinical outcomes and greater reduction in risk than current standard of care in an obese, pre-diabetic population.

Methods

Data was collected from a single center clinical practice with trained nutritionists and exercise physiologists. Inclusion criteria consisted of obese patients (BMI >30 m/kg²) which had additional comorbid health conditions. The 12-week program consisted of: initial assessment (baseline fitness and health markers and goal planning), a health intervention (lifestyle and nutrition counseling, personalized individual and group training, and health education), and outcome assessment (repeat fitness and health assessment). Participants in this program were compared to similarly matched control patients who were given standard of care treatment (physician recommendations on diet and exercise), and had received similar health marker screening at initial visit and again between 3 and 6 months post physician appointment.

Results:

A total of 362 participants met criteria to be included in this data set. 69 intervention group with a mean starting age of 60 years of age and a starting BMI of 38.0 kg/m². 293 control, with a mean starting age of 71 years and starting BMI of 34.8 kg/m². The intervention group saw reduction in HbA1C (5.9 vs 5.7%), Total cholesterol (170 vs 159 mg/dL), and Triglycerides (154 vs 136 mg/dL), and weight (238 vs 222 lbs). By comparison, the HbA1C and weight of the control group were not significantly changed from baseline (HbA1C 6.5 v 6.5%; Weight 219 v 217 lbs). Fitness levels were also significantly increased in the intervention group (22 v 26 ml/kg/min).

Conclusion:

In obese, pre diabetic patients, preliminary data reported shows a significant improvement in health markers and fitness levels following a comprehensive 12-week program utilizing trained exercise and nutritional professionals, individualized coaching and goals, and health education. This data suggests that this inclusive model of health intervention may be beneficial for at risk patients, and is promising for individuals choosing between various treatment modalities.

2126 Board #139 June 1 2:00 PM - 3:30 PM
The Antihypertensive Benefits Of Yoga: A Meta-Analysis

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Yoga practice elicits changes in resting blood pressure (BP) ranging from -29 to +10 mmHg. Reasons for this large variability in the BP response are not clear. **PURPOSE:** To investigate the efficacy of Yoga as antihypertensive therapy and identify moderators of the BP response to Yoga. **METHODS:** Database searches identified 44 controlled Yoga trials that involved adults ≥ 19 yr, yielding 49 interventions. Analyses followed random-effects assumptions. **RESULTS:** Participants ($N=3,376$) were middle-aged (48.2 \pm 16.1yr), overweight (27.3 \pm 3.8kg/m²) adults with prehypertension (systolic BP [SBP]/diastolic BP [DBP], 129.3 \pm 14.0/ 80.9 \pm 9.1mmHg). Yoga was practiced 3.9 \pm 3.1 sessions/wk for 61.0 \pm 22.0 min/session for 14.8 \pm 13.5 wk. Overall, Yoga elicited

moderate reductions in SBP ($d = -0.48$, 95% CIs: -0.63, -0.33; -4.3mmHg) and DBP ($d = -0.50$, 95% CIs: -0.64, -0.35; -3.4mmHg) compared to control ($ps < 0.001$). Yoga produced greater SBP reductions among: samples with hypertension (-11.8mmHg, $k=13$) than prehypertension (-6.6mmHg, $k=20$) and normal BP (-2.9mmHg, $k=14$, $p < 0.001$); interventions located in India (-9.9mmHg, $k=21$) than non-India Asian (-7.0 mmHg, $k=9$) and non-Asian (-4.2mmHg, $k=17$, $p < 0.012$) countries; and interventions with the largest variance (i.e., standard error) in the BP response (-20.0mmHg, $k=15$) than moderate (-6.5mmHg, $k=16$) and small (-1.6mmHg, $k=16$, $p < 0.001$). Yoga produced greater DBP reductions among: samples with hypertension (-10.2mmHg, $k=5$) than prehypertension (-5.4mmHg, $k=14$) and normal BP (-2.1mmHg, $k=24$, $p < 0.001$); interventions located in India (-4.0mmHg, $k=20$) than non-India Asian (-2.3mmHg, $k=8$) and non-Asian (-0.8mmHg, $k=15$, $p < 0.019$) countries; and samples that practiced Yoga with a balanced combination of breathing, postures, and meditation/relaxation (-5.8mmHg, $k=25$) than Yoga largely focused on a single practice (e.g., left nostril breathing) (-2.3mmHg, $k=18$, $p = 0.006$). **CONCLUSION:** Overall, 60 min of Yoga practiced 4 sessions/wk lowered BP ~3-4 mmHg among adults with prehypertension. Yoga reduced SBP/DBP ~12/10 mmHg among adults with hypertension, reductions nearly double of those reported with aerobic exercise. Yet caution is warranted in the clinical translation of our findings until future controlled trials specifically designed to target BP confirm them.

2127 Board #140 June 1 2:00 PM - 3:30 PM
Effectiveness Of A 10-wk Lifestyle Modification Program In Reducing Hypertension In Brazilian Free-Living Adults

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PURPOSE: High blood pressure (BP) is a strong, independent and etiologically relevant risk factor for cardiovascular diseases. Free distribution of more than 15 medications for HYPertension and DIAbetes (HIPERDIA program) clearly shows the important role of drugs in the Brazilian Government's effort to tackle these two diseases. Each medicated BP subject has an estimated cost of US\$ 39.50. However, drug therapy has been largely unsuccessful in halting and reversing the hypertension epidemic and more emphasis must be placed on primary prevention guidelines. BP is often associated with unhealthy lifestyles such as consumption of high fat and/or high-salt diets and physical inactivity.

METHODS: A lifestyle modification program (LSM) involving dietary counseling and regularly supervised physical activity ("Move for Health") has been used here, since 1991, for NCDs primary care. Cross-sectional analysis of clinical, anthropometric, dietary and physical activity data from 1317 subjects (2006-2016) was used to characterize the BP subjects at baseline. Next, a sub-sample ($n=453$) were submitted to a 10-wk LSM and repeated assessments. Statistical comparisons were defined by $p=0.05$.

RESULTS: The BP rate (higher than 140/90mmHg) was 51.2% for SBP and 42.7% for DBP. The top quartile of blood pressure (142.2/88.5mmHg) differed from the lower quartile (120.6/69.2mmHg) by being older and lower either, schooling, income, physical activity (IPAQ) and aerobic capacity (VO₂max.). The p75 showed a low quality diet (HEI score) with more processed foods (higher CHO/fiber, sodium/potassium and saturated fat). They showed also a higher body fatness and prevalence of metabolic syndrome (MetS) along with MetS comorbidities of inflammation, peroxidation and insulin resistance but, without differences in the Framingham score. After 10 weeks of LSM the BP normalization achieved 17.8% for SBP and 9.3% for DBP with a net effectiveness of 8.5% and 2.4%, respectively. The reduction of BP was followed by increased aerobic conditioning and reduced intake of processed foods along with decreased values of BMI, abdominal fatness and comorbidities.

CONCLUSIONS: Based on this effectiveness and, if applied nationwide, one would save medications for 3.1 million of Brazilian hypertensives at an estimated saving of US\$ 1.47 billion a year!

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The Effects of a Group Exercise Rehabilitation Session on Stroke Survivors

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(No relationships reported)

UK stroke mortality rates are falling, but > 50% of stroke survivors have functional disabilities. These impairments reduce capacity to perform activities of daily living (ADL) such as walking, basic self-care and independence, even several years post-stroke. Disability predisposes them to a chronic sedentary lifestyle, leading to further deconditioning and muscle atrophy, compounding disability. Cardiorespiratory fitness (CRF) is markedly reduced in a stroke population, with survivor VO₂ max \approx 50%

below a healthy age-matched population. Hypertension (HTN) is a modifiable risk factor for stroke, yet 75% of recurrent stroke sufferers have HTN. In the UK there is no routine exercise provision for chronic care of stroke survivors. **PURPOSE:** To investigate the impact of a weekly community-based group exercise session on key health parameters and functional capacity of stroke survivors.

METHODS: 10 (63.70±13.21 yrs; 4 females; 6 males) stroke survivors were referred by an acute stroke rehabilitation team to a community-based exercise session. This referral pathway was set-up as a collaboration between the local health care providers and the University of Kent. Participants attended once a week, completing a series of cardiovascular conditioning exercises (circuit format), strength and flexibility training. Health (weight, BMI, resting heart rate, resting systolic and diastolic blood pressure (SBP and DBP), waist circumference) and functional capacity (six-minute walk distance (6MWD), timed up and go, grip strength) assessments completed after 10 sessions (10 weeks).

RESULTS: Reductions in resting SBP (136.30±14.40 mmHg vs 150±14.19 mmHg $p=0.006$) and DBP 76.50±10.91 mmHg vs 83 mmHg $p=0.035$). 6MWD increased (392±112.29 m vs 321.90±106.88 m $p=0.001$). **CONCLUSIONS:** A once a week exercise session reduced SBP to < 140 mmHg and DBP in stroke survivors, who were already medicated with anti-hypertensives. Improved physical capacity evidenced by increased 6MWD. Walking speed increased from 53.65 m.min⁻¹ (3.2 kph) to 65.33 m.min⁻¹ (3.9 kph); improved walking speed ≈3.0 METs (≈2.5mph). This study emphasises the importance of continued exercise rehabilitation post-stroke for further HTN risk factor management (secondary prevention) and continued recovery of physical condition.

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Mechanical Adaptations In Walking Performance Using Ankle Foot Orthoses For Patients With Peripheral Artery Disease

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(No relationships reported)

PURPOSE: Part of the limited success of community-based walking programs for people with peripheral artery disease (PAD) and intermittent claudication (IC) in the calf is a lack of strategies to manage pain during exercise. Carbon fiber ankle foot orthoses (AFO) could delay the onset of IC as they store elastic energy during stance that assists the calf muscles during gait propulsion. Clinical dogma may limit AFO implementation as many practitioners believe that AFO will reduce muscle recruitment during gait with a decline in function over time. Our purpose was to determine the gait adaptations in ankle mechanics, walking speed, and calf muscle recruitment when using AFOs to supplement a community walking program.

METHODS: Fifteen patients with PAD (Age=67±12 yrs) were fitted with bilateral AFO. An initial 3D gait analysis with plantar flexor electromyography data was completed 1 week after fitting. We used a within-session comparison of walking with/without the AFO. Patients were then given standard advice to walk at home using the devices ad libitum for 12 weeks. Twelve patients completed follow up testing after 12 weeks. Differences between conditions and test times were analyzed using paired t-tests.

RESULTS: The AFO reduced peak ankle plantar flexion power during the propulsion phase of walking at initial testing (mean±SE with AFO=1.5±0.2 W·kg⁻¹, without AFO=2.6±0.3, $p<0.001$). Reduced propulsion power was coupled with 4.5° less dorsiflexion during the terminal phase of stance (with AFO=8.6±0.7°, without AFO=13.6 ± 0.9°, $p<0.001$). Peak ankle plantar flexion moment and calf muscle recruitment did not change between conditions ($p>0.05$). The same pattern of results occurred at 12 weeks with no change in the variables over time ($p>0.05$). Gait speed was constant between conditions and over time ($p>0.05$; pooled initial=1.09 m·sec⁻¹, pooled 12 weeks=1.06 m·sec⁻¹). **CONCLUSIONS:** Maintenance of calf muscle recruitment when using the AFO was an unexpected, but favorable finding that contradicts conventional wisdom. Patients maintained normal values of ankle motion using AFO and sustained their gait velocity over time. The AFO reduces power demands on the calf muscle which has potential to reduce IC while still maintaining muscle integrity and walking function. Funding: Pilot and Mini-grants from NIH NIGMS 5U54GM104944.

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The Acute Arterial Stiffness Response to Interval vs. Continuous Exercise in Postmenopausal Women

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(No relationships reported)

High Intensity Interval Exercise (HIIIE) has been associated with greater reductions in cardiovascular disease (CVD) risk factors when compared to continuous moderate

exercise. Arterial stiffness (AS) is an independent risk factor for CVD that increases exponentially in women following menopause. **PURPOSE:** The current research was designed to investigate the acute AS response to a single bout of HIIIE versus a single bout of moderate continuous endurance exercise (MCE) in postmenopausal women. **METHODS:** A total of 13 women (age = 60.85 ± 4.41 years) completed the study. Subjects completed both a HIIIE and a MCE treadmill protocol on separate occasions. Time of the MCE intervention was adjusted to match for the average number of heart beats obtained during the HIIIE intervention. Pulse wave velocity (PWV), augmentation index (AIx), central systolic blood pressure (CSBP), and central diastolic blood pressure (CDBP) were measured pre exercise, 15 min post exercise, and 30 min post exercise to assess arterial stiffness. **RESULTS:** No significant interaction ($p > .05$) between exercise intervention and time was determined for PWV, AIx, CSBP, or CDBP. No change in PWV was found from pre to post exercise ($p = .109$). A trend was found for a greater decrease in AIx following HIIIE compared to the decrease in AIx following MCE ($p = .086$). A significant decrease in AIx was found from pre exercise to 15 min post exercise ($p = .002$; $M_{pre} = 33.91$, $M_{15post} = 27.40$) and from pre exercise to 30-min post exercise ($p = .035$; $M_{pre} = 33.91$, $M_{30post} = 28.67$). **CONCLUSION:** The results of this study indicate that whether postmenopausal women perform MCT or HIIIE, the acute response of central arterial stiffness does not differ. No change in PWV from pre to post exercise was found for either exercise intervention.

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Physical Activity After Hospitalization For Acute Coronary Syndrome: Correlates Of Exercise Days Using Objective Measures

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Exercise is essential in the secondary prevention of acute coronary syndrome (ACS). To date, there is a lack of data examining factors associated with objectively measured exercise in ACS patients post-discharge, a critical window for (re)forming health habits. **PURPOSE:** The purpose of this study was to examine factors associated with lack of exercise among ACS patients over the first 5 weeks post-discharge.

METHODS: ACS patients (myocardial infarction or unstable angina; N=269) from a hospital in Upper Manhattan were enrolled into an observational cohort study. Patients wore a wrist-based accelerometer for 35 days post-discharge. Days in which participants accumulated ≥30 min of moderate to vigorous physical activity in bouts ≥10 min were considered exercise days, expressed as % of days exercised over the 35 day wear period. Multivariable logistic regression models were used to examine correlates of non-exercise (0 days over the 35 day period), which included sociodemographic factors (age, sex, race, body mass index [BMI], partner status, social support), psychological factors (depression, post-traumatic stress disorder), health status/disease severity (GRACE risk score, Charlson comorbidity index [CCI], perceived mental and physical health [SF-12]), and hospital length of stay (LOS) and procedures (coronary artery bypass grafting [CABG], percutaneous coronary intervention [PCI]). All models were adjusted for age, sex, race, and ethnicity. Data are reported as odds ratios (OR) and 95% confidence intervals (CI). **RESULTS:** Among the 269 patients, 63.6% did not exercise at all. Factors associated with non-exercise were GRACE risk score (OR: 1.03; 95% CI: 1.01-1.04; $p=0.003$), LOS (OR: 1.15; 95% CI: 1.05-1.26; $p=0.002$), PCI (OR: 0.26; 95% CI: 0.12-0.58; $p=0.001$), CABG (OR: 5.46; 95% CI: 1.50-19.86; $p=0.010$), BMI (OR: 1.09; 95% CI: 1.03-1.15; $p=0.003$), and perceived physical health (OR: 0.96; 95% CI: 0.93-0.98; $p=0.002$). **CONCLUSION:** In ACS patients in whom exercise participation was objectively measured for 35 days post-hospitalization, factors related to poorer physical health and greater disease severity, but not psychological factors, were associated with low frequency of exercise. Future research may be warranted to elucidate how to address these factors to increase exercise post-ACS.

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Predicting Biomarkers through Affordable Fitness Band in Chinese Breast Cancer Survivors

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PURPOSE: Breast cancer survivors (BCS) are at great risk for low physical activity (PA) levels and quality of life. Applying affordable wearable fitness bands to track PA while also serve to provide predictive utility regarding clinical biomarkers may

enhance health professionals' ability to prevent and manage disease recurrence for BCS. This cross-sectional study described objective PA data from the Xiaomi Mi wrist band among Chinese BCS while evaluating if PA data is predictive of clinical biomarkers.

METHODS: A total of 95 Chinese BCS ($\bar{X}_{age} = 44.8 \pm 7.9$ years; $\bar{X}_{BMI} = 22.2 \pm 3.5$) participated in baseline measurements of a larger parent intervention. Inclusion criteria were: 1) ≥ 21 years old; 2) diagnosed with stage 0-III breast cancer; and 3) completed primary cancer treatment 3 months to 10 years earlier with no new or recurrent cancer. BCS were given the fitness band for 4 weeks after which blood assays were taken to assess biomarker levels. The PA outcome was average steps/day while biomarkers included total cholesterol, triglycerides, high- and low-density lipoproteins (HDL and LDL, respectively), two-hour postprandial blood glucose (2HrBG) change, carcinoembryonic antigen (CEA), and cancer antigen 15-3 (CA 15-3). Descriptive statistics were conducted for all variables while regression analyses assessed if average steps/day predicted the aforementioned biomarkers.

RESULTS: Chinese BCS were observed to take an average 10,635 steps/day. Null to weak correlations between average steps/day and biomarkers (range $r = -.18$ to $.24$) were observed. Regression analyses indicated average steps/day to only be significantly predictive of HDL, $r^2 = .06$, $p = .04$, with marginal predictive utility of average steps/day seen for CEA, $r^2 = .04$, $p = .08$. Specifically, higher average steps/day was associated with slightly higher HDL and CEA levels. Yet, patients' PA failed to significantly predict other biomarkers.

CONCLUSIONS: Use of PA data from a wearable fitness band has some predictive utility for certain biomarkers. Notably, findings suggest health professionals may want to focus on increasing PA in BCS with lower HDL levels while tracking abnormally high CEA levels. Greater predictive utility of the Xiaomi Mi for clinical biomarkers might be seen with larger samples of BCS.

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Cardiorespiratory Fitness And Muscle Strength In Pancreatic Cancer Patients

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Pancreatic cancer is the fourth most common cause for cancer death. Despite progress in diagnosis and therapies in recent years, the 5-year survival rate of all stages is still only 6%. Exercise-related research in this patient group is widely missing. **PURPOSE:** It is well known, that cancer patients frequently experience reduced physical fitness due to the disease itself as well as treatment-related side effects. However, studies on physical fitness in pancreatic cancer patients are missing. Therefore, we assessed cardiorespiratory fitness and muscle strength in this patient group. **METHODS:** Sixty-five pancreatic cancer patients, mostly after surgical resection, were included in this study. Cardiorespiratory fitness was assessed using cardiopulmonary exercise testing (CPET) and 6-minute walk test (6MWT). Hand-held-dynamometry was used to evaluate isometric muscle strength. Physical fitness values were compared to reference values from a healthy population. Associations between sociodemographic and clinical variables with patients' physical fitness were analyzed with multiple regression models. **RESULTS:** Cardiorespiratory fitness (VO_{2peak} , 20.5 ± 6.9 ml/min/kg) was significantly lower (-24%) compared to healthy reference values. In the 6MWT pancreatic cancer patients nearly reached predicted values (555 vs. 562 meters). Maximal voluntary isometric contraction (MVIC) of the upper (-4.3%) and lower extremities (-13.8%) were significantly lower compared to reference values. Overall differences were larger in men than in women. Participating in regular exercise in the year before diagnosis was associated with greater VO_{2peak} ($p < .05$) and MVIC of the knee extensors ($p < .05$). **CONCLUSIONS:** Pancreatic cancer patients had significantly impaired physical fitness with regard to both, cardiorespiratory function and isometric muscle strength, already in the early treatment phase (median 95 days after surgical resection). Our findings underline the need to investigate exercise training also in pancreatic cancer patients to counteract the loss of physical fitness. Supported by the German Cancer Aid (SUPPORT-Study; Grants No. 110513 and 110552)

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Aerobic Exercise And Cancer-Related Fatigue In Adults: A Re-examination Using The Ivhet Model

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BACKGROUND: Using the traditional random-effects model, a recent meta-analysis of randomized controlled trials reported a statistically significant standardized mean

difference (SMD) reduction in cancer-related fatigue (CRF) as a result of aerobic exercise (SMD, -0.22, 95% CI, -0.39 to -0.04, $p = 0.01$). However, a recently developed inverse heterogeneity (IVhet) model has been shown to be more valid than the traditional random-effects model. **PURPOSE:** The purpose of this study was to compare these previous meta-analytic results with those using the IVhet model. **METHODS:** Using data from a previous meta-analysis that included 36 SMD effect sizes (ES's) representing 2,830 adults (1,426 exercise, 1,404 control), results were pooled using the IVhet model. In addition, absolute and relative differences between the IVhet and random-effects results for CRF were calculated as well as influence analysis with each SMD ES deleted from the IVhet model once. Non-overlapping 95% confidence intervals were considered statistically significant. **RESULTS:** A statistically non-significant reduction in CRF fatigue was found as a result of aerobic exercise using the IVhet model (SMD, -0.08, 95% CI, -0.31 to 0.14, $p = 0.46$). The IVhet model yielded a SMD ES that was 0.14 (63.6%) smaller than the random-effects model. With each study deleted from the IVhet model once, results remained statistically non-significant with SMD ES's ranging from -0.11 (95% CI, -0.33 to 0.11) to -0.06 (95% CI, -0.28 to 0.16). **CONCLUSIONS:** The results of the current study suggest that there is currently insufficient evidence to support the use of aerobic exercise for reducing CRF in adults. Future studies should consider use of the IVhet versus traditional random-effects model when conducting aggregate data meta-analyses. Supported by NIH Grant U54GM104942

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Examining The Relationships among Chinese Breast Cancer Survivors' Psychosocial Outcomes and Physical Fitness

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Purpose: A decline in physical fitness has been evident among breast cancer survivors (BCS) following diagnosis. Yet, the relations among psychosocial beliefs and fitness in this population remains unexplored. This study investigated the correlates of psychosocial outcomes and fitness in Chinese BCS while determining the extent to which whether patients' fitness can be predicted by psychosocial factors.

Methods: A total of 135 BCS ($M_{age} = 44.3$, $SD = \pm 8.1$) were recruited from Southern region of China. Selected psychosocial outcomes were assessed by validated Patient-Centered Assessment and Counseling for Exercise Scale (2001), including physical activity confidence (PAC); physical activity family support (PAF); physical activity friend support (PAF); and physical activity environment factors (PAEF). Patients' fitness testing consisted of leg strength and endurance (LSE; 30-second chair stand test); upper body strength and endurance (UBSE; 30-second arm curl test); lower body flexibility (LBF; chair sit and reach test); shoulder range of motion (SRM; measured by back scratch test); aerobic endurance (AE; 2-minute step test); and mobility and balance (MB; up and go test).

Results: Correlation analyses revealed no significant relationships were observed among psychosocial outcomes and overall fitness ($p > .05$). However, PAC was positively correlated with LBF ($r = .18$, $p < .05$), despite correlation was low. Regression analysis indicated the overall model was statistically significant when PAC was used to predict LBF [$F(1, 133) = 4.1$, $p < .05$, $r^2 = .03$], suggesting PAC was a significant predictor of LBF ($t = 2.1$, $p < .05$).

Conclusion: Findings suggest that as BCS's PAC increases, their LBF is expected to increase modestly. Additionally, findings indicate that PAC significantly predict LBF—suggesting PAC may be a determinant of patients' low body fitness. Nevertheless, other psychosocial outcomes were not significantly associated with any fitness component. It appears that psychosocial factors may not serve as ideal determinants for BCS' fitness. Future research is warranted, therefore, to investigate other factors such as physiological and rehabilitative outcomes that may influence fitness in this population.

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Physical Activity Levels and Cardiometabolic Risk Factors in Adults with Asthma-COPD Overlap Syndrome (ACOS).

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Asthma-COPD overlap syndrome (ACOS) is characterized by persistent airflow limitation and symptoms associated with both asthma and chronic obstructive pulmonary disease (COPD). However, those with ACOS have worse health outcomes than those with asthma or COPD alone. Regular physical activity may be important in the management of ACOS and the prevention of cardiometabolic comorbidities.

Purpose: To investigate the association between physical activity and the presence of ACOS, and second, to investigate the association between physical activity levels and cardiometabolic disease risk factors in adults with ACOS aged 45 years and older. **Methods:** The Canadian Community Health Survey (CCHS) is a cross sectional survey that collects information pertaining to the health determinants, health care utilization, and health status of Canadians. Data from respondents with ACOS (n= 1,569) and those without a respiratory condition (n= 64,175) from CCHS version 1.0, 2013 were analyzed. Self-reported physical activity was used to categorize respondents as active or inactive. Self-perceived health, body mass index and physician-diagnosed high blood pressure were used as outcomes. Descriptive statistics were used to calculate the frequencies of outcomes (physical activity level, self-perceived health, high blood pressure, and BMI) within the ACOS and no respiratory disease groups. Logistic regression analyses were conducted to determine the association between physical activity and ACOS, and between physical activity levels and cardiometabolic disease risk factors in ACOS. **Results:** Those with ACOS were 59% less likely to be physically active than those without a respiratory condition (OR = 0.59, CI = 0.50-0.71). Physically active adults with ACOS had higher odds of good self-perceived health (OR = 2.66, CI = 1.71-4.16), and were 60% less likely to report high blood pressure (OR = 0.60, CI = 0.43-0.86) than those who were inactive. BMI seemed to be an important correlate for self-perceived health, and high blood pressure, but was not significant when used as an outcome. **Conclusion:** Physical activity levels among adults with ACOS are low. This may increase their risk for poor health outcomes. Future research is needed to determine the effectiveness of exercise within this population.

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Affective Response To Sprint Interval Exercise In Adults With And Without Exercise-induced Bronchoconstriction

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Individuals with exercise-induced bronchoconstriction (EIBC) often experience symptoms such as wheezing, coughing and shortness of breath during or following exercise; this may lead to greater perceptions of in-task effort and less enjoyment. Adults with EIBC report higher affect after performing high intensity interval exercise compared to moderate intensity continuous exercise (MICE). **Purpose:** To examine in-task perceptions of effort, dyspnea, and affective feelings during a sprint interval exercise (SIE) and MICE session in adults with and without EIBC. **Methods:** Participants with EIBC (aged 22.0±2.6) and participants without EIBC (aged 21.7±0.6) completed SIE (4 x 30 second sprints at 0.075kg/kg bodyweight, separated by 4.5 minutes of unloaded cycling) and MICE (65% peak power output for 20 minutes) sessions. Ratings of perceived exertion (RPE), ratings of perceived dyspnea (RPD) and 1-item feeling scale (1-FS) were monitored each minute during exercise. The Physical Activity Enjoyment Scale was completed by participants following each exercise protocol. Participants were also asked if they preferred SIE or MICE after the second session. Sessions were completed in random order. **Results:** Among those with EIBC, average RPE was not different during MICE (13.4±1.9) compared to SIE (11.5±0.5, p=0.29), there were no differences in average RPD during MICE (4.5±1.4) compared to SIE (4.3±0.6, p=0.81), average affect was greater during MICE (2.8±1.6) compared to SIE (2.0±1.5, p<0.05), and differences in physical activity enjoyment scores for MICE (93.0±5.6) compared to SIE (77.0±4.6, p=0.09) were approaching significance. There were no differences in RPD or affect between those with and without EIBC for either SIE or MICE. Those without EIBC reported higher RPE during SIE and had a higher enjoyment scores for SIE compared to those with EIBC. Two thirds of participants with EIBC preferred MICE and all participants without EIBC preferred MICE. **Conclusion:** SIE was associated with similar exertion and dyspnea but lower affect and enjoyment compared to MICE. Therefore, SIE may not be recommended for adherence to regular exercise in adults with EIBC.

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Physical Activity Interventions And Chronic Diseases: A Matched-Pair Analysis Comparing Cochrane And Non-Cochrane Systematic Reviews

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PURPOSE: Systematic reviews and meta-analyses are important tools used to support evidence-based decisions in health care. A recent study concluded that non-Cochrane reviews report larger effect sizes with less precision when compared with Cochrane reviews. The analysis mainly considered pharmacological interventions. Therefore

we explored whether there were similar differences between the two types of reviews that examined the role of physical activity in chronic diseases. Such an analysis is particularly relevant to policy makers in ensuring that recommendations made to populations are based on the most accurate and precise evidence.

METHODS: This is a substudy of an overview of 56 Cochrane reviews with RCTs of physical activity interventions for chronic diseases (cancer; cardiovascular, respiratory, renal diseases; metabolic, mental, musculoskeletal disorders). A matched-pair analysis was chosen to contrast Cochrane and non-Cochrane reviews. A systematic literature search was undertaken to identify non-Cochrane reviews that matched based on intervention, condition, outcomes and publication year as in the corresponding Cochrane reviews. Methodological quality of the reviews was assessed using AMSTAR. The pairs will be contrasted in terms of frequency and degree of concordance in their results and whether differences affected the citation rate.

RESULTS: Of the 56 Cochrane reviews within our data set, we found 33 non-Cochrane reviews that met the eligibility criteria. The full analysis will be completed by the end of 2016 and final results will be presented fully for the first time at the ACSM meeting.

CONCLUSION: This is the first study comparing systematic reviews that were conducted within and outside the Cochrane Collaboration, in particular with respect to physical activity interventions for chronic diseases. Unlike a previous study using meta-analyses on medication therapy within the cardiovascular literature, we applied a more precise methodological approach that concurrently points out how differences can be explained. The findings of our study should make an important contribution to the field of evidence-based physical activity and emphasize that a critical appraisal of systematic reviews reporting physical activity interventions is highly recommended for health professionals.

2139 Board #152 June 1 2:00 PM - 3:30 PM

P.p1 {margin: 0.0px 0.0px 0.0px 0.0px; Font: 24.0px Helvetica} Physical Activity For The Prevention And Treatment Of Major Chronic Disease: An Overview Of Systematic Reviews

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PURPOSE: Evidence of physical activity (PA) as beneficial for health stems mainly from observational studies. Findings from randomised controlled trials (RCTs) often differ and systematic reviews of RCTs demonstrate mixed results making translation into clinical practice difficult. An overview of existing review evidence is needed to identify PA interventions that are effective in preventing or treating major chronic disease.

METHODS: We searched the Cochrane Database of Systematic Reviews for reviews of RCTs restricted to 20 major chronic diseases. A minimum of two authors independently screened search outputs, selected studies, extracted data and assessed quality of included reviews using AMSTAR. Certainty of effect estimates was assessed using the GRADE method. Primary RCTs within included reviews found to demonstrate confounding were excluded, and affected pooled estimates were re-calculated. **RESULTS:** 56 Cochrane systematic reviews (49[88%] deemed high quality according to AMSTAR) across 20 chronic health conditions consisting a total of 829 RCTs and 65,032 participants were included. Data were extracted on 435 outcomes of which GRADE assessments were already available for 56 (13%) and newly derived for a further 189 (43%). We re-analysed 159 pooled-estimates across 27 reviews due to exclusion of 321 confounded trials. We found high quality evidence of a clinical and statistical benefit of PA for self-reported pain and self-reported pain and physical function in patients with osteoarthritis of the knee and hip; and dyspnoea and fatigue quality of life measures in patients with COPD. Conversely, high quality evidence for no effect of PA was found for bone mineral density of the neck, hip and trochanter in postmenopausal women; and disease activity and radiological damage in patients with rheumatoid arthritis. The remaining outcomes showed moderate (42[17%]), low (112[46%]) and very low (79[32%]) quality evidence, predominantly in favour of PA. **CONCLUSIONS:** A number of chronic health conditions for which clinical guidelines recommend physical activity may not be supported by high quality, clinically relevant evidence. Where there is a strong evidence-base, a formula of efficacious physical activity interventions is warranted but maybe hampered by heterogeneity within the available literature.

THURSDAY, JUNE 1, 2017

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Evidence Of Benefits Of Exercise And Its Mechanisms In Inflammatory Arthritis

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INTRODUCTION: Rheumatoid arthritis (RA) and Ankylosing spondylitis (AS) are systemic, autoimmune diseases causing severe joint inflammation, leading to joint damage and functional disability. Both diseases may feature co-morbidities e.g. cardiovascular disease (CVD) and hypercholesterolemia. RA is most prevalent in individuals aged ≥ 18 years, with an estimated prevalence distribution of 0.4-1.3% worldwide. AS has an age onset of 15-35 years, typically affecting 7-9/100 000, with a 3:1 male-to-female ratio. **PURPOSE:** Evidence of benefits of exercise, and its hypothesised mechanisms in RA and AS patients were explored. **METHODS:** Research literature on stage of disease, amount and type of exercise and classification levels were assessed using Medline and Scopus databases.

RESULTS: Pre-evaluation includes staging of level of function (class I-IV) and assessment of disease activity and co-morbidities. Recommended amount and type of exercise vary depending on the site and amount of impaired joints, presence/absence of inflammation, joint stability and previous joint replacements. The FITT-Pro principle (frequency, intensity, time, type and progression) is followed in exercise prescription. Evidence of benefit of aerobic and resistance exercise programs shows an increase in aerobic capacity, muscle strength, self-reported functional ability, endothelial function, blood pressure, lipid profile, autonomic function and muscle mass, with a decrease in body fat percentage and trunk fat mass. Inflammatory disease is characterised by increased levels of circulating TNF α that induces cachexia and lead to deterioration of muscle strength. Pro-inflammatory cytokine production may also predispose patients to atherosclerosis, loss of muscle mass, and metabolic disorders (insulin resistance and dyslipidemia). Exercise not only improve functional outcome, but also induces an anti-inflammatory response, specifically suppressing TNF α production and stimulating the production of anti-inflammatory cytokines (IL-1ra and IL-10) via muscle derived IL-6. **CONCLUSIONS:** Scientific literature supports the benefit of exercise to both improve functional ability and reduce CVD mortality and other co-morbidities. Mechanisms of the effect of exercise are on functional and anti-inflammatory level.

2141 Board #154 June 1 2:00 PM - 3:30 PM
Improving Strength and Mobility of Adults with Multiple Sclerosis Through a 16-week Exercise Program

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Canada has the highest prevalence rate of multiple sclerosis (MS) globally (291 per 100,000). People with MS often experience intense fatigue, muscle weakness, decreased aerobic endurance, loss of flexibility, and impaired balance and gait. To mitigate these symptoms, which negatively affect quality of life, physical activity is often recommended.

Purpose: To examine the effectiveness of a 16-week exercise program on improving common symptoms of MS.

Methods: Nine adults diagnosed with MS (M_{age} : 51.3 years; range: 42-65 years, 1 male) completed a progressive exercise program including cardiovascular, strength, flexibility, balance, and proprioception exercises (60 minutes, twice a week for 16 weeks). General measurements of health, physical fitness, functional movement, cognitive function, and quality of life were collected pre-, mid-, and post-program. A one-way ANOVA with repeated measures (Session: pre-, mid-, post-program) was performed on all dependent measures ($\alpha = 0.05$). Effect sizes were calculated using the partial omega-squared (ω^2_p) test.

Results: Collectively, participants showed significant ($p < 0.05$) improvements from pre- to post-program on the timed up-and-go (TUG) ($\omega^2_p = 0.21$) and wall push-up tests ($\omega^2_p = 0.45$). Strong trends ($p < 0.1$) toward improvement were shown for flexibility ($\omega^2_p = 0.19$), comfortable walking speed (CWS) ($\omega^2_p = 0.28$), gait cadence ($\omega^2_p = 0.20$), vitality ($\omega^2_p = 0.26$), fatigue ($\omega^2_p = 0.17$), and mental health ($\omega^2_p = 0.18$). Individually, five participants showed improvement in mental health, six showed improvement in cadence, and seven showed improvement in one or more of TUG, wall push-ups, flexibility, CWS, vitality, and fatigue (all pre- to post-program).

Conclusions: The progressive exercise program was successful in providing significant improvement in mobility (TUG) and upper body strength (wall push-ups). Although not statistically significant, strong trends were recognized in the areas of gait (CWS and cadence, which support the significant improvement in TUG) and quality of

life (vitality, fatigue, and mental health), which may be functionally meaningful. Future research could investigate the possibility of using exercise to slow the progression of the degenerative effects of the disease.

Supported by the University of Windsor Strategic Priority Fund.

2142 Board #155 June 1 2:00 PM - 3:30 PM
Aquatic-Dietary Intervention On Fitness & Metabolism In SCI Individuals With Glucose > 100mg/dl

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PURPOSE: Assess dosed group aquatic exercise at 70-75% of heart rate reserve (HRR) and weekly nutritional guidance upon body mass, glucose, insulin, A1C, peak VO₂, and resting metabolic rate (RMR) for four individuals with CMISCI and a history of elevated fasting glucose concentrations greater 100 mg/dL.

METHODS: Four men (63 yo, AIS D, body mass index (BMI) 31.9; 34 yo non-ambulatory, AIS C, BMI of 31.6; 58 yo, AIS D, BMI 27.4; and 45 yo non-ambulatory, AIS C, BMI 28.56) enrolled in an individualized 10-week aquatic exercise (3 days per week for 40 minutes each session) and dietary guidance (by phone once per week) intervention. Nutritional guidance included reducing refined carbohydrates and processed food, limiting high glycemic fruits, and increasing vegetable, fluid and lean protein intake. Outcome measures (pre/post) included: three-day electronic food logs, weekly hard copy food logs, glucose, insulin and A1C (via standard fasting venipuncture), peak VO₂ and RMR.

RESULTS: Participant one decreased glucose, 20% (132 to 106 mg/dL); A1C, 11% (6.3-5.6); weight, 10%, (11.9 kg); RMR, 13%; and peak VO₂, 12%. Participant two showed no change in A1C or RMR; decreased weight, 3% (3.3kg); peak VO₂ (16.4%); and increased glucose 9%. Participant three decreased: glucose, 14%, (126 to 108 mg/dL); A1C, 5% (7.5 to 7.1); weight, 6% (88.9 to 83.8 kg); RMR, 12.5%; and increased peak VO₂ 8% (21.9 to 23.7). Participant four increased glucose, 9.3% (86 to 94 mg/dL); decreased A1C 5.5%; showed no change in weight; increased peak VO₂, 34.1%; and RMR, 24.6%.

CONCLUSIONS: Moderate exercise with weekly nutritional guidance decreased body mass, glucose, and A1C in individuals with CMISCI. Further examination of the impact of a low cost intervention of combined aquatic exercise with nutritional guidance exerts upon body mass, metabolic status, and cardiovascular fitness for individuals with CMISCI is indicated

D-66 Exercise is Medicine®/Poster - EIM - Older Adults

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2143 Board #156 June 1 2:00 PM - 3:30 PM
Long-term Exercise Program Enrolment in Older Adults: Effects on Cardiorespiratory and Musculoskeletal Fitness

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 (No relationships reported)

Substantial research supports the benefits of exercise training for older adults, but much of the existing evidence comes from highly structured, laboratory-based interventions. A longitudinal investigation of the impact of enrolment in a community exercise program on cardiorespiratory fitness (CRF) and muscular strength among a heterogeneous population of older adults is warranted. **PURPOSE:** To examine changes in CRF and muscular strength among participants of the MacSeniors Exercise and Wellness program through a retrospective chart review. **METHODS:** Included subjects ($n = 124$) completed exercise tests prior to program entry and after a minimum of one-year participation in the program. One-sample t -tests were used to analyze rates of change in CRF and muscular strength (separately for each muscle group) in comparison to the population sample. The rate of 1.00% per year was selected for comparison because it is the minimum expected CRF decline. Rates of strength decline were compared to those established in the Health Aging and Body Composition Study (2006) by Goodpaster et al. (3.42% and 2.65% for men and women, respectively) due to its comparable design and participant characteristics. **RESULTS:** After a mean follow-up time of 5.2 ± 2.6 years, absolute- ($-0.29 \pm 0.58\%$, $p = 0.23$) and relative- ($0.06 \pm 0.62\%$, $p = 0.13$) changes in VO_{2peak} were not significantly different than the

minimum expected decline of 1.00% per year, among men. However, both measures of CRF significantly improved over time in women (absolute $\dot{V}O_{2peak}$ [2.25 ± 0.66%, $p < 0.001$]; relative $\dot{V}O_{2peak}$ [2.24 ± 0.68%, $p < 0.001$]). Changes in muscular strength were significantly less than the established rates of decline across all muscle groups in both men ([1-repetition maximum (1-RM) bench press: -0.38 ± 0.96%, 1-RM row: -0.01 ± 0.82%, 1-RM knee extension: 0.25 ± 0.83%], $p < 0.05$) and women ([1-RM bench press: 3.23 ± 1.11%, 1-RM row: 1.58 ± 0.91%, 1-RM knee extension: 0.73 ± 1.21%], $p < 0.05$). **CONCLUSION:** Enrolment in the MacSeniors Exercise and Wellness program attenuated the age-related decline in $\dot{V}O_{2peak}$ in women, but not in men in comparison to previously published rates of decline. Decline in upper and lower body large muscle force was attenuated in both men and women across all muscle groups compared to previously published normative rates of change.

2144 Board #157 June 1 2:00 PM - 3:30 PM
Effects Of Mulan Quan On Physiological Functions In Middle-Aged And Elderly Women

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Mulan Quan is a modern form of Tai Chi created specifically for women. **Purpose:** To explore the effects of Mulan Quan exercise on vascular function, pulmonary function and cardiovascular fitness in middle-aged and elderly women. **Methods:** Twenty middle-aged and elderly women were recruited from the Senile University of Chengdu, China. Women who were sedentary and had never practiced Mulan Quan were included in the control group ($n=10$, 57±5 years old), and those who had been practicing Mulan Quan for 4 years or longer were included in the exercise group ($n=10$, 60±5 years old). The exercise group practiced Mulan Quan 40-60 minutes each time, 3 times each week. Pulse wave velocity (PWV) and ankle-brachial blood pressure index (ABI) were determined by an Omron arteriosclerosis detector, forced vital capacity (FVC) was measured by spirometer, and cardiovascular fitness was evaluated by a step test. Independent t-tests were used for group comparisons. **Results:** For vascular function, PWV values from both sides were significantly lower in the exercise group than in the control group (left side: 1372.00±136.57 cm/s vs. 1687.00±1167.71 cm/s, $p<0.05$; right side: 1371.70±123.09 cm/s vs. 1661.30±180.25 cm/s, $p<0.05$), and ABI value from the right side was significantly lower in the exercise group than in the control group (1.07±0.07 vs. 1.14±0.06, $p<0.05$); there was no group difference in ABI values from the left side. For pulmonary function, the PVC was significantly higher in the exercise group than in the control group (2326.50±327.75 ml vs. 1938.00 ± 514.08 ml, $p<0.05$). For cardiovascular fitness, the step index was significantly higher in the exercise group than in the control group (66.50±8.57 vs. 59.20±6.27, $p<0.05$). **Conclusions:** Long-term Mulan Quan practice can significantly improve vascular function, pulmonary function and cardiovascular fitness in middle-aged and elderly women. Future studies are needed to elucidate the mechanisms through which Mulan Quan promotes health.

2145 Board #158 June 1 2:00 PM - 3:30 PM
Age, Physical Activity, And Body Composition Independently Influence Physical Function In Middle-aged And Older Women

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 (No relationships reported)

PURPOSE: With aging, physical activity (PA) declines and adverse changes in body composition occur, including both increases in adiposity (%Fat) and reductions in lean mass (LM), negatively impacting lower-extremity physical function (LEPF) and risk for physical disability. However, the interactive effects of these factors on LEPF remains incompletely characterized in middle-aged and older women known to be at higher risk of physical disability compared to male counterparts. Thus, this study aimed to evaluate the associations of age, PA, %Fat, and leg LM relative to body weight (LEG-LM/BW) with LEPF in middle-aged and older females.

METHODS: Women ($n = 274$; 50-89 & 66.7±8.2 yo; 43.5 ± 6.8%Fat) were assessed for PA using accelerometry (NL-1000; 4 valid, 10-h days of wear), body composition via DXA and LEPF using a composite Z-score from 6-Minute Walk Test, Timed Up and Go, and 30-second Chair Stand scores.

RESULTS: Age, PA, %Fat, and LEG-LM/BW were all associated with LEPF ($r = -0.53, 0.58, -0.35, 0.27$ respectively; all $p < 0.01$). As expected mathematically, %Fat and LEG-LM/BW were strongly related ($r = -.95$; $p < 0.01$) thereby not included in the same regression model. Linear regression analyses revealed A) Age and %Fat independently explained 28% and 13% of the variance in LEPF, respectively (both $p < 0.05$); B) Age and LEG-LM/BW independently explained 28% and 12% of the

variance in LEPF, respectively (both $p < 0.05$). Within a subsample with objective PA ($n=166$; 50-77 & 62.8±6.7 yo; 6648 ± 2880 steps/day), linear regression analyses revealed A) Age, %Fat, and PA independently explained 21%, 26%, and 5% of the variance in LEPF, respectively (all $p < 0.05$); B) Age, LEG-LM/BW, and PA independently explained 21%, 21%, and 7% of the variance in LEPF, respectively (all $p < 0.05$). However, interactions among independent variables of interest (age, %Fat, LEG-LM/BW, and/or PA) were not predictors of LEPF (all $p>0.05$).

CONCLUSION: Our results confirm that age, %Fat, LEG-LM/BW, and PA are individually associated with LEPF but, the interactive influence of these inter-related factors on LEPF are less clear. Further study is warranted to determine the salient factors for intervention to ameliorate the age associated decline in LEPF increasingly observed in middle-aged women.

2146 Board #159 June 1 2:00 PM - 3:30 PM
Exercise-based Cardiac Rehabilitation Improves Physical Health And Quality Of Life In Elderly Women

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Post-event cardiac rehabilitation (CR) improves cardiorespiratory fitness (CRF) and quality of life (QoL) while reducing depression and anxiety. Unfortunately women are less likely than men to participate in CR, despite research showing women benefit from CR, more than men. Similarly, women who complete CR have a 64% reduction in mortality rate, compared to those who don't complete CR. Research on the efficacy of CR in elderly women is lacking and research is needed to assess exercise-based CR's role in physical health and quality of life post cardiac event.

PURPOSE: This study sought to examine the effectiveness of an exercise-based cardiac rehabilitation program on CRF, self-reported QoL, depression and anxiety in elderly women with CVD.

METHODS: Participants ($n=30$) with CVD (71.2 ± 5.2 yrs) were referred to an exercise-based CR program located in Auckland, NZ. All participants underwent baseline and follow-up assessment which included a ramped ECG monitored maximal exercise test with gas analysis, a QoL (Short Form-36), and Hospital Anxiety and Depression Scale (HADS) questionnaire. Participants completed 3 weekly sessions of aerobic (40-70% $\dot{V}O_{2R}$), resistance (1-2 sets; 12-15 reps at 40-80% 1RM) and balance and flexibility exercise, totalling approximately 60 minutes/session. Significantly different ($p<.05$) pre- vs. post-program values were identified by dependent t-tests. Data are the mean ± SD.

RESULTS: Post-program CRF significantly increased (18.5 ± 6.3 to 21.1 ± 7.5 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) despite no significant increase in HRpeak (131.9 ± 28.7 to 132.1 ± 40.1 bpm) and respiratory exchange ratio (1.03 ± 0.1 to 1.03 ± 0.2) during maximal exercise testing. Resting heart rate decreased significantly (72.4 ± 11.8 to 68.6 ± 10.8 bpm), whilst no change in systolic (126.3 ± 24.2 to 129.8 ± 16.0 mmHg) or diastolic blood pressure (82.0 ± 16.0 to 79.2 ± 8.2) was observed. SF36 component scores for physical (49.4 ± 41.5 to 72.6 ± 37.3) and mental health (74.9 ± 15.9 to 82.8 ± 10.1) increased significantly while the HADs anxiety (5.6 ± 3.4 to 3.6 ± 2.3) and depression (2.9 ± 2.4 to 1.8 ± 1.8) scores were significantly lower post-program.

CONCLUSIONS: Twelve weeks of exercise-based exercise CR is safe and effective for increasing CRF, and QoL while reducing depression and anxiety in elderly women.

2147 Board #160 June 1 2:00 PM - 3:30 PM
Changes in Cardiometabolic Risk Factors after High-Velocity Circuit Resistance or Treadmill Training in Older Adults

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Cardiometabolic syndrome (CMS) is an aggregation of major risk factors that increases a person's risk for developing cardiovascular disease, diabetes mellitus and the risk of mortality from cardiovascular disease. Continuous treadmill training (TM) has been shown to effectively attenuate the magnitude of CMS risk factors in a multitude of clinical populations. However, there is a paucity of research on the effects of high-velocity circuit resistance training (CRT) on CMS risk factors in older adults.

PURPOSE: To compare the effects of CRT versus TM versus no exercise (CONT) on older adults with CMS risk factors. **METHODS:** Thirteen subjects (1M, 12F; 68.5 ± 7.3 years) with multiple risk factors for CMS participated in 12-weeks of CRT or TM. BMI, body fat % (BF), waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), fasting glucose (GLUC), glycated hemoglobin (A1C), and C-Reactive Protein

(CRP) were measured before and after the training. Nutritional intake was monitored to eliminate influence on CMS biomarkers. **RESULTS:** A within-group analysis showed that CRT exhibited significant decreases in A1C (MD= -0.367, SE= .142, p=0.03), SBP (MD= -21.67, SE= 6.35, p<.01), and DBP (MD= 9.33, SE= 2.53, p=.01), while TM had a trend toward decreased LDL-C (MD= 15.25, SE= 8.16, p=.09), and CONT showed a trend toward increases in CRP (MD= -0.16, SE= .08, p=.08). CRT also exhibited greater decreases in BMI, BF, and CRP than TM and CONT after the intervention, although statistical significance was not reached. There were no significant changes in TC, LDL-C, TG, or GLUC in any group. A between-group analysis showed CRT had significantly greater decreases in DBP compared to TM (MD= -10.58, SE= 3.34, p=.03) and CONT (MD= -12.13, SE= 3.19, p=.01) and a trend toward decreased SBP compared to CONT (MD= -19.47, SE= 8.03, p=.08). **CONCLUSION:** These preliminary results indicate that CRT results in greater improvements in CMS risk factors than TM. Although statistical significance was not reached for certain risk factors, a larger subject pool may strengthen our results.

2148 Board #161 June 1 2:00 PM - 3:30 PM
Continued Improvement and Maintenance in Older Veterans After Two Years of Gerofit Exercise Program

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 (No relationships reported)

PURPOSE: Gerofit is an outpatient facility-based clinical exercise program for Veterans ≥ 65 years that was developed at the Durham VA Medical Center. This model was implemented at the Baltimore VA Medical Center (BVAMC) Geriatric Research Education and Clinical Center (GRECC) in 2013. Participants in Gerofit receive individualized exercise programs based on their functional assessments to improve function and mobility. We assessed lower extremity function and mobility changes in Veterans who completed 2 years of Gerofit.

METHODS: Older Veterans (≥ 65 yr) with primary care at the BVAMC were referred to Gerofit. Veterans attended Gerofit sessions up to 3 d/wk. Assessments included measures of: lower extremity function (Short Physical Performance Battery (SPPB); 30 second chair stands), endurance (six-minute walk (6MW)), gait speed (10 meter walk), agility (8 foot up and go (TUG)) and balance (four-square step test (FSST)). A repeated measure ANOVA was used to compare function and mobility changes at baseline, 1 and 2 yrs of participation. When significant differences were found a Bonferroni Post-hoc was used.

RESULTS: Twenty-five Veterans (24 male, 69.7 ± 4.2 yr (mean \pm SD), 72% African American, BMI 32.9 ± 6.5 kg/m²) completed 2 yr of Gerofit. Data are presented as baseline, 1 yr, 2 yr. Lower extremity function improved 37% between baseline and 2 yr testing as measured by chair stands (12.1 ± 5 , 15.6 ± 7.1 , 16.6 ± 8.1 ; $p < 0.01$). Endurance increased 12% (502.8 ± 146.1 , 533.5 ± 179.6 , 563.9 ± 176 ; $p < 0.01$). TUG scores decreased 15% (7.6 ± 2.2 , 6.9 ± 2.6 , 6.7 ± 2.7 ; $p < 0.05$) and FSST decreased 8.7% (11.2 ± 3.8 , 9.8 ± 3.3 , 10.3 ± 5.6 ; $p < 0.05$). SPPB and 10 meter walk did not significantly improve ($p = 0.15$ and $p = 0.78$). No test resulted in significant changes between 1 yr and 2 yr ($p \geq 0.20$).

CONCLUSIONS: Veterans who participated in two years of Gerofit demonstrated significant improvements in dynamic balance, including lower body function, endurance, and agility. The SPPB did not significantly change and this may be due to a ceiling effect as baseline scores were 10 out of 12. These results demonstrate participation in Gerofit results in the significant changes in function after 1 year. These changes are maintained with exercise for a second year and suggest the importance of adhering to an exercise program to maintain physical function with aging.

2149 Board #162 June 1 2:00 PM - 3:30 PM
The Challenges and Successes During a 12-week Exercise Program for Post-Menopausal Women: A Qualitative Study.

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 (No relationships reported)

Commitment and follow through to an exercise and weight-loss program can be challenging. One of the ways to improve retention is through self-monitoring techniques such as weekly journaling. During our study comparing high-intensity interval training (HIIT) and walking as forms of exercise among post-menopausal women we attempted use qualitative methods to explore what the participants experienced. **PURPOSE:** To investigate the thoughts and feelings, specifically related to the challenges and successes, participants experienced while completing a 12-week exercise program. **METHODS:** Participants (N=18) were post-menopausal (56 ± 5.94 years), sedentary female volunteers, randomly assigned into one of two exercise groups. Both groups exercised five out of seven days for 12 weeks. At the end of each week, participants submitted their answers to five open-ended reflective questions about their experience in the program, including the challenges and successes that week. This was done through an email exchange with a member of the research team. Additional specific follow-up questions were asked when needed.

A total of 187 weekly email exchanges were collected and coded using Dedoose software. Data were analyzed via a general inductive approach to identify significant themes. A constant comparison process was employed during analysis to identify commonalities and differences between the two groups and among individuals. Data saturation was reached. Trustworthiness was established via peer review. **RESULTS:** For both exercise groups, the major theme of support developed. This included support from family, peers, and the researcher. Between the groups different challenges were identified including time commitment and weather challenges for the walking group and the intensity of the workouts for the HIIT group. **CONCLUSION:** When working with clients attempting to lose weight and commit to an exercise program, support is a key component of success. When possible, family, co-workers, and others should be included in the process to encourage and help participants reach their goals. Weekly check-ins with a member of the research team is another way to facilitate program compliance and retention. Supported by Grant #CO-OP 2014-04 from University of Scranton and Marywood University, Scranton, PA.

2150 Board #163 June 1 2:00 PM - 3:30 PM
Perceptions of Exercise Screening Among Older Adults

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PURPOSE: The older adult population is largely inactive and barriers and enablers to the initiation of exercise participation have been identified. To explore the perceptions of exercise screening among older adults in order to inform evolving screening guidelines, which seek to safely encourage as many people as possible to engage in regular healthful physical activity. **METHODS:** A convenience sample of 86 community-dwelling participants (mean age (SD): 75.7 ± 7.7 years; 44% female) underwent a physical exam and screening (stress test and the Get Active Questionnaire) at a research laboratory routinely conducting screening for community-based referrals. One week later, participants returned to the study site and were interviewed on perceptions of the screening process by a research assistant who documented all responses. Questions focused on physician evaluation, self-screening, how screening impacted willingness to exercise, and experiences in completing the questionnaire. Thematic analysis was conducted. **RESULTS:** Themes identified were that: (1) Older adults largely think it's a good idea to be screened for exercise (for precautionary reasons and to assess physical condition) and that screening independently of consulting their physician was positive; however, some older adults felt it was unnecessary as they were in good physical condition; (2) There is a lack of self-screening among most older adults, (3) Older adults may perceive that checking in with a health care provider is 'self-screening' and that a self-screening tool may be unnecessary and non-specific; (4) Most older adults do not feel that screening impacts their willingness to exercise and indicate that it is not inconvenient. For some older adults, screening increased their confidence and found the screening process reassuring and motivating. The questionnaire, while simple in design, had confusing format and wording for some; subjects suggested tools should address the need for simplicity of design, be convenient and instill motivation and confidence prior to starting or changing exercise behaviours. **CONCLUSION:** Our findings suggest older adults may find screening supportive of adopting exercise and that such tools should be simple, convenient and support motivation and confidence to exercise.

D-67 Free Communication/Poster - Exercise Testing

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2151 Board #164 June 1 3:30 PM - 5:00 PM
Fasting Plasma Glucose is Associated with the Heart Rate Response to Maximal Exercise

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 (No relationships reported)

Introduction: Chronic hyperglycemia associated with diabetes impairs the exercise heart rate (HR) response. However, the relationship between fasting plasma glucose (FG) and chronotropic response to exercise has not been well characterized in individuals with normal and impaired FG values. **PURPOSE:** To evaluate the relationship between FG and multiple HR response indices during and after maximal cardiopulmonary exercise testing (CPX). **METHODS:** Data were obtained from

the Adult Physical Fitness Program cohort of CPX from 981 individuals (44±12 yr.; 51% male) without known cardiovascular or metabolic disease. Pearson and partial correlations examined the relationship between FG and resting HR, HR acceleration (HRacc), HR recovery (HRrec), HR reserve (HRres), % age-predicted max HR achieved (%APMHR), and chronotropic index (CI). Similar comparisons were made with HbA1c and HR responses in a subset of individuals (n=121). Additionally, individuals were grouped as (normal [NFG], impaired fasting glucose [IFG], diabetic [T2D]) based on ADA classification and compared for differences in HR responses. **RESULTS:** FG was positively correlated (P<0.01) with resting HR (r=0.085) and inversely with HRres (r=-0.125). HbA1c was positively correlated (P<0.01) with CI (r=0.200) and inversely with %APMHR (r=-0.214), HRrec (r=-0.233), and HRres (r=-0.338). After adjusting for age, sex, body mass index (BMI), and cardiorespiratory fitness (CRF), HbA1c remained inversely correlated with HRrec (r=-0.187, P<0.05). HRres displayed a graded relationship among groups being highest (P<0.05) in NFG and lowest (P<0.05) in T2D. Resting HR and CI were higher (P<0.05) while HRacc, HRrec, and %APMHR were lower (P<0.05) in T2D compared to NFG. HRacc and %APMHR were lower (P<0.05) in T2D compared to IFG. Differences among groups for CI, %APMHR, and HRres remained significant after adjusting for age, sex, BMI and CRF. **CONCLUSIONS:** These data suggest that impairment in exercise HR response observed in chronic hyperglycemia is also present in prediabetes which should be considered when interpreting CPX data and developing an exercise prescription.

2152 Board #165 June 1 3:30 PM - 5:00 PM
Treadmill vs. Cycle Ergometry Graded Exercise Test Responses in Multiple Sclerosis Patients

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INTRODUCTION: Cardiorespiratory fitness is measured by peak oxygen consumption (VO_{2max}) and is one of the strongest predictors of all-cause and cardiovascular disease mortality. In a healthy adult population, VO_{2max} values obtained on a treadmill are approximately 10-15% higher than those yielded by cycle ergometry. VO_{2max} testing in those with multiple sclerosis (MS) is typically performed on a cycle ergometer, as loss of walking mobility or balance issues may limit treadmill walking. Therefore, potential mode-specific differences in VO_{2max} may result in the inability to accurately assess MS patients' risk and lead to inaccurate exercise prescriptions in this cohort. **PURPOSE:** To compare hemodynamic, ventilatory, and cardiorespiratory responses between graded exercise tests performed on both a treadmill and cycle ergometer in individuals with relapsing-remitting MS. **METHODS:** Twenty persons with MS (42±11 years, 11±10 years since Dx, 26.9±6.5 kg·m⁻²) completed two VO_{2max} tests approximately 1 week apart, with random order of testing. Treadmill tests consisted of a constant, self-determined speed with an increase in grade of 2% every two minutes. Cycle ergometry tests increased wattage by 15 watts per minute. A repeated measures ANOVA was used to investigate differences in testing response to both treadmill and cycle ergometry. **RESULTS:** Treadmill testing resulted in VO_{2max} values that were 11% higher and respiratory exchange ratio (RER) values that were 8% lower than those obtained via cycle ergometry. See Table 1. **DISCUSSION:** Relapsing-remitting MS patients exhibit a mode-related difference in VO_{2max} similar to healthy adults. Therefore, exercise prescriptions or study designs cannot directly calculate submaximal workloads for one mode based on maximal data obtained from the other. Additionally, while HR_{peak} values are within normal limits, they're bordering chronotropic incompetence.

	Treadmill	Cycle Ergometer
VO _{2peak} (ml·kg ⁻¹ ·min ⁻¹)	27.0 ± 6.7*	23.9 ± 6.0
HR _{peak} (beats·min ⁻¹)	159 ± 19	153 ± 16
SBP _{peak} (mmHg)	166.8 ± 20.5	163.4 ± 27.5
DBP _{peak} (mmHg)	72.7 ± 13.3	75.1 ± 11.5
RPE	17.9 ± 1.9	18.0 ± 2.0
VE _{peak} (L·min ⁻¹)	75.5 ± 21.2	79.1 ± 23.6
RER	1.09 ± 0.08*	1.19 ± 0.07

Table 1. Mean ± SD. *p<0.05 between Treadmill and Cycle Ergometer

2153 Board #166 June 1 3:30 PM - 5:00 PM

The YMCA Submaximal Cycle Test and the 6-Minute Walk Test are Not Accurate Predictors of Cardiorespiratory Fitness During Mid-pregnancy

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PURPOSE: Assessing cardiorespiratory fitness is important for determining health status and prescribing exercise. Measurement of peak oxygen uptake (VO_{2max}) is the gold standard for the evaluation of cardiorespiratory fitness. However, VO_{2max} testing is not always feasible as it involves trained personnel, expensive equipment, and the ability of the test-subject to safely exercise until exhaustion. The ability to accurately predict VO_{2max} using submaximal protocols is important, particularly in special populations such as pregnant women. A validated test to predict fitness levels in pregnant women will allow health care providers to evaluate their patients' health status as well as tailor their patients' exercise prescriptions; thus, maximizing the established benefits of exercise during pregnancy. The 6-minute walk test (6MWT) and the YMCA submaximal cycle test (YMCAT) are currently validated tests to predict VO_{2max} in non-gravid populations; however, neither test has been validated during pregnancy. Therefore, the purpose of this study is to determine the validity of the 6MWT and the YMCAT as predictors of cardiorespiratory fitness in healthy weight women during mid-pregnancy. **METHODS:** Women (18-24 weeks gestation) with low-risk pregnancies participated. At Visit 1, participants completed the 6MWT and the YMCAT in randomized order. Both tests were used to predict VO_{2max} according to validated protocols/equations for non-gravid populations. At Visit 2, participants completed a graded exercise treadmill test (VO_{2max}) using the Bruce Protocol. The predicted VO_{2max} from each submaximal test and the measured VO_{2max} were compared using Pearson Product Moment Correlation Coefficients. **RESULTS:** 16 women participated in the study (pre-pregnancy BMI= 23.8±4.3 kg/m², Age=30.1±3.2 yr, Gestation age=22.0±1.3 wk). Mean predicted VO_{2max} values were 36.3±3.9 and 41.1±19.0 ml/kg/min for the 6MWT and the YMCAT, respectively. Mean VO_{2max} obtained from the graded exercise test was 34.9±10.0 ml/kg/min. Actual and predicted VO_{2max} values were not correlated for either submaximal test (6MWT: r=0.28, p=0.31; YMCAT: r=0.08, p=0.79). **CONCLUSIONS:** The 6MWT and YMCAT do not accurately predict VO_{2max} values during mid-pregnancy. These tests should not be used to estimate peak fitness levels among pregnant women.

2154 Board #167 June 1 3:30 PM - 5:00 PM
A Novel Maximal Treadmill Exercise Testing Protocol in the Morbidly Obese: A Descriptive Report

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INTRODUCTION: Although the results from treadmill exercise tests have been widely used as a marker of fitness and prognosis for various diseases, morbidly obese individuals often terminate testing at a level of discomfort far below their physiologic maximum. This early termination demonstrated in morbidly obese individuals may be due to bio-mechanical factors, low levels of fitness and the parameters of more traditional exercise testing protocols. Given the increasing obesity epidemic facing the United States and the world, it would be prudent to investigate exercise testing protocols for this population to assist with disease prognosis and stratification as well as the provision of appropriate exercise prescriptions. **PURPOSE:** To describe the utilization and psychometric properties of a novel treadmill test protocol used in morbidly obese individuals. **METHODS:** The data was pooled from baseline maximal exercise testing data of all subjects currently enrolled in a pre-bariatric surgery exercise training study who used this novel protocol. The protocol used a constant speed (2mph), graded exercise test which increased at a rate of 2% every 2 minutes. Metabolic data was collected, heart rate was measured with 12 lead ECG, blood pressures were measured manually, and rating of perceived exertion was assessed using the modified Borg Scale. **RESULTS:** In total, the results from 7 participants were included in this analysis, all female, non hypertensive and without diagnosed cardiopulmonary disease.

THURSDAY, JUNE 1, 2017

Baseline data								
	Age (yrs)	Height (cm)	Body Weight (kg)	BMI	Waist Circumference (cm)	Resting Heart Rate (bpm)	Rest SBP (mmHg)	Rest DBP (mmHg)
Avg	33.14	168.97	136.89	48.00	129.57	87.29	115.00	78.14
SD	6.64	4.73	27.60	10.01	24.67	19.19	5.80	8.69
Pooled testing data								
	Peak-VO ₂ (ml/kg/min)	Exercise Time (min)	Peak RER	Peak HR (bpm)	Peak % Age Predicted HR Max (APHRMax)	Peak SBP (mmHg)	Peak DBP (mmHg)	Peak RPE
Avg	19.52	12.00	1.00	166.00	0.89	170.00	74.00	6.36
SD	8.52	4.00	0.07	17.06	0.08	16.59	8.39	2.29

CONCLUSION: This novel treadmill exercise testing protocol yielded peak testing results that could be considered to be acceptable criteria for a maximal effort for this special population of morbidly obese individuals, based on pooled average values of Peak %APHRMax, peak RER, and test duration. More research is needed to investigate the psychometric properties of this test and to develop testing parameters specific to morbidly obese individuals.

2155 Board #168 June 1 3:30 PM - 5:00 PM

Assessment Of Cardiorespiratory Fitness And Recovery Capacity Among Women With Fibromyalgia

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Cardiorespiratory fitness (CRF) level among women living with fibromyalgia (FM) has been documented with some contradictory results most probably due to differences in the methodological approaches used. Furthermore, some studies have suggested that aerobic capacity was affected in patients with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) 24 hours after performing a maximal CRF test. To our knowledge, no research has looked at the capacity to recover after a maximal CRF test in FM patients, a disease often compared with ME/CFS.

PURPOSE: To describe and compare the CRF and recovery capacity of women, who are mildly or moderately affected with FM, 24 hours after a maximal exercise test.

METHODS: Twelve FM women were submitted twice to a maximal exercise test (BSU/Bruce ramp) interspersed by 24 hours (T1 & T2), until participants achieved volitional exhaustion. Gas exchange (Ergocard, Medisoft) and ECG (Quinton) were continuously monitored throughout the test. Blood lactate, blood pressure, pain intensity and rate of perceived exertion, were also assessed at different moments. The Revised Fibromyalgia Impact Questionnaire was completed by participants to determine their FM severity level. **RESULTS:** No significant differences in VO_{2peak} (25.5 ± 5.3 vs. 26.5 ± 5.3 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$, $p > 0.05$) and VO_2 at ventilatory threshold (VO_{2VT} : 21.2 ± 4.8 vs. 21.7 ± 4.8 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$, $p > 0.05$) were found between T1 & T2. When considering the severity of the disease, mildly affected FM patients had a significantly greater CRF only at T2 (VO_{2peak} : $T2 = 30.4 \pm 3.3$ ml $O_2 \cdot kg^{-1} \cdot min^{-1}$) and higher VO_2 at the ventilatory threshold at T1 and T2 (VO_{2VT} : $T1 = 24.0 \pm 4.0$; $T2 = 24.9 \pm 3.2$) when compared with moderately affected FM patients (VO_{2peak} : $T2 = 22.9 \pm 4.7$ ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ and VO_{2VT} : $T1 = 18.5 \pm 4.4$; $T2 = 18.7 \pm 4.5$ ml $O_2 \cdot kg^{-1} \cdot min^{-1}$). Furthermore, CRF levels were lower than the general population. In fact, 75% of the VO_{2peak} results were below the «Fair» category, of which 25% were below the «Very Poor» category, when compared to the ACSM normative values for VO_{2peak} . **CONCLUSION:** In general, participants showed no significant difference in CRF and recovery after 24 hours. However, the severity of fibromyalgia negatively affected CRF in our study population and their CRF level was lower than the general population.

2156 Board #169 June 1 3:30 PM - 5:00 PM

Indirect Assessment Of Vo2max

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VO₂max is considered like the most valuable objective predictor of cardio-respiratory fitness and general health. Many evidence based studies prove that higher level of VO₂max is adversely related to prevalence of many diseases, such as cardio-metabolic syndrome, ischemic heart disease, hypertension, diabetes II and others. However, only very few general practitioners can afford complete equipment for direct estimation of this important fitness biomarker

PURPOSE: a) To find the highest correlation between the fitness markers, which don't need O₂-CO₂ analyzer for their assessment (W170, Wmax) on one side and VO₂max on the other side. b) To determine regression equations which could be used for calculation of VO₂max and VO₂max/kg

METHODS: The data of 2777 spiroergometric tests (2015 males and 762 females) from the data-base of our institute in the period 1995 till 2015 were included into the study. The subjects were healthy competitive and leisure athletes and also non-athletes aged 9 to 95 years. All performed bicycle ergometer test with step wise increased workload up to the exhaustion.

RESULTS: The highest correlations were found between maximal performance achieved in watts (Wmax) and VO₂max, and between Wmax/kg and VO₂max/kg in both men and women. Regression equations for indirect assessment of VO₂max are:

Men: $VO_{2max} = 0.0095 \cdot Wmax + 0.54$ (l/min) (R=0.89); $VO_{2max}/kg = 8.3 \cdot$

$Wmax/kg + 13$ (ml/min/kg) (R=0.83)

Women: $VO_{2max} = 0.0083 \cdot Wmax + 0.67$ (l/min) (R=0.85); $VO_{2max}/kg = 8.0 \cdot$

$Wmax/kg + 13$ (ml/min/kg) (R=0.83)

CONCLUSION: The regression equations can be used for assessment of VO₂max and/or VO₂max/kg body weight respectively even in those testing procedures, where bicycle ergometry enables to measure maximal performance during step wise increased workload, however, where no O₂-CO₂ analyzer is available. The data can serve as a feedback information about the effectiveness of physical activity in wider range of population than direct VO₂max measurement, limited by the capacity of specialized laboratories.

2157 Board #170 June 1 3:30 PM - 5:00 PM

A Pregnancy-Specific Equation for Predicting Cardiorespiratory Fitness

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(No relationships reported)

PURPOSE: The ability to measure VO_{2max} is important for determining health status and prescribing exercise. However, directly measuring VO_{2max} is not always feasible, particularly in special populations such as pregnant women. Therefore, the purpose of this study was to create pregnancy-specific equations to predict cardiorespiratory fitness using baseline and exercise data.

METHODS: Nineteen pregnant women (Age: 29.8 ± 3.1 years, Pre-pregnancy BMI: 23.8 ± 3.9 kg/m², Gestation Age: 22.0 ± 1.4 weeks) participated in the study. Each participant completed baseline measurements/anthropometrics and the Bruce protocol maximal treadmill test. Exercise data was obtained from the maximal test using heart rate from stages 1, 2, 3, and 4, and used to create regression equations calculated to predict measured VO_{2max} levels. In addition, other variables such as body mass index, age, gestation age, and physical activity level were included in these regression models based on their predictive ability.

RESULTS: Stepwise multiple regression analysis (SPSS, version 24) was conducted to predict the VO_{2max} in pregnant women based upon baseline measures and exercise data. The results of this analysis indicated that VO_{2max} was significantly related to maximum heart rate (maxHR), $F(1,11) = 22.38$, $p < .001$, and demonstrated $R^2 = .670$ and adjusted $R^2 = .640$. The regression equation for this linear model is:

$VO_{2max} = -179.74 + (1.25 \times \text{maxHR})$

The other baseline and exercise variables did not predict significantly in this sample. Based upon these results, maxHR appears to be the best predictor of VO_{2max} in pregnant women.

CONCLUSIONS: Data from the current study was used to create an equation that can be used to predict cardiorespiratory fitness in pregnant women. A logical next step is to further validate such equations in a larger cohort of pregnant women. Validated equations created will allow healthcare providers to safely and effectively predict their pregnant patients' fitness level; thus, allowing them to best tailor their patients' exercise prescriptions in order to maximize the benefits of exercise in both the mother and her offspring.

2158 Board #171 June 1 2:00 PM - 3:30 PM
The Use of Prediction Equations in Hypertrophic Cardiomyopathy
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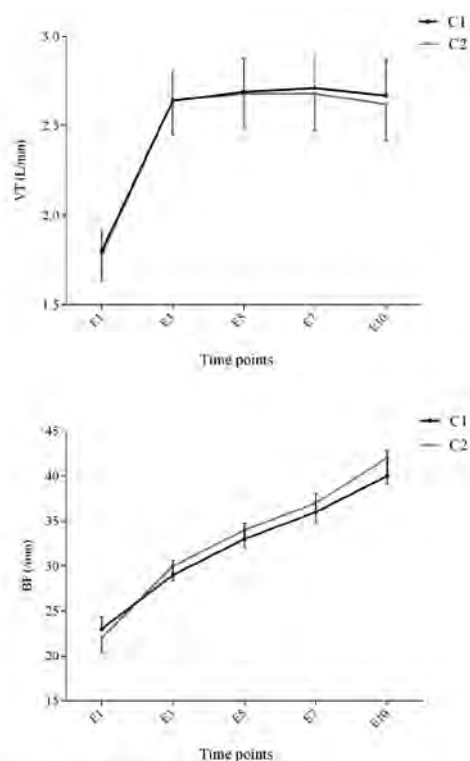
PURPOSE: To evaluate a recent equation (FRIEND) for the estimation of peak exercise capacity (VO_{2peak}) in a heterogeneous clinical population of patients with cardiomyopathy against the current standard in estimation equations (Wasserman, 1986).
METHODS: 1100 consecutive ambulatory patients performed clinical cardiopulmonary exercise testing (CPX) at Stanford University. VO_{2peak} was measured directly during CPX (CosMed USA), and estimated VO_{2peak} were calculated using the FRIEND (Fitness Registry and the Importance of Exercise: National Database) registry equation and the equation from Wasserman et al. VO_{2peak} data were assessed for variation around the median and comparisons were made.
RESULTS: Patients were on average 48 (15) y and 62% male. VO_{2peak} as measured by CPX was on average 23.7 (9.8) ml/kg/min. The Wasserman equation average prediction for VO_{2peak} was 27.8 (9.4) which resulted in an percent predicted of 88%, whereas the FRIEND equation resulted in average predicted VO_{2peak} of 42.2 (10.3) ml/kg/min, resulting in 56% of predicted.
CONCLUSIONS: In a large sample of patients with known moderate to severe cardiomyopathy, the standard reference equation by Wasserman assessed them as slightly below average whereas the FRIEND equation assessed the same patients as having severely impaired performance. Caution should be used in the interpretation of CPX results when using current VO_{2peak} estimation equations and further development of these equations seems warranted.

2159 Board #172 June 1 3:30 PM - 5:00 PM
Association Between Heart Rate Recovery, Cardiorespiratory Fitness, And Physical Activity In HIV+ Hispanic Adults
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Heart rate recovery (HRR) after intense exercise is one aspect of chronotropic incompetence (CI), the inability to match HR response to metabolic demands. Impaired HRR after peak exercise has been observed in HIV+ adults. However, physical activity (PA) and cardiorespiratory fitness (CRF) are both associated with improved exercise recovery, but their influence on HRR in this population has not been established.
PURPOSE: To evaluate the association between PA, CRF, and HRR; and test the hypothesis that HIV+ Hispanic adults classified as active and with good CRF will have higher %HRR after peak exercise compared with those inactive and with low CRF.
METHODS: A group of 89 adults (59 HIV+ and 30 HIV-) completed an exercise test on a treadmill with ECG and gas exchange measures (i.e., HR and VO₂) using the modified Bruce protocol. Measurements continued for 6 minutes post-exercise. They also wore an ActiGraph GT3X+ accelerometer attached to an elastic waist band placed in the right hip area for 7-days. T-tests were used to detect differences by group and classification of PA and CRF. Correlation and regression analyses were used to evaluate associations between variables. **RESULTS:** No differences in the proportion of HIV+ and HIV- classified as active vs. inactive (42.4 vs. 52.5% & 53.6 vs. 46.4%; P=0.328), and with good vs. low CRF (44.1 vs. 55.9% & 60.0 vs. 40.0%; P=0.155) were observed. HRR was not different by group, but %HRR was lower in HIV+ compared with HIV- (38.4±7.4 vs. 44.0±5.6%; P<0.001). Considering PA classification, active HIV+ had lower HRR and higher %HRR than inactive HIV+ (91.0±11.8 vs. 98.4±10.6 bpm, P= 0.02; 41.6±4.3 vs. 36.0±8.4%, P=0.004; respectively); while HIV- showed no differences. Based on CRF classification, HRR was not different in both groups, but %HRR was higher in both HIV+ and HIV- with good CRF compared with those with low CRF (41.2±6.2 vs. 36.1±7.5%, P=0.007; 45.6±5.6 vs. 41.6±5.0%, P=0.05). Correlation and regression analyses confirmed associations between VO_{2peak}, PA, and %HRR. **CONCLUSION:** Impaired %HRR among HIV+ Hispanic adults compared with HIV- was apparent regardless of CRF and PA classification. However, both PA and CRF positively influenced %HRR in the HIV+ group, supporting our hypothesis. Supported by: NIH/CTSA KL2-RR024151, NIH/NIMHHD 8U54MD 007587-03.

2160 Board #173 June 1 2:00 PM - 3:30 PM
Posture During Exercise Effects Breathing Pattern And Reports Of Dyspnoea
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Purpose: The posture an athlete holds during exercise may alter breathing pattern and increase reports of exercise induced respiratory symptoms. The purpose of this study was to investigate the effect of different postural positions during high-intensity cycling on breathing frequency (BF), tidal volume (VT), rating of perceived exertion (RPE) and dyspnoea.
Methods: Fifteen healthy male athletes (Mean +/- SD age: 26.1±7.0 yrs.) performed a 10-minute cycling test at 70% of their peak power in two conditions, in a randomised order: with normal shoulder position (C1) and with hunched shoulders (C2). BF and VT were continuously monitored during exercise. RPE and dyspnoea were gauged by using Borg RPE and Borg-10 scales, respectively.
Results: BF and VT showed no significant difference between conditions at any time point, however an alteration in BF was observed in C2 (Figure 1). Significant main effects of time emerged for BF, RPE and dyspnoea in both conditions (all p values <0.001).
Conclusions: Cycling with hunched shoulders at high intensities over a prolonged period leads to altered breathing mechanics and as a consequence, an increase in perceived exertion and dyspnoea. These findings suggest that posture may contribute to reports of respiratory symptoms during exercise in the absence of cardio-pulmonary disease.



C1 represents normal shoulder position and C2 represents hunched or lifted shoulder position. E1, E3, E5, E7, E10 represent minutes 1, 3, 5, 7 & 10 of the 10-minute cycling test.

THURSDAY, JUNE 1, 2017

D-68 Free Communication/Poster - Fitness Assessment

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2161 Board #174 June 1 3:30 PM - 5:00 PM

Vertical Jump Height Measurements: Correlation Between Vertec And My Jump App.

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Vertical jump testing is a commonly used method for measuring an individual's anaerobic (explosive) power (Markovic, et al., 2004). Reliable and repeatable assessment of the vertical jump has implications in many health, wellness, and physical activity domains. The Vertec™ and force plate (gold standard) are devices used for accurately measuring vertical jump height; research conducted on these devices have shown their validity in measuring jump height (Buckthorpe, et al. 2012). The force plate and the Vertec™, although accurate at measuring vertical jump height, are costly and not easily accessible to many coaches and the general public. An accurate and accessible field measure would allow assessment of vertical jump height and power in many settings. **PURPOSE:** The purpose of this experiment was to examine the reliability and validity of the My Jump app (utilized on Ipad mini) compared to the Vertec™.

METHODS: Sixty-five college-aged participants performed three maximal countermovement vertical jumps. A Vertec™ measurement device was used in conjunction with the My Jump app to measure jump height. Jump heights from the Vertec™ were then correlated to those from the My Jump app. Peak power values were calculated using the Sayers equation (Sayers et al. 1999). The Pearson product-moment correlation coefficient was determined between the jump heights measured by the Vertec™ and the My Jump app.

RESULTS: The average jump height measured by the Vertec™ 20.1 in. (5.4) was significantly higher than the height from My Jump app 16.1 in. (4.5). A strong and significant correlation was found between the two height measurements, $r=0.814$, $p<0.01$ and for peak power measures $r=0.933$ $p<0.01$.

CONCLUSIONS: The My Jump app may provide a reliable measure of vertical jump height in multiple settings without the need of costly equipment such as force plates or Vertec™. We chose to compare the My Jump app to the Vertec™ because the Vertec™ is more commonly used to measure jump height due to the expense compared to a force plate. The lower height values using My Jump app may stem from the fact that subjects reach for the rungs on the Vertec™ while My Jump app measures the flight time to determine the vertical height of the center of mass. However, the ease of use and portability makes the app an accessible tool for measuring jump height in multiple settings.

2162 Board #175 June 1 3:30 PM - 5:00 PM

No Difference In Time To Stabilization Between Male & Female Dancers Following A Jump-landing Task

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Dance is a jump intensive activity, and, similar to other sports, ankle sprains among dancers are the most common traumatic injury, typically occurring when landing from a single leg jump. Ankle sprain injuries happen among dancers most often by age thirteen and have a high recurrence rate often leading to long term disability. As dance medicine epidemiology studies continue to evolve, it is evident that a gender disparity exists among dancers with females having up to 55% higher relative frequency of ankle sprains compared to their male counterparts. **PURPOSE:** To determine the effect of gender on time to stability (TTS) after landing from a horizontal jump. **METHODS:** Forty-one professional ballet and modern dancers (14 men, 23.8±4.3 and 27 women, 26.1±4.7) without prior ankle injury consented to participate in this biomechanics laboratory study. Shod in personal, flat soled running shoes, subjects performed three submaximal (50% maximum) trials of the TTS test. Independent t-tests were employed with gender (male/female) as the independent variable and TTS (anterior-posterior [AP]/medial-lateral [ML]) as the dependent variables. **RESULTS:** No differences were found between men and women dancers for either AP or ML aspects of the horizontal TTS jump test (AP: men 2.707±0.11 seconds, women 2.709±0.11 seconds; $p=0.98$), (ML: men 2.718±0.294 seconds, women 2.853±0.177 seconds; $p=0.121$). **CONCLUSION:** Men and women dancers exhibited similar TTS after landing from

a horizontal jump task when wearing flat soled shoes on a flat surface. The gender disparity in landing mechanics found by other researchers may not have been found here due to jump type or to extrinsic factors such as the interaction of variable floor surfaces common in the dance workplace and different shoe wear often required of the women which place them in the loose pack position of the ankle joint.

2163 Board #176 June 1 3:30 PM - 5:00 PM

Relationship Between the Ruffier Test and Maximal Treadmill Testing in Healthy Adults

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PURPOSE: Estimating aerobic fitness in the busy outpatient clinical setting with gold standard maximal fitness testing is challenging due to time, staffing and equipment access limitations. Short tests that can be performed with minimal equipment and staff may overcome these limitations, and improve clinician ability to provide customized exercise recommendations and track fitness responses over time. This study piloted whether a peak fitness level could be estimated by a short, simple Ruffier exercise readiness test.

METHODS: Seventeen adults (32.6 ± 10.8 yrs; 26.0 ± 10.7 kg/m²; 9 F) participated. During one testing session, participants performed a Ruffier fitness readiness test (30 squats in 45 s) and a Balke maximal treadmill fitness test. In the Ruffier test, heart rate (HR) was measured pre-test, immediately post and 1-min post-test. Ruffier scores were calculated and classified from the 3 HR values. During the Balke test, endurance time and peak values for HR, rate of oxygen use (VO_{2peak}), ventilation (VE) and respiratory quotient (RQ) were captured.

RESULTS: Mean HR values during the Ruffier test were 68.7 ± 9.9 bpm (pre-test), 129.5 ± 9.7 bpm (immediately-post) and 88.4 ± 19.5 bpm (1-min post), which represented a significant change over time; $p<0.0001$. The Ruffier score averaged 8.8 ± 3.4 points (from 0-20 points). The Balke VO_{2peak} measure averaged 39.7 ± 11.6 ml/kg*min, with a peak HR of 179.3 ± 14.4 bpm and RQ of 1.2 ± 0.08. Average endurance time was 21.2 ± 4.5 min. Correlation between Ruffier scores and VO_{2peak} value revealed a Pearson correlation coefficient $r = 0.540$ (two-tailed p-value of $p=0.024$, at 0.05 level).

CONCLUSIONS: Moderate associations were found between the fitness scores of the two tests from this group. The 45 s Ruffier exercise test may be useful for quickly identifying patients with poor aerobic fitness levels in the clinical setting, but may not be long enough to produce physiological responses that could discern fine gradations of fitness.

2164 Board #177 June 1 3:30 PM - 5:00 PM

Hip Adductors are Stronger in Persons with Bilateral Compared to Unilateral Knee Injury: Pilot Study

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Introduction: The role of hip adductor strength in persons with bilateral and unilateral knee injury is not well reported nor well understood. Studies that examined adductor strength often report no significant differences. Such studies include persons with unilateral and bilateral knee injuries, such as patellofemoral pain (PFPS). This pilot investigation separated those with unilateral or bilateral knee injury to assess differences in adductor strength and abductor-to-adductor strength ratio.

Purpose: Determine if differences in hip adductor strength is present in persons with unilateral compared to bilateral knee injuries.

Methods: Males and females, ages 18-24, with a history of unilateral (n=10; 6 F, 4 M; PFPS or anterior cruciate ligament reconstruction (ACLR)) or bilateral knee injuries (n=10; 6 F, 4 M; B PFPS or B ACLR) of at least 6 months ago, were recruited from local universities. The Knee Outcome Survey-Sport Activity Scale (KOS-SAS) questionnaire was completed by all participants. Hip adductor and abductor strength was measured with a calibrated dynamometer. The ratio of abductor-to-adductor strength, and peak hip muscle strengths were compared between groups and limbs ($p<0.05$).

Results: Between groups, there were no significant differences in age, height, weight, BMI, Tegner Activity Level, or KOS-SAS ($p>0.5$). Hip adductor strength was significantly weaker ($p=0.03$) in persons with unilateral (2.8 ± 1.7 %BW*HT) compared to bilateral (6.0 ± 1.9 %BW*HT) injury. The hip abductor-to-adductor ratio was significantly greater ($p=0.004$) in persons with unilateral (1.6 ± 0.5 %BW*HT) compared to bilateral (3.3 ± 1.9 %BW*HT) injury. There were no significant differences between limbs in abductor strength in either group ($p=0.2$).

Conclusion: Hip adductors were significantly stronger in both limbs in persons with bilateral knee injury compared to persons with unilateral knee injury. In order for the hip abductor-to-adductor ratio to be greater in persons with unilateral knee injury, the hip adductor strength [denominator] must be weaker. How persons compensate for an injury may depend on unilateral or bilateral involvement. This pilot study would be improved by including additional participants in PFPS or ACLR groups.

± 11.1 %) of $\dot{V}O_{2max}$ respectively, with no differences between the groups ($p=0.3$, $p=0.8$). **CONCLUSION:** The health and fitness of MU were not different from NU. We speculate that because all individuals in the study were physically active and had $\dot{V}O_{2max}$, LT and OBLA in higher fitness categories, it is possible that exercise provided protection against any marijuana related side effects in a healthy, male population. Funded by: FRBP-NPP at UNC

2165 Board #178 June 1 3:30 PM - 5:00 PM
Impact Of CrossFit And Non-CrossFit Programs On Range Of Motion
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 (No relationships reported)

Range of motion (ROM) is vital for daily living and exercise. Flexibility is especially of interest since tightness limits ROM and often results in muscle imbalances leading to injury. Different types of training have different effects on ROM. CrossFit, a higher intensity program, is often stigmatized as a muscle building exercise regimen that decreases ROM. Previous studies have shown lower intensity programs may increase flexibility and decrease injury. To date, few studies have addressed ROM comparisons of CrossFit and non-CrossFit programs. **Purpose:** The purpose of this study was to compare shoulder and hip joint ROM in individuals participating in CrossFit and non-CrossFit fitness programs. **Methods:** An experimental design with random assignment was used to examine the ROM differences in a CrossFit and non-CrossFit fitness program observing 26 volunteers, consisting of nine males and 17 females aged 21.3 ± 4 years. Baseline ROM assessments for shoulder flexion, shoulder internal rotation, shoulder external rotation, hip flexion, hip extension, hip internal rotation were measured. Participants were randomly assigned to a CrossFit and non-CrossFit group. The participants completed eight-weeks of training, attending three, one hour sessions per week and refrained from any additional training. After training, the participants were tested using the same protocol as pretesting. Paired samples t-tests determined within group changes and one-way ANOVAs determined between group changes, and the alpha level was set at 0.05. **Results:** The CrossFit group revealed a statistically significant difference in left shoulder external rotation (pre: 80.85 ± 12.13 ; post: 62.28 ± 14.89 ; $p=0.033$). No other statistically significant differences were found in the non-CrossFit group or between groups when comparing joint ROM in bilateral shoulder flexion, shoulder internal rotation, shoulder external rotation, hip flexion, hip extension, and hip internal rotation. **Conclusion:** This study followed current research trends, as there were few significant differences in ROM between and within CrossFit and non-CrossFit programs. However, this study found the CrossFit group to have a decrease in shoulder joint external rotation.

2167 Board #180 June 1 3:30 PM - 5:00 PM
Effect Of Pacing Strategy During The Final Two Minutes of a Self-paced $\dot{V}O_{2max}$ Test (spv)
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 (No relationships reported)

Self-paced $\dot{V}O_{2max}$ tests (SPVs) have increasingly been used as an alternative to traditional closed-loop protocol with predetermined workload increases. SPVs have been shown to produce values that are as high, and sometimes higher, than traditional protocol. What is not known is if the pacing strategy during the final two minutes of the test affects the maximal values attained. **PURPOSE:** Compare two different pacing strategies, conservative and aggressive, during the final two minutes of a 10-minute SPV. **METHODS:** Fourteen healthy subjects (29.36 ± 5.6 years; mean \pm SD) volunteered to participate. After a familiarization session, subjects completed two SPVs. The SPV protocol was closed-looped and consisted of five two-minute stages with a total test time of 10 minutes exactly. Subjects were asked to maintain prescribed ratings of perceived exertion (RPE) levels of 11 (light), 13 (somewhat hard), 15 (hard), 17 (very hard) and 20 (maximal exertion). During the final stage, subject used either a conservative (CON) or aggressive (AGG) pacing strategy. In CON, subjects were asked to use the entire 2 min. stage and gradually build to RPE20. Conversely, in AGG they were asked to start the last stage immediately at RPE20, knowing full well they would have to decrease their speed toward the end of the test. The primary variables collected were relative $\dot{V}O_{2max}$ (ml/kg/min), respiratory exchange ratio (RER) and maximum heart rate (HRmax). After the study they were asked which strategy they preferred. Paired samples t-tests were used to compare the mean values found in each condition. **RESULTS:** There was no difference in $\dot{V}O_{2max}$ values between AGG (58.8 ± 8.8 ml/kg/min) and CON (58.3 ± 7.9). Similarly, no differences were seen in HRmax between AGG (186.7 ± 4.2 bpm) and CON (187.0 ± 4.9 bpm). The maximal RER recorded in AGG (1.25 ± 0.09) was significantly higher ($p < .05$) than CON (1.18 ± 0.07). Of the 12 subjects that responded to the question about preference, 7 (58%) preferred the AGG strategy. **CONCLUSION:** These results suggest that the pacing strategy used during the final two minutes of an SPV does not affect the maximal $\dot{V}O_{2max}$ or HR values that are elicited. The maximal RER was higher in AGG, which suggests a higher anaerobic component with this strategy. Perhaps more subjects chose that strategy because they felt that a greater amount of effort was involved.

2166 Board #179 June 1 3:30 PM - 5:00 PM
Marijuana Use and The Health and Fitness of Physically Active Users and Non-Users
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Although an increasing number of states are legalizing marijuana (MJ) for recreational use, research examining the chronic fitness and health related effects of MJ use in humans have been limited. **PURPOSE:** To examine the health and fitness of physically active MJ users and non-users. **METHODS:** Physically active, healthy males ($N=23$) were placed into groups based on MJ use: marijuana users (MU; $n=12$) or non-users (NU; $n=11$). Physical activity level and MJ use were confirmed using IPAQ-Short Format and the Marijuana Use Measure questionnaires. MU had used MJ products at least once per week for the past 6-months. NU had not used MJ within the past 12-months. Descriptive measures including age, body mass (BM), resting heart rate (RHR), body mass index (BMI), body fat (skinfold, BF) resting systolic (SBP) & resting diastolic (DBP) blood pressure were assessed. Pulmonary function was evaluated (forced expired volume in 1-second percent (FEV1%) and relative forced expired volume in 1-second (RFEV1_{max})) using spirometry. Cardiorespiratory fitness ($\dot{V}O_{2max}$), lactate threshold (LT) and onset of blood lactate accumulation (OBLA) (treadmill test with measurement of expired gasses) were assessed. Independent t-tests were used to identify differences between groups ($p < .05$). Data are presented as mean \pm SD. **RESULTS:** MU used MJ an average of 21 times out of the last 30-days. All MU were smoking MJ in some form. All participants (MU and NU) averaged 23 yrs. \pm 5 yrs. age, 80.4 ± 14.9 kg BM, 25.0 ± 3.6 kg/m² BMI, 12.0 ± 5.9 % fat, 65.8 ± 13.1 bpm RHR, 123.2 ± 8.4 mmHg SBP, and 70.3 ± 10.0 mmHg DBP. RFEV1_{max} (54.7 ± 10.2 ml/kg/s) and FEV1% (92.9 ± 12.8 %) were not different between groups ($p < 0.05$). $\dot{V}O_{2max}$ was not different between groups (MU= 51.1 ± 8.9 ; NU= 53.5 ± 5.5 ml/kg/min; $p=0.5$). Rate of perceived exertion at termination for MU and NU were (8.9 ± 0.9) and (9.5 ± 0.7), ($p=0.1$). LT and OBLA occurred at (69.3 ± 9.2 %) and (80.4

2168 Board #181 June 1 3:30 PM - 5:00 PM
Validation of a 6-s Cycle Ergometry Sprint to Measure Peak Power in Recreationally Active Females
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The 30-s Wingate Anaerobic Test (WAnT30) is frequently used to determine peak anaerobic power (PP). When PP, which is generally achieved within the first 5-s is the primary measure of interest, there may be no advantage in completing a 30-s test. It is not clear if a shorter test can be validated against the WAnT30. **Purpose:** To determine if a modified 6-s anaerobic test could be used to measure PP as an alternative to the traditional WAnT30 in recreationally active females. **Method:** Thirteen females (28.4 ± 6.3 yr., 163.2 ± 5.3 cm, 66.8 ± 10.9 kg⁻¹), previously familiarised with protocols, performed a WAnT30. In a subsequent separate session participants performed a modified 6-s Wingate Test (WAnT6) and a 6-s Wattbike Pro 'all out' sprint (Watt6) in a randomised manner. A 15 min standardised recovery was completed between sprints. Agreement was measured between WAnT6, Watt6 and WAnT30 using simple linear regression models and Bland Altman plots. **Results:** WAnT30 correlated with WAnT6 ($R^2 = 0.74$; $P < .001$) with a mean bias of -55 W. Between Watt6 and WAnT30 the agreement was $R^2 = 0.40$ ($P < .05$), with a mean bias of 41W. The bias between a WAnT30 and a WAnT6 could be corrected using the following equation: $WAnT30 = 0.691 * (WAnT6) + 156.1$ W ($r = 0.85$, $R^2 = 0.72$, $SEE = 60.3$ W; $P < 0.001$). **Conclusion:** A WAnT6 can be used instead of WAnT30 in recreationally active females when PP is the main measure of interest. This avoids unnecessary fatigue and

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discomfort and would allow performance of other maximal tests in the same session. The regression equation provided in this study could be used to predict an individual's PP during WAnT30 from WAnT6.

2169 Board #182 June 1 3:30 PM - 5:00 PM

Evaluating Upper-body Strength And Power From A Single Test: The Ballistic Push-up

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Muscular strength and power are major determinants for many explosive, short duration sporting events. Consequently, the assessment of muscular strength and power is imperative for training program design and talent identification purposes. The one repetition maximum (1RM) squat and bench press are the most frequently used field tests for assessing lower and upper body strength, respectively. However, time constraints and maximal testing for untrained individuals may limit the use of 1RM testing in large population groups. Additionally, there has been only a limited number of investigations that have focused on the evaluation of upper body muscular power. **PURPOSE:** The purpose of this study was to examine the reliability of the ballistic push-up (BPU) exercise, and to develop prediction equations for 1RM bench press and upper-body power. **METHODS:** Sixty recreationally-active men completed a 1RM bench press and two BPU in three separate testing sessions. Intraclass correlation coefficients (ICC) of peak and mean force, peak velocity, flight time, and peak and mean power were calculated and used to examine the reliability of the BPU. Mean force, flight time and peak velocity was used to develop equations to predict the 1RM bench press, and time-based and velocity-based upper-body power. **RESULTS:** ICC's ranged from 0.849 - 0.971 for the BPU measurements. Multiple regression analysis provided the following 1RM bench press prediction equations: $1RM = 0.31 \times \text{Mean Force} - 1.64 \times \text{Body mass} + 0.70$ ($R^2 = 0.837$, $SEE = 11$ kg); time-based power prediction equations: $\text{Peak Power} = 11.0 \times \text{Body Mass} + 2012.3 \times \text{Flight Time} - 338.0$ ($R^2 = 0.658$, $SEE = 150$ W), $\text{Mean Power} = 6.7 \times \text{Body Mass} + 1004.4 \times \text{Flight Time} - 224.6$ ($R^2 = 0.664$, $SEE = 82$ W); and velocity-based power prediction equation: $\text{Peak Power} = 8.1 \times \text{Body Mass} + 818.6 \times \text{Peak Velocity} - 762.0$ ($R^2 = 0.797$, $SEE = 115$ W); $\text{Mean Power} = 5.2 \times \text{Body Mass} + 435.9 \times \text{Peak Velocity} - 467.7$ ($R^2 = 0.838$, $SEE = 57$ W). **CONCLUSIONS:** Results indicate that the BPU is a reliable test for both upper-body strength and power. Furthermore, the mean force generated from the BPU can be used to predict 1RM bench press, while peak velocity and flight time measured during the BPU can be used to predict upper-body power. These findings support the potential use of the BPU as a valid method to evaluate upper-body strength and power.

2170 Board #183 June 1 3:30 PM - 5:00 PM

Ntprobnp, Lactate And Bp Responses To The Want In Young Male Wrestlers And Untrained

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ABSTRACT

Purpose: To investigate the influence of the WAnT on blood pressure, lactate, and NTproBNP in trained Wrestlers and untrained young males. **Methods:** 20 males (n=20), ages 18-25 underwent the WAnT. The study included 2 groups. Group 1 included 10 untrained individuals, and group 2 included 10 wrestlers. NTproBNP (ng/mL), lactate (mmol/L), and blood pressure (mmHg) were measured at rest, immediate-post, two minutes post, and ten minutes post. The mechanical outputs (W) calculated for each subject. NTproBNP was analyzed utilizing ELIZA. **Results:** The wrestler's resting NTproBNP levels were higher (35.5 ± 7.59 vs 35.15 ± 4.82 accordingly), with non-significant differences between the groups. Immediate Post NTproBNP was higher for wrestlers (40.25 ± 14.08 vs 37.33 ± 9.94) with a positive and strong correlation between PP and IP NTproBNP ($r = 0.85$). While the untrained had a substantially higher post 10 NTproBNP (45.07 ± 11.75 vs 32 ± 5.57), both group's NTproBNP was elevated post 10 minutes with a significant difference from post 2 minutes values ($p=0.035$). PP was significantly higher for the wrestlers (1031.6 ± 188.65 vs 960.91 ± 189.01). No significant differences were found between groups for RPP and RMP. **Conclusions:** NTproBNP values were within the ranges reported in the literature. The WAnT did not put any of the subjects at risk due to cardiac stress. The recovery dynamics regarding NTproBNP were different between groups. Wrestlers recovered rapidly with a slight elevation 10 minutes post-test, while the untrained recovered slowly with a significant elevation of NTproBNP 10 minutes post-test.

2171 Board #184 June 1 3:30 PM - 5:00 PM

Relationship Between the Repeated-Sprint Ability Test, Maximal Exercise and Exercise Tolerance in Female Athletes

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The repeated-sprint ability (RSA) test consists of 6 maximal sprints of 40m (20m + 180° turn + 20m) with 20s of passive recovery between each sprint. It has been used in most intermittent-like sport modalities (i.e. soccer, rugby) to match-relate athletes' performances, however, the RSA relationship with maximal exercise capacity as well as exercise tolerance needs to be investigated. **PURPOSE:** To verify the relationship between the RSA test with a maximal cardiopulmonary exercise test (CPX) and a constant speed test until time to exhaustion (TTE) of intermittent-sport female athletes. **METHODS:** Twenty-two professional female soccer athletes (23 ± 4 years, 55.4 ± 6.9 kg, 162 ± 6 cm, maximal oxygen uptake ($\dot{V}O_2$) 2341.8 ± 209.4 ml.min⁻¹) performed the RSA test in a grass field. RSA mean performance time and percentage of performance decrement were calculated afterwards (RSA_{mean} and RSA_{dec}, respectively). At least 48h later, all athletes underwent the CPX on a treadmill, where cardiac and respiratory variables were measured and calculated by a metabolic cart. Additionally, arterialized blood samples from earlobe puncture were collected in order to quantify blood lactate concentration ($[\text{lac}]_b$) during maximal exercise. Lastly, after 48h, all athletes performed a constant speed test (at 100% speed reached in CPX) until TTE to verify their exercise tolerance. **RESULTS:** Statistically significant correlations were found between: 1) maximal heart rate of CPX and RSA_{dec} ($P = .000$, $r = .692$); 2) $[\text{lac}]_b$ at the peak of CPX and RSA_{dec} ($P = .012$, $r = .539$); and 3) TTE and RSA_{dec} ($P = .000$, $r = -.632$). No correlations between RSA variables and $\dot{V}O_2$ were found. **CONCLUSION:** This study showed that maximal chronotropic and blood lactate responses to maximal exercise testing are related to RSA test performance. In addition, exercise tolerance obtained during a near maximal exercise performance is also associated to RSA test performance in female intermittent-like sport modality athletes. Supported by CNPq Grant #487385/2013-6 and FAPESP Grants #2014/10145-9 and #2015/04101-1.

2172 Board #185 June 1 3:30 PM - 5:00 PM

Differences Between Open and Closed-Kinetic Chain Measurements for Assessing Bilateral Strength Deficits

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Rugby is an 80-minute closed-kinetic chain field sport with maximum bouts of speed, power, strength, and physicality. Assessing a player's strength capacity is important for determining position, eligibility, and return to play after injury. Bilateral strength deficits (difference between bilateral strength and the sum of both unilateral measures) could potentially put an athlete at greater risk for injury. The isometric mid-thigh pull (IMTP) is a closed-kinetic chain test examining multiple muscle groups force output involving the whole body, more similar to rugby, whereas the isometric knee extension is an open-kinetic chain test isolating the torque output of only the quadriceps muscle group. Some disagreement exists regarding whether open or closed-kinetic chain tests are more valid to assess an athlete's bilateral strength deficit. **PURPOSE:** To determine differences between an isolated open-kinetic chain and closed-kinetic chain tests to evaluate the bilateral deficit. **METHODS:** Seventeen club rugby athletes (men n=6, age=22.0±2.6 yrs, height= 172.66±6.12 cm, mass=80.28±11.13; women n=11, age= 24.72±3.66 yrs, height= 164.00±5.23 cm, mass =74.00±18.14 kg) completed a standardized warm-up then stood on an AMTI force plate and performed a bilateral IMTP, and two IMTP measured for each leg unilaterally in random order. They also performed a Biodex knee extension isometric test bilaterally, as well as each leg unilaterally in random order. **RESULTS:** ANOVA revealed that the Biodex bilateral deficit (20.99%±13.86%) was significantly greater than the IMTP (6.75%±9.78%). **CONCLUSIONS:** Injury rates have previously been associated with bilateral strength deficits, making strength assessments crucial for coaches. The IMTP closed-kinetic test may be more sport-specific, however, athletes may compensate for leg weaknesses with other muscle groups. The ability of the Biodex open-kinetic test to isolate specific muscle groups may be more beneficial for coaches testing bilateral strength deficits, and determining their athlete's return to play.

2173 Board #186 June 1 3:30 PM - 5:00 PM

Physiological Attributes of an NCAA Intercollegiate Triathlon Team

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The NCAA recently added women's triathlon to its "emerging sports" program. Prior literature has focused on the attributes of highly trained, junior elite, and recreational triathletes and comparative benchmark data of varsity intercollegiate triathletes are currently unavailable.

PURPOSE: To examine physiological attributes of NCAA varsity intercollegiate triathletes.

METHODS: Six male (age 19.0 ± 1.1 yrs) and 3 female (age 18.7 ± 0.6 yrs) varsity intercollegiate triathletes underwent physiological testing during maximal treadmill run and cycling protocols, and a 1km pool swim time trial performed on separate days. Physiological indices assessed for each protocol are presented in the table. Data were compared to determine sex differences between athletes in the present study and versus highly trained, junior elite and recreational triathletes as reported in the literature.

RESULTS:

Group differences were observed between males and females for the run and cycle tests and for the 1km swim.

	VARIABLE	MALE	FEMALE
RUN	VO _{2peak} (ml/kg/min)	66.2 ± 5.9	49.1 ± 4.6 *
	HRmax (bpm)	194.8 ± 8.3	201.0 ± 7.2 *
	Lactate Peak (mmol/l)	7.8 ± 2.5	11.0 ± 3.4 *
BIKE	VO _{2peak} (ml/kg/min)	60.9 ± 6.2	51.5 ± 2.1 *
	HRmax (bpm)	188.3 ± 3.6	184.7 ± 13.9
	Lactate Peak (mmol/l)	10.7 ± 2.5	8.4 ± 1.6 *
	Peak Watts	332.5 ± 14.4	283.3 ± 38.1 *
SWIM	Watts/kg	4.7 ± 0.2	4.7 ± 1.3
	HRmax (bpm)	182.2 ± 9.4	190.6 ± 9.2 *
	HRavg (bpm)	170.2 ± 8.8	180.6 ± 10.1
	Breaths per lap	8.7 ± 1.4	11.0 ± 0.8 *
	1 km time (min:sec)	12:45.6 ± 0:46	14:34.8 ± 1:03 *

* Sig. diff.; p ≤ 0.05; mean ± SD

Participants had lower VO_{2peak} values than highly trained (male 73.8 ± 1.6, female 59.7 ± 5.0 ml/kg/min; p ≤ 0.05) and junior elite triathletes for run (male 73.2 ± 7.4 ml/kg/min; p ≤ 0.05) and bike (male 68.2 ± 7.4 ml/kg/min; p ≤ 0.05) but had greater aerobic capacities than recreational triathletes for run (male 62.9 ± 7.2 ml/kg/min; p ≤ 0.05) and bike (male 59.6 ± 5.4 ml/kg/min; p ≤ 0.05). Mean (± SD) 1km swim times for male and female participants were significantly slower than national performance standards for 19 yr old triathletes (male 11:59.0 and female 12:48.0; p ≤ 0.05).

CONCLUSION: Our findings are the first to present physiological attributes of NCAA varsity intercollegiate triathletes and indicate favorable VO_{2peak} values compared to recreational triathletes, but not to highly trained or junior elite triathletes.

2174 Board #187 June 1 3:30 PM - 5:00 PM

Sex Differences In Bilateral And Unilateral Asymmetries In Recreationally Trained Individuals

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(No relationships reported)

PURPOSE: Limb musculature performance asymmetry can negatively impact various exercise and sport performance outcomes, but whether the percent difference of torque asymmetry between men and women is different remains less examined. Therefore, the purpose of the investigation was to determine sex differences in bilateral and unilateral asymmetries in recreationally trained individuals.

METHODS: Forty-five males (n = 24; age, 23.54 ± 2.24 yrs; mass, 83.07 ± 10.48 kg; height, 168.65 ± 2.14cm) and females (n = 21; age, 22.47 ± 2.42yrs; mass, 63.33 ± 6.80kg; height, 163.94 ± 5.71cm) participated in both a familiarization session and a testing session in one day. Participants signed an IRB approved informed consent, physical activity readiness questionnaire, and a health history questionnaire, followed by measuring age, weight, and height. Participants were instructed to perform 5 maximal repetitions of knee flexion and extensions on each leg at an angular velocity of 60°/s. Percent differences in torque were calculated for bilateral and unilateral asymmetries, bilateral quad percent difference (BQ%), bilateral hamstring percent

difference (BH%), unilateral right leg percent difference (UR%) and unilateral left leg percent difference (UL%). Independent t-tests were used to analyze sex differences between all variables. Additionally, independent t-tests were used to analyze sex differences between age, height, and weight.

RESULTS: There were no significant (p>0.05) differences between recreationally trained males and females for BQ% (M= 9.89 ± 5.95%; F= 7.26 ± 5.69%), BH% (M= 6.97 ± 5.97%; F= 10.02 ± 10.88%), UR% (M= 50.28 ± 6.86%; F= 46.65 ± 11.28%), and UL% (M= 50.19 ± 7.71; F= 50.13 ± 10.85%). There was no significant (p>0.05) difference between sex for age and height, however there was a significant (p<0.05) difference for weight.

CONCLUSIONS: Sex appears to have no significant effect on the percent difference of bilateral and unilateral torque asymmetries despite several different known physiological aspects. This could be due to the fact that our subject population was recreationally trained individuals, which can represent multitude of sports, workouts and training programs. Future research should investigate sex differences in sport-specific athletes.

2175 Board #188 June 1 3:30 PM - 5:00 PM

Correlation Between Bench Press and Pushup Repetitions to Failure Relative to Bodyweight

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The bench press and pushup are popular exercises used to develop strength and power. They are also often associated with equal benefits in developing upper body muscular endurance. However, it is unknown how they are related as pushups use a bodyweight load while the bench press uses greater weight. **PURPOSE:** To investigate the correlation between bench press and pushup repetitions to failure relative to a bodyweight load. **METHODS:** Fourteen recreationally trained males (age=24.71±2.64yrs, height=177.29±6.87, mass=83.74±9.41) performed a 1RM bench press test and an isometric pushup to determine bodyweight load supported in both the up and down positions. Grip width on the bench press was measured as the distance between middle fingers and this distance was used for hand placement during pushups. Subjects were positioned for a pushup with their hands on an AMTI force plate and their feet off the plate. Isometric force was measured for 3 seconds in the up and down positions, in random order. For the down position, triceps were parallel to the floor, while for the up position, triceps were perpendicular to the floor. Days 2 and 3 consisted of performing repetitions to failure for either the bench press or pushup exercise. For the pushup, subjects performed repetitions following an 80/s tempo. The test was terminated if they failed to complete a full repetition, could not maintain cadence or there were three faults in form. For the bench press, subjects performed repetitions to failure with a load that was equal to the average relative bodyweight force of the up and down pushup positions. **RESULTS:** There was a very low relationship (r=0.289) between bench press repetitions to failure (29.5±7.59) and push up repetitions to failure (33.0±6.53). Load for the bench press test, relative to their 1RM (0.51%±0.07) was significantly less than the pushup down position (0.75%±0.03), up position (0.71%±0.03), and the average of the up and down positions (0.73%±0.03) relative to their body mass. **CONCLUSIONS:** The bench press and pushup must be seen as two distinct and different exercises that use very different loads, which could result in dissimilar upper body muscular endurance adaptations.

2176 Board #189 June 1 3:30 PM - 5:00 PM

Hamstrings to Quadriceps Ratios Differ Between Legs and Isometric and Dynamic Tests in Amateur Rugby Players

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Non-contact knee injuries have been associated with large differences in strength between the quadriceps and hamstrings muscle groups. Similarly, favoring movements on the dominant vs. non-dominant leg may lead to imbalances that could result in injury. Screening players for hamstring to quadriceps ratios (HQR) by measuring isometric and dynamic strength prior to the season may demonstrate mode specific imbalances. **PURPOSE:** To measure the dynamic and isometric strength of the quadriceps and hamstrings in the dominant and non-dominant legs of rugby players prior to a collegiate season. **METHODS:** 19 amateur rugby players (11 females, age= 24.73±3.66 yrs, height=164.00±5.23 cm, mass=74.00±18.14 kg) and (8 males, age=22.38±2.45 yrs, height=175.38±7.44 cm, mass=83.24±10.99 kg) performed dynamic maximal effort 3-repetition isokinetic concentric knee flexion/extension at 60°/s, and maximal effort isometric tests on the dominant and non-dominant legs on a Biodex dynamometer at a 60° knee angle. Peak torque (PT) was measured for all tests. **RESULTS:** Dominant leg Q isometric PT was 231.61±58.11Nm and H was 140.90±39.76Nm. Dominant leg Q dynamic PT was 222.58±59.63Nm and H

was 152.60±47.04Nm. Non-dominant Q isometric PT was 240.02±80.49Nm and H was 132.42±38.65Nm. Non-dominant Q dynamic PT was 219.50±68.14Nm and H was 164.81±59.14Nm. A 1x4 repeated measures ANOVA revealed that dominant leg isometric HQR (.61±.10) was less than dominant leg dynamic HQR (.69±.12). Non-dominant leg isometric HQR (.57±.09) was less than non-dominant leg dynamic HQR (.76±.16). Dominant leg isometric HQR was greater than non-dominant HQR while non-dominant leg dynamic HQR was greater than dominant leg dynamic HQR. **CONCLUSIONS:** These results demonstrate that rugby players have greater HQR ratios in dynamic vs. isometric strength tests in both legs. Dynamic strength is displayed during rugby specific situations such as the scrum and therefore may be a more relevant measure. However, the importance of isometric HQR should also be of concern as isometric and dynamic muscle actions are performed by the hamstrings and quadriceps throughout a game. Therefore, test specificity should be considered when assessing muscle strength and ratios.

2177 Board #190 June 1 3:30 PM - 5:00 PM
Effect Of Exercise Intervention On Health States Of Civil Servants In Chengdu City

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PURPOSE: Understand the health states of civil servants in Chengdu city by physical measurement and blood test, and design different exercise prescription to the civil servants. Observe its effect, so as to provide practical information to the exercise intervention in health states.

METHODS: Through the random number table method randomly divide 110 Chengdu civil servants, aged 20-59 into 5 groups (control group, 6000 steps, 10000 steps, 6000 + joint gymnastic, 10000 + joint gymnastic, and each group of 22 people), took an exercise intervention 4 times per week for 12 weeks. The physical and blood parameters were measured before and after intervention, at the same time analyzed the intervention effect. Statistical analysis, T-test, and one-way ANOVA were conducted by SPSS19.0. $P < 0.05$ was considered statistically significant. **RESULTS:** Compared with pre-intervention: ① There were no significant difference in 6000 group. ② There were significant differences in body shape, SBP and muscle strength in 10000 group ($P < 0.05$), and TG was significantly decreased ($P < 0.05$). ③ There were significant differences in waist circumference and systolic blood pressure in 6000+group ($P < 0.05$). ④ The scores of physical fitness, body shape, BP, upper and lower limbs muscle strength and flexibility were significantly improved ($P < 0.05$) in 10000+group, TC, TG and LDL were significantly decreased ($P < 0.05$). ⑤ Compared between these interventions, walking+joint gymnastic is better than walking, 10000+joint gymnastic is the best.

CONCLUSIONS: ① The health status especially in blood indicators of Chengdu civil servant is not good compared with other people in China. We should strengthen the public health awareness. ② Exercise is medicine, exercise can effectively improve the health, physical quality and the state of blood of civil servant. The 10000+joint gymnastic it is worth promoting in change the health status of civil servants.

2178 Board #191 June 1 3:30 PM - 5:00 PM
Validation Of An On-ice Continuous Multistage Test For Short Track Speed Skaters

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PURPOSE: There are still no sport-specific tests to evaluate directly on ice the aerobic capacity for short track speed skating athletes. The aim of this project was to create an on-ice test to estimate skater's VO_{2max} .

METHODS: Two athletes of the men's Canadian national team participated in the pilot study. Participants were 22 years old, with mean body weight of 69.8 ± 1.0 kg and height of 176.5 ± 8.9 cm. The skaters performed a continuous multistage test on Olympic-sized ice rink (Maurice Richard arena, 111.12m course perimeter). An audio track was created (beep test audio track) so that the speed of skating would accelerate by 0.20 seconds every 2 lap stages. The first stage started at 13.0 seconds/lap, representing a speed of 8.55 m/s. The skaters had to follow the rhythm of increasing speed until exhaustion or until they could no longer maintain the pace (off on two consecutive beeps). Measurements during the test for oxygen consumption (VO_{2}), respiratory exchange ratio (RER) and heart rate (HR) were performed with a portable metabolic analyzer and an HR monitor.

RESULTS: Skater #01 stopped at stage 15 (10.89 m/s) with an HR of 185 bpm, a VO_{2max} of 61 ml/min/kg and a RER of 1.27, compared to skater #02 who stopped at stage 18 (11.58 m/s) with an HR of 194 bpm, a VO_{2max} of 66 ml/min/kg and a RER

of 1.28. These preliminary results suggest that the protocol brings athletes to their maximal capacity by reaching a plateau for the HR and VO_{2} , and a RER higher than 1.15.

CONCLUSIONS: A progressive speed skating test till exhaustion appears to measure maximum aerobic capacity of elite speed skaters. Nonetheless, many other data collections should be done with different levels of skaters, at different ages and gender, with the aim of creating a VO_{2max} estimating chart and also confirmed with a laboratory-based VO_{2max} measurement on cycle ergometer.

2179 Board #192 June 1 3:30 PM - 5:00 PM
Muscle Function Tests as Field Measures of Tibial Bone Strength

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Osteoporosis is a leading cause of fracture and morbidity in older populations (Colon-Emeric & Saag, 2006). An effective strategy in minimizing the risk of osteoporosis is an active lifestyle in adolescence (Turner, 2004). Suboptimal bone strength in individuals who do not reach peak bone mass during childhood or adolescence may contribute to the development of fractures later in life (Bachrach, 2001). Bone strain and, thus, structural adaptations of bone are due to muscle forces acting on bone during activity (Robling, 2009). Therefore, field measures of muscle force could be used to assess skeletal health. **PURPOSE:** The purpose of this study is to investigate the relationship between common muscle function tests (1 rep max/body weight, relative grip strength, peak power) and bone strength variables in a healthy college-age population. **METHODS:** Twenty participants from CSU East Bay, 9 females and 11 males (age (yrs) 23.4 ± 2.5, height (m) 1.7 ± 0.1, body fat % 20.8 ± 9.6) performed a relative grip strength test using a hand dynamometer, a one repetition maximum (1 RM) on a leg press machine and a vertical jump test using the Vertec. Peak power was then calculated from vertical jump height. Moment of inertia (J), cortical area (Ct.Ar), cortical bone mineral density (cBMD), and strength-strain index (SSI) were measured using peripheral Quantitative Computed Tomography (pQCT) to determine bone strength at the 50% tibia site. Correlation analysis determined muscle bone relationships. **RESULTS:** 1 RM/BW and relative grip strength were not significantly correlated with bone strength parameters. Peak power resulted in significant, positive correlations with J ($R^2 = 0.6089$, $p = 0.008$), Ct.Ar ($R^2 = 0.6030$, $p = 0.008$), and SSI ($R^2 = 0.5948$, $p = 0.009$). Peak power resulted in a significant, but negative relationship with cBMD ($R^2 = 0.7080$, $p = 0.002$). **CONCLUSION:** Our findings suggest peak power is a significant surrogate measure of bone strength in a healthy college-age population. Although cBMD had a negative relationship with peak power, this finding is possibly due to low numbers of participants at this stage. This study is important because health professionals and physical educators can use peak power as a practical and non-invasive method of determining bone strength and health.

2180 Board #193 June 1 3:30 PM - 5:00 PM
The Age-related Changes In Multi- And Single-joint Measures Of Power Output

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Many previous studies have demonstrated age-related reductions in power output. However, few studies have identified if the age-related declines in power output during a functional lower body movement are similar to single-joint isokinetic testing.

PURPOSE: To compare the relationships between the age-related reduction in power output using a single-joint isokinetic muscle action versus a more functional multi-joint vertical jump (VJ) assessment.

METHODS: Forty middle- to older-aged men (mean ± SD; age = 59.2 ± 7.8 years; range = 50-74 years) visited the lab on two occasions, separated by 48-72 hours. During the second visit, and following a familiarization session on visit one, participants performed 2-3 maximal countermovement VJ attempts while attached to commercially available equipment designed to examine lower body power output. The equipment was placed on the floor behind the subject to allow the cord to be extended without impeding the VJ technique. Following the VJ assessment, the participants performed three maximal concentric isokinetic muscle actions of the right leg extensors at 240°·sec⁻¹ using a calibrated isokinetic dynamometer. The torque and position signals were sampled from the dynamometer at 2 kHz and were processed offline using custom written software. Isokinetic mean power (MP) was calculated as the product of the average torque (Nm) during the load range and isokinetic velocity (°·sec⁻¹). Pearson correlation coefficients (r) were used to evaluate the relationships between age and VJ, and age and isokinetic MP. The Steiger Z calculation and an effect size was used to determine the difference between the relationships. The alpha level was set at $P \leq 0.05$.

RESULTS: There were significant relationships between age and VJ power output ($r=-0.633$; $P<0.001$) and age and isokinetic MP ($r=-0.410$; $P=0.009$). The correlation coefficients were similar ($P=0.112$), however, there is a moderate difference (effect size=0.31) between the relationships.

CONCLUSIONS: Single-joint isokinetic power output may demonstrate a weaker, but similar relationship with age when compared with more functional VJ assessments.

2181 Board #194 June 1 3:30 PM - 5:00 PM
Comparison Of Mechanical Efficiencies From Self-selected And Rapid Speed Rock Climbs

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Purpose: To determine if there is a difference in mechanical efficiency between a self-preferred and a rapid-speed rock climb.

Methods: Ten experienced climbers volunteered to participate in this study (ages 18-40 years, 7 males, 3 females, at least one year of recreational climbing experience). Participants climbed up and down a vertical route (30 feet) on a rock-climbing wall at a self-selected pace for ten minutes. They then climbed the same vertical route as fast as they could to cover the same distance achieved during the 10 minutes of the self-selected climb. VO₂ was measured at rest and then continuously during the climb using a portable COSMED device. Mechanical efficiency of each participant was calculated for both the self-selected pace and rapid-speed climbs, and then compared using a paired T-test on Microsoft Excel 2016 with statistical significance accepted at $p<0.05$.

Results: There was no significant difference in mechanical efficiency between the self-preferred and rapid speed climbs ($p=0.4211$).

Conclusion: The rock climbers did not experience a significant change in mechanical efficiency between the self-selected and rapid-speed climbs. Familiarity with the climbing route and forearm fatigue may have contributed to this finding. Future studies should consider using a counterbalance system for assigning climbing order.

2182 Board #195 June 1 3:30 PM - 5:00 PM
The Relationship between Echo Intensity and Specific Strength as Measures of Muscle Quality

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The use of ultrasound (US) echo intensity (EI) as a measure of muscle quality has increased in popularity over recent years. However, in early studies muscle quality was quantified as a function of force per unit of muscle, or specific strength (MQ_{ST}). Limited data exist that have examined the relationship between these two measures of muscle quality. **PURPOSE:** The purpose of this study was to examine the relationship between US EI and MQ_{ST} as measures of muscle quality. **METHODS:** Thirty-one healthy volunteers (mean ± SD age, 35 ± 7 yrs; Body Mass Index [BMI], 28.66 ± 5.08) participated in this study. Following a familiarization session, participants visited the laboratory on a separate occasion for isometric strength testing and skeletal muscle US imaging. Peak torque (PT) was determined from highest mean value (500 ms) that occurred during three maximal voluntary contractions. Vastus lateralis (VL) cross-sectional area (CSA) and EI were assessed with a B-mode US device. The VL images were taken perpendicular to the longitudinal axis of the muscle at half of the distance between the greater trochanter and articular cleft of the knee. All US images were analyzed in ImageJ using the polygon function to determine the VL CSA that included as much muscle as possible without the surrounding fascia. The same region of interest was used for the EI (gray-scale) analyses and subsequently corrected for subcutaneous fat thickness. MQ_{ST} was defined as PT per unit of muscle size (VL CSA). Pearson correlation coefficients were used to examine the relationship between VL EI and MQ_{ST}, while separate partial correlation coefficients were used to examine the influence of BMI and sex. An alpha level of $P \leq 0.05$ was used to determine statistical significance. **RESULTS:** There was a significant relationship between VL EI and MQ_{ST} ($r = 0.409$, $P = 0.022$). In addition, similar relationships existed when controlling for BMI ($r = 0.376$, $P = 0.041$) and sex ($r = 0.411$, $P = 0.024$). **CONCLUSIONS:** A significant relationship exists between VL EI and MQ_{ST}, however a large amount of variance is left unexplained ($r^2 = 0.167$). Although both are considered to reflect muscle quality, each measure may be influenced by unique physiological variables (i.e. muscle activation, hydration status). **GRANT FUNDING:** National Institute of Occupational Safety and Health (T42OH008673)

2183 Board #196 June 1 3:30 PM - 5:00 PM
Improved Fitness Trends In Firefighter Recruits Over A 12-year Span

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Firefighting is a physically demanding occupation. As a population, firefighters (FFs) are at high risk for many health-related issues (e.g., sudden cardiac events, obesity, hypertension, fatigue, depression, post-traumatic stress disorder, anxiety). Physical fitness is an effective preventative strategies FFs can use to improve health and performance, as well as combat multiple health risks. **PURPOSE:** Examine physical fitness parameters and assessments in FFs from 2004 through 2016. **METHODS:** Participants were male FF recruits ($N=556$; 26.3 ± 4.2 yrs; ht: 179.98 ± 7.32 cm; wt: 87.20 ± 15.0 kg) from the Illinois Fire Service Institute. Baseline descriptive measurements included waist (89.99 ± 11.4 cm) and hip circumference (95.71 ± 9.8 cm), and BMI (26.97 ± 4.21). Baseline fitness testing included measurements of cardiovascular endurance (1.5-mi run (12.87 ± 1.77 min, $M \pm SD$); estimated VO_{2max} (41.54 ± 5.10 ml·kg⁻¹·min⁻¹), muscular endurance [60-s sit-ups (31.6 ± 8.5 reps), 60-s push-ups (40.3 ± 12.3 reps), bench press (28.99 ± 11.4 reps)], and flexibility [sit and reach (30.65 ± 7.8 cm)] during the first week of a 6-wk fire academy. **RESULTS:** Significant differences were shown across time ($P_s < 0.001$, all $ES_s = 0.86-0.99$) for weight and BMI, waist and hip circumference, 1.5-mi run time, 60-s push-ups, 60-s sit-ups, muscular endurance, and flexibility. Analyses examining trends over the 12-yr span revealed relationships between time and 1.5-mi run time ($r=0.67$), 60-s push-ups ($r=0.51$), muscular endurance ($r=0.56$), and flexibility ($r=0.74$). **CONCLUSIONS:** Over the span of 12 years, male FF recruits have shown increases in various fitness parameters (cardiovascular endurance, muscular strength/endurance, flexibility) while measures of weight, BMI, waist and hip circumferences have remained relatively stable and consistent. Measures of cardiovascular endurance (1.5 mi run time) improved by 11.9% over this time period, and measures of muscle strength/endurance (e.g., push-ups) increased by 21.8%. The data suggest that the fitness levels of male FFs are increasing as they begin their career in the fire service. These increases in fitness may reflect national efforts in the fire service to promote fitness and may lead to decreases in disease and work-related disability.

2184 Board #197 June 1 3:30 PM - 5:00 PM
Physical Activity Intervention Fitness Of Male'S Middle Students In China: A Systematic Review And Meta-analysis

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Purpose: Approximately 50 % of Chinese weight are not reach the national standard. Approximately 70 % of Chinese adolescent are not physically active enough to achieve health benefits. The purpose of this study was to systematically review and meta-analyze the effect of fitness for Chinese middle students interventions on physical activity.

Methods: CNKI, Wanfang Data, Weipu Data and Web of Science Database were systematically searched to identify all relevant randomized controlled trials that evaluated the effect of fitness for Chinese middle students on physical activity from 2011 to 2015 years. According to the study design, the data of the boys were selected for analysis. The studies were described and effect size data were included in meta-analyses.

Results: Eighteen studies were included in the review and ten reported statistically significant improvements in physical activity. A meta-analysis of ten studies showed a statistically significant effect (SMD= 0.21, $p=0.004 < 0.01$) of Grip on physical activity immediately post-intervention. The intervention had a statistically significant effect (SMD=0.20, $P=0.006 < 0.01$) of the Sit and Reach. However, it is not statistically significant effect of Vital Capacity (SMD=0.19, $P=0.25$), Weight (SMD=-0.11, $P=0.12$) and Height (SMD=0.13, $P=0.06$) on physical activity immediately post-intervention.

Conclusion: Daily activity is to be effective at increasing weekly duration of exercise in middle students, but the effect size is small. Training Chinese adolescents to encourage increased physical activity may provide an effective method for reaching their fitness health. More studies with detailed quantification of total physical activity will help to find more precise relative estimates for different levels of activity of Chinese adolescents.

2185 Board #198 June 1 3:30 PM - 5:00 PM
The Relationship between Vertical Power and Bone Mineral Content in College-Aged Women

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(No relationships reported)

INTRODUCTION: Peak and mean power assessed, by a vertical jump, has been shown to be a strong predictor of bone mineral content (BMC) in children and adolescents. However, this relationship has not been demonstrated in young women. **PURPOSE:** To examine the relationship between vertical power and BMC in college-aged women. **METHODS:** Body composition and BMC was assessed by dual-energy X-ray absorptiometry in 77 women (age: 20.9 ± 2.2 years, height: 163.3 ± 12.7 cm, body mass: 60.9 ± 8.5 kg). Peak and mean vertical power was determined using a VertecTM scale and was calculated by the Sayers and Lewis equations, respectively. **RESULTS:** Peak and mean vertical power were 3109 ± 521 Watts and 841 ± 125 Watts, respectively. Relationships were observed between BMC and peak vertical power ($r = 0.52, p < 0.001$) as well as mean vertical power ($r = 0.58, p < 0.001$). Multiple linear regression ($r = 0.63, p < 0.001$) resulted in the following equation: $BMC = 0.436 - (0.00107 * \text{Peak Power}) + (0.00635 * \text{Mean Power})$. Additionally, a strong relationship was observed between body mass and BMC ($r = 0.75, p < 0.001$). **CONCLUSIONS:** The results of this study indicate that 40% of the variability of BMC in college-aged women can be predicted by peak and mean vertical power. These findings support the use of an assessment of vertical power as a predictor of bone strength in young women. We recommend that college-aged women with a goal to improve BMC perform plyometric types of activities that involve jumping and rebounding.

2186 Board #199 June 1 3:30 PM - 5:00 PM
Sex Differences in the Physiological Responses of Elite Collegiate Hockey Players during a Submaximal Test

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To optimize the health and sport performance in athletes, sport scientists have recently turned to monitoring physiological variables and markers of performance. Currently, preferred types of monitoring have not been identified and past research has shown that males and females might react differently to physiological stress. **Purpose:** To compare the physiological response of male and female elite collegiate hockey players after a 4-minute submaximal cycling test performed at a predicted 75% of $\dot{V}O_2$ max. **Methods:** 52 elite Canadian collegiate hockey players, 28 males (age = 22.6 ± 1.3 , height = 182.59 ± 6.00 cm, weight = 87.12 ± 6.43 kg, body fat = $17.3 \pm 4.28\%$) and 24 females (age = 19.9 ± 1.3 , height = 166.97 ± 7.20 cm, weight = 67.75 ± 8.10 kg, body fat = $26.3 \pm 4.68\%$) participated in a 4-minute submaximal cycling test at a predicted 75% of $\dot{V}O_2$ max. Heart rate (HR) and rate of perceived exertion (RPE) were assessed during each stage and after the submaximal test, while blood lactate level was measured 2 minutes after the test. ANOVA was used to compare sex differences in HR, RPE and post exercise blood lactate. **summary of Results:** Females had higher heart rates at each stage of the exercise test: time 1 ($F(1,51) = 5.914, p \leq .05$), time 2 ($F(1,51) = 14.457, p \leq .05$), time 3 ($F(1,51) = 15.299, p \leq .05$) and time 4 ($F(1,51) = 14.628, p \leq .05$). There were no between sex differences in post exercise blood lactate and RPE at any stage of the exercise test. **Conclusion:** Under similar physiological stress, male and female athletes demonstrate similar post exercise blood lactate levels. However, submaximal heart rates at each stage of the submaximal test were higher among the female athletes. More work is needed to understand cardio-metabolic sex differences, which could help sport scientists better tailor training program for elite female athletes. This novel method of testing may be suitable for tracking physical fitness over the course of a playing season for male and female athletes.

2187 Board #200 June 1 3:30 PM - 5:00 PM
Physical Activity Level Of College Students: Do We Really Know How Much?

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Physical Activity Level of College Students: Do we really know how much? Ashby M. Williamson, Danielle N. Ludlam, Sarah M. Henry, G. William Lyerly. Coastal Carolina University, Conway, SC 29528
Background: Around the world, people in different populations are struggling with mental and physical disabilities that are caused by poor health. Poor health involves many factors including a low physical activity (PA) level. A person's PA can be measured in several ways, one that has become popular is an accelerometer. Most PA guidelines recommend that an adult must acquire 7,500-10,000 steps/day to be considered somewhat active. However, studies have found that different equipment can calculate different step counts. **Purpose:** To determine if college students are meeting recommendations for physical activity in regards to steps taken per day and if current measurement devices are accurately reporting these outcomes. **Methods:** Thirty one college students (20 y.o.; 69.93 kg) wore an Actigraph GT3X accelerometer (GT3X) around the waist during daily activities to determine steps taken in an average week. We compared our calculated outcomes versus GT3X's reported outcomes. All data used was collected via the GT3X. **Results:** The GT3X reported that the students averaged 5,746 steps/day, while we calculated an average of 4,493 steps/day, resulting in a difference of 1,253 steps/day. **Conclusion:** Our results indicated that college students either fall in a step count range of approximately less than 5,000 or a range of 5,000-7,499 steps/day. Our data suggests that college students may be categorized as low active or sedentary based on which count is accurate. The difference in steps may have resulted from how total time was calculated. Further research is warranted to gain a better understanding of how to monitor the accuracy of measurement devices when determining activity levels for a population. This gained knowledge could lead to healthier students with a lower risk of mental and physical disabilities across multiple college campuses.

2188 Board #201 June 1 3:30 PM - 5:00 PM
Agreement of Ventilatory Responses to Continuous and Interval Specific Taekwondo Cardiopulmonary Exercise Tests

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(No relationships reported)

PURPOSE: To analyze the agreement of ventilatory responses of continuous and interval taekwondo cardiopulmonary exercise tests (CTKDet and iTKDet, respectively). **METHODS:** Twelve male taekwondo athletes (age: 20 ± 2 yrs; body mass: 67.5 ± 5.7 kg; height: 175 ± 8 cm) visited the laboratory three times. The University ethics committee approved this study (opinion #765.698). In the first visit, an anthropometric assessment was performed. In the next two visits, participants performed cTKDet and iTKDet, in a counterbalanced order. Taekwondo tests were constituted by progressive stages of kicking sequences, with 1 min duration, and kick intervals starting from 4,6s and reduced 0,4s every minute until fatigue. iTKDet also presented a passive recovery between every two stages. During all tests, respiratory variables were measured continuously with expired gas analyzer VO2000 (MedGraphics, Saint Louis, USA), with 20s sampling. Ventilatory thresholds were determined by the ventilatory equivalents method. Shapiro-Wilk test was performed to verify normality. Parametric data were described by average (standard deviation), 95% Confidence Interval of Mean, and compared using Paired T-test (effect size: Cohen's *d*). Non-parametric data were described by median (interquartile range), 95% Confidence Interval of Median, and compared using Wilcoxon test (effect size: z/\sqrt{n}). Ventilatory responses agreement was assessed with Intraclass Correlation Coefficient (ICC) and ICC 95% confidence interval calculation. $P < 0.05$ was adopted for all tests. **RESULTS:** The results are present in Table 1. **CONCLUSION:** Besides the absence of significant difference between the test, interval, and continuous methods may not be interchangeable to assess Taekwondo athletes' ventilatory responses. Additionally, interval seems to yield higher performance, with shorter kick intervals, for peak and ventilatory thresholds in the specific tests. Supported by CAPES, FAPERJ, and CNPq.

Table 1. Agreement of ventilatory responses to cTKDet and iTKDet.

		Mean (SD) or Median (IR)	95%CI	Comparison Test's ρ (ES)	ICC (ICC 95%CI)
VO ₂ PEAK (mL.kg ⁻¹ .min ⁻¹)	cTKDet	52.3 (5.3)	48.9 - 55.7	0.73 (0.10)	0.82* (0.34 - 0.95)
	iTKDet	52.7 (4.3)	50.0 - 55.4		
Peak Kicks Interval ^{NP} (s)	cTKDet	1.2 (0.2)	1.0 - 1.4	0.004* (-0.82)	0.19 (-0.24 - 0.63)
	iTKDet	0.9 (0.1)	0.8 - 1.0		
VT ₁ VO ₂ ^{NP} (mL.kg ⁻¹ .min ⁻¹)	cTKDet	38.8 (1.0)	37.8 - 39.9	0.14 (-0.43)	0.22 (-1.05 - 0.75)
	iTKDet	35.8 (3.8)	33.3 - 39.9		
VT ₁ VO ₂ (%)	cTKDet	73.6 (5.8)	68.0 - 79.0	0.11 (0.51)	-0.22 (-2.05 - 0.60)
	iTKDet	69.5 (4.9)	66.0 - 72.0		
VT ₁ Kicks Interval ^{NP} (s)	cTKDet	4.0 (0.2)	3.8 - 4.2	0.02* (-0.74)	0.17 (-0.61 - 0.69)
	iTKDet	3.8 (0.0)	3.4 - 3.8		
VT ₂ VO ₂ ^{NP} (mL.kg ⁻¹ .min ⁻¹)	cTKDet	46.9 (5.0)	41.6 - 50.8	0.64 (0.14)	0.74* (0.06 - 0.92)
	iTKDet	47.6 (5.5)	43.6 - 51.9		
VT ₂ VO ₂ (%)	cTKDet	89.7 (3.4)	88.0 - 92.0	0.80 (0.07)	0.34 (-1.66 - 0.82)
	iTKDet	90.2 (6.8)	84.0 - 97.0		
VT ₂ Kicks Interval ^{NP} (s)	cTKDet	1.8 (0.3)	1.4 - 2.2	0.02* (-0.68)	0.39 (-0.30 - 0.79)
	iTKDet	1.4 (0.0)	1.0 - 1.4		

cTKDet - continuous taekwondo cardiopulmonary exercise test; iTKDet - interval taekwondo cardiopulmonary exercise test. p - Significance level. 95% CI - 95% confidence interval. ES - Effect Size. ICC - Intraclass Correlation Coefficient. The absence of ^{NP} denotes parametric data, presented as mean (sd - standard deviation) and 95% confidence interval of mean (inferior limit - superior limit). ^{NP} Denotes non-parametric data, presented as median (IR - interquartile range) and 95% confidence interval of median (inferior limit - superior limit). Parametric data compared through Paired T-test (Cohen's d effect size). Non-parametric data compared through Wilcoxon signed rank test (z/\ln effect size). * Denotes $p < 0.05$. VO₂PEAK - Highest oxygen uptake value observed. VT - Ventilatory threshold. Percentage variables (%) were calculated with the peak value observed at each test.

2189 Board #202 June 1 3:30 PM - 5:00 PM

Training-Induced Change in Aerobic Fitness and Anaerobic Power among Female College Basketball Players

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(No relationships reported)

PURPOSE: To examine training-induced changes in aerobic fitness and anaerobic power in a sample of division I, female college basketball players.
METHODS: Aerobic fitness and anaerobic power were measured in a sample of female college basketball players before and after preseason training. Aerobic fitness was measured using a VO₂ max test, and anaerobic power was measured using a Wingate test. Preseason training lasted one month and consisted of 8 hours per week of a combination of weight training, high-intensity interval sprint training, and skill workouts. Paired-sample t-tests were used to examine change pre- and post-intervention. Pearson correlations were conducted to examine potential associations among variables.
RESULTS: A total of 13 female athletes completed this study. Maximal aerobic fitness significantly ($p = .013$) increased after preseason training, from 47.9 to 49.9 kg/ml/min. Relative peak power and relative mean power significantly increased after preseason training from 8.3 to 9.1 W/kg ($p = .025$) and from 6.7 to 7.6 W/kg ($p < .001$), respectively. Fatigue index did not significantly change as a result of preseason training. Despite these positive results, individual responses varied widely. Change in maximal aerobic fitness ranged from +0.2 to +6.1 ml/kg/min. Change in relative peak anaerobic power ranged from -1.0 to +3.0 W/kg, and change in relative mean anaerobic power ranged from +0.9 to +1.5 W/kg. Interestingly, change in maximal oxygen uptake and change in measures of anaerobic power were not significantly correlated with baseline levels of either of these variables. There were also no significant correlations between these changes in performance and age, year in school, or position played. There was, however, a significant, positive correlation ($r = .77, p = .002$) between change in relative peak anaerobic power and relative mean anaerobic power.
CONCLUSIONS: Preseason training can have a positive effect on aerobic endurance and anaerobic power. These changes varied widely between athletes. However, this variation was not related to baseline fitness levels, age, year in school, or position played. This information may be useful for strength and conditioning coaches to design individualized training programs to maximize effects.

2190 Board #203 June 1 3:30 PM - 5:00 PM

Gender Inequality and Sex Differences in 20 Meter Shuttle Run Test Performance across 45 Countries

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PURPOSE: To determine if within-country sex differences in 20-meter shuttle run test (20mSRT) performance are related to global gender inequality indices. **METHODS:** A systematic review was carried out to identify studies that reported 20mSRT descriptive data on apparently healthy children and youth aged 9 to 17 years. Descriptive data were standardized to running speed (km/h) at the last completed stage. Within-country 20mSRT performance for girls and boys were calculated as population-weighted mean z-scores relative to children of the same age from all countries. Within-country population-weighted mean z-scores for girls and boys were subtracted to represent the mean z-score sex difference in 20mSRT performance for each country, described as Z_{diff} . Five gender inequality indices were identified as potentially relevant in describing sex differences in 20mSRT performance across countries (i.e., Gender Equity Index, Gender Empowerment Measure, Global Gender Gap Index, Gender Inequality Index, and Social Institutions and Gender Index). Pearson's correlations were calculated to describe the associations between Z_{diff} and indices of gender inequality. **RESULTS:** Sex-specific z-scores were calculated from 1,141,514 children and youth (48% female). Within-country 20mSRT performance of girls and boys were very strongly correlated ($r=0.92$; 95%CI: 0.87, 0.96). The sex differences in performance (Z_{diff}) were calculated for 45 countries representing five continents. The mean Z_{diff} was 0.04 ± 0.23 with values ranging from -0.48 (girls had a better 20mSRT mean z-score relative to boys) to 0.67 (boys had a better 20mSRT mean z-score relative to girls) standardized units across the 45 country sample. Z_{diff} across countries were moderately and negatively correlated with the Global Gender Gap index ($r=-0.42$; 95%CI: -0.65, -0.12). Correlations across all other indices were of low-to-moderate strength, ranging from $r=-0.23$ (95%CI: -0.46, 0.11) to $r=0.25$ (95%CI: -0.05, 0.52). **CONCLUSIONS:** Although various indices measure gender inequality, it appears that the underlying constructs of these indices vary substantially. Furthermore, gender inequality does not fully explain sex differences in 20mSRT performance, and other broad country-level aspects may better explain the differences between boys and girls.

2191 Board #204 June 1 3:30 PM - 5:00 PM

Physical/Physiological Comparison between Cohorts of Marine Corps Forces Special Operations Command Experienced and Entry Level Operators

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(No relationships reported)

Marine Corps Forces Special Operations Command Operators (MARSOC) must possess optimal musculoskeletal and physiological performance characteristics to sustain health and fitness, and maintain physical readiness. Upholding these characteristics can be difficult due to age, deployment cycles and the related demands of training. **PURPOSE:** To examine the effects of age and service time on physical and physiological characteristics of Experienced and Entry Level MARSOC Operators. **METHODS:** A total of 37 Experienced Operators (Age: 31.8 \pm 4.3 years, Height: 176.7 \pm 6. cm, Mass: 84.7 \pm 10.0 kg, 13.36 \pm 4.12 years of service) and 98 Entry Level Operators (Age: 25.1 \pm 2.2 years, Height: 178.6 \pm 6.7 cm, Mass: 85.0 \pm 8.4 kg, 6.52 \pm 1.07 years of service) participated. Testing included fat mass (FM), fat free mass (FFM), anaerobic power (PAnP), anaerobic capacity (MAnP), aerobic capacity (VO₂max) and knee and torso isokinetic strength testing (KF, KE, TF, TE). Differences between groups were evaluated using independent samples t-tests, or Mann-Whitney U tests if required ($p < 0.05$). **RESULTS:** Entry Level Operators demonstrated greater KF (144.4 \pm 27.1%BW, 127.4 \pm 23.6%BW; $p=0.011$), KE (268.6 \pm 41.7 %BW, 246.5 \pm 45.8%BW; $p=0.003$), and MAnP (9.2 \pm 0.7 W/kg, 8.8 \pm .9 W/kg; $p=0.028$). Entry Level operators demonstrated less TE (422.24 \pm 77.5 %BW, 387.25 \pm 77.1 %BW; $p=0.021$). No significant differences were found in FM ($p=0.726$), FFM ($p=0.915$), TF ($p=0.529$), PAnP ($p=0.598$), or VO₂max ($p=0.145$). **CONCLUSION:** Experienced Operators demonstrated less overall leg strength and anaerobic capacity than Entry Level Operators. Further consideration is necessary to determine what characteristics may be influenced by the combined effect of training demands, age, and overall service time and the impact on career longevity.
Supported by the Office of Naval Research (N00014-15-1-0069)

2192 Board #205 June 1 3:30 PM - 5:00 PM
Relationship Between Heart Rate Variability Outcomes vs Firefighter Performance, Physical Activity, and Fitness Measures

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 (No relationships reported)

PURPOSE: The purpose of this study was to determine the relationship between heart rate variability (HRV) versus firefighter (FF) occupational performance, fitness characteristics and physical activity measures. **METHODS:** Twelve male structural firefighters (age: 37.3±7.6 yr; height: 183.2±7.1 cm; body mass: 90.4±13.7 kg; body mass index: 26.9±2.4 kg·m⁻²) wore an accelerometer for 19.1±5.8 days to measure physical activity. Physical activity was also quantified by a self-reported log. HRV was determined with a portable ECG device upon waking for 20.8±4.6 days. HRV was assessed daily, upon waking, and included SDNN, RMSSD, High frequency (HF) and low frequency (LF) components. FFs completed a simulated fire ground test (SFGT) and a battery of fitness tests including estimated 1-repetition maximum shoulder press, deadlift, bench press, bent over row and kettlebell swing, and a submaximal prediction of aerobic capacity. HRV was assessed the day of the SFGT (acute) and averaged over all days during the observation period (chronic). Descriptive statistics were calculated as mean ± standard deviation and Pearson product moment correlation coefficients were calculated. The level of significance was set at $p < .05$. **RESULTS:** SDNN values recorded the same day as the SFGT were correlated with decreased SFGT time on 3 individual SFGT tasks ($r = -.7$ to $-.745$, $p < .05$) and overall SFGT time ($r = -.735$, $p = .016$). Chronic HF was correlated with frequency of moderate-to-vigorous physical activity ($r = .728$, $p = .011$). RMSSD and SDNN were also correlated with shoulder press strength ($r = .885$, $p < .01$; and $r = .875$, $p < .01$ respectively) and bench press strength ($r = .775$, $p = .008$; and $r = .758$, $p = .011$ respectively). **CONCLUSIONS:** Increased acute HRV was associated with more efficient SFGT performance, whereas chronic HRV was associated with physical activity and strength measures. These outcomes indicate that HRV parameters may reflect the physiological status of FFs and the complex interaction between HRV, physical activity and fitness outcomes. Supported by the NSCA's Senior Investigator Research Grant

2193 Board #206 June 1 3:30 PM - 5:00 PM
Relationship Between Anthropometric Profiles and Sports Specific Physical Performance Tests in College Football Players

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 (No relationships reported)

INTRODUCTION: Football specific testing is done at all levels of football to assess player's strength, speed, and agility. Differences exist in anthropometric profile between skill position players and non-skill position players. These differences in physical performance measurements are due to the nature of physical requirements based on position. **PURPOSE:** To look at the relationship between body fat percentage (BF%), and speed, agility, jumping, and strength performance measurements. **METHODS:** Eighty-five (n=85) football players participated and were categorized into two groups: skill players (n=55) and non-skill players (n=30). BF% was assessed via air plethysmography for all players. Physical performance measurements included: clean and jerk, bench press, squat, 40-yard dash, pro agility, broad jump, and vertical jump. Pearson's product moment correlation coefficient was applied to BF% across the physical assessments. Bivariate correlation comparisons were conducted to identify significant differences in between skilled and non-skilled athletes using the Fisher's r-to-z transformation, followed by an independent sample z-tests to assess statistical differences in correlation coefficients of skilled to non-skilled athletes. Statistical significance set at $p \leq 0.05$. **RESULTS:** For non-skilled players, the relationship between BF% and all performance measurements showed significance except for the broad jump. In the skill positions, significance was observed in the relationship between speed, explosion and agility assessments compared to BF%. No significance was found in the strength measurements. When comparing skilled and non-skilled positions, both bench and pro agility showed significant differences. For bench press, non-skilled players had a higher correlation coefficient compared to skill players. For pro-agility, skilled players had a higher correlation coefficient than non-skill players. **CONCLUSION:** These findings suggest that BF% is related to measurable performance advantages across different types of tests, depending on player position and position-specific demands. Results from both of these types of testing parameters can possibly be utilized to predict future player performance and to better evaluate player development and progress.

2194 Board #207 June 1 3:30 PM - 5:00 PM
Physical Activity Classes Improve Health-Related Physical Fitness Levels

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PURPOSE: College is sometimes associated with weight gain and a decline in physical fitness levels, yet very few universities require physical activity classes even though the health and academic benefits are well known. This study investigated the effect of a college-level physical activity (PA) class on fitness level and BMI. **METHODS:** Participants were 124 college students (mean age: 20.8 ± 1.0 years, 59% male) who enrolled in a 16-week PA class at a university in the USA. The PA classes met two or three times a week for a total of 150 minutes/weekly, focusing on different activities addressing health-related physical fitness. Body mass index (BMI), Progressive Aerobic Cardiovascular Endurance Run (PACER), curl-ups, push-ups, trunk lift, and sit and reach tests were administered to the participants at the beginning (pretest) and end (posttest) of the semester. Performances of each measure at the two test points were compared separately by gender with paired-samples t-tests and with an alpha level set at 0.05. **RESULTS:** For males, significant improvements ($p < 0.001$) occurred between pre and post-test results in PACER laps (59.4 ± 21.8 vs. 65.6 ± 22.4), curl-ups (55.4 ± 20.7 vs. 62.1 ± 19.0), push-ups (23.6 ± 6.6 vs. 27.2 ± 7.8), and trunk lift inches (10.2 ± 2.2 vs. 12.5 ± 2.1). Sit and reach (inches) showed a non-significant improvement (17.3 ± 3 vs. 17.5 ± 3, $p < 0.10$), and no improvement was shown in BMI (25.8 ± 4.7 vs. 25.8 ± 4.5, $p = 0.38$). As for females, significant improvement ($p < 0.01$) was observed in PACER laps (35.3 ± 11.7 vs. 40.7 ± 12.7), curl-ups (43.6 ± 21.8 vs. 50.4 ± 20.4), push-ups (18.8 ± 6.6 vs. 21.1 ± 8.1), trunk lift inches (11.8 ± 2.5 vs. 13.0 ± 1.7), and sit and reach inches (18.6 ± 3.6 vs. 19.3 ± 3.9). The only measure remaining unchanged in females was BMI (23.6 ± 3.1 vs. 23.6 ± 3.0, $p = 0.73$). **CONCLUSIONS:** While there may be a tendency of weight gain and fitness decline among university students, PA classes focused on health-related physical fitness may be effective in maintaining body mass index and improving health-related physical fitness in college students. Future research needs to examine the longevity of these changes in fitness, find ways to help students continue along a similar trajectory of improved health, and explore whether improved fitness levels lead to improved academic performance.

D-69 Free Communication/Poster - Integrative Exercise Physiology

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2195 Board #208 June 1 2:00 PM - 3:30 PM
Inonotus Obliquus Polysaccharide Extract (IOP) Does Not Enhance Exercise Duration or Alter Interstitial Oxygen Kinetics in Rat Skeletal Muscle

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Skeletal muscle produces reactive oxygen species during contractions, that lead to fatigue by depressing force in contracting muscle. The polysaccharide extract of the mushroom *Inonotus obliquus* (IOP) has been proposed to have antioxidant properties and to delay the onset of fatigue. Contractile function in skeletal muscle is dependent on the balance between oxygen delivery (QO₂) and oxygen consumption (VO₂) as reflected by the interstitial partial pressure of oxygen (PO_{2i}) within the muscle. **PURPOSE:** To determine whether IOP supplementation in rats 1) reduced muscle fatigue (treadmill run time to exhaustion) and 2) altered PO_{2i} kinetics in the isolated soleus and extensor digitorum (EDL) muscles. **METHODS:** Rats (n=10) were acclimated to treadmill running (at 20% incline) then randomly divided into two groups; control (C, n=5) and IOP supplementation (IOP, n=5). IOP was dissolved in the drinking water at 300 mg/kg/day. On day 14 of IOP, all rats performed a time to exhaustion treadmill test (Test 1) in which speed was increased 5 ft/min each minute until the rats could no longer continue. On day 16, a second treadmill test (Test 2) was performed in which speed was held constant at 70 ft/min and the rats ran until they could no longer maintain this speed. Starting on day 18 of IOP, the rats were anesthetized with pentobarbital sodium (50 mg/kg ip) and the soleus and extensor digitorum longus (EDL) muscles of the rats were surgically isolated. The muscles were electrically stimulated to study PO_{2i} kinetics using phosphorescence quenching at a low intensity (1 Hz, 2 ms) and at a higher intensity (2 Hz, 20 ms). **RESULTS:** Time to exhaustion during both treadmill tests was not different between groups (Test 1: 15:28

$\pm 1:11$ vs. $15:26 \pm 1:10$ min; Test 2: $7:44 \pm 0:06$ vs. $7:45 \pm 0:04$ min). During isolated muscle contractions, the initial PO_{2i} and PO_{2e} kinetics at the onset of contractions were not different between C and IOP groups in either the soleus or EDL muscles, at either low or high intensity. **CONCLUSION:** These data indicate that IOP supplementation did not reduce fatigue or enhance exercise duration, and did not result in changes in QO_2 to VO_2 matching during muscle contractions. Supported by a grant from the Graduate Program, KCOM-ATSU.

2196 Board #209 June 1 2:00 PM - 3:30 PM
Upper Limits Of Exercise Tolerance

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 (No relationships reported)

The power-duration relationship accurately predicts exercise tolerance for constant power exercise performed in the severe intensity domain. At intensities above critical power (CP, highest sustainable power without impending failure), the power-duration relationship establishes a hyperbolic curve. This curve can be linearized as a 1/time model. However, the prediction of exercise tolerance is currently unclear for work rates (WR) within the extreme intensity domain (durations <2 min). **PURPOSE:** To test the hypothesis that the power-duration relationship deviates from a linear 1/time relationship for WRs within the extreme intensity domain. **METHODS:** To date, two men (age 21 yrs) completed the experimental protocol. Two-legged knee extension was performed to determine peak aerobic power (Ppeak). A one-repetition maximum (IRM) was determined by progressively increasing weight until a pre-determined range of motion could not be achieved. Subjects performed exercise tests to exhaustion at 6 different %Ppeak intensities (40, 60, 90, 130, 170, and 180 %Ppeak; 20, 30, 40, 60, 75, and 85 % IRM, respectively), each on different days. Test durations between 2 - 15 min (40 - 90 %Ppeak) were used to determine CP (1/time model) with a 95% confidence interval (95% CI). WRs with durations < 2 min (130 - 180 %Ppeak, 60 - 85 % IRM) were plotted on the previously determined 1/time model. **RESULTS:** The r2 for 1/time models were 0.99 (p < 0.05). CP, Ppeak, and IRM were 20, 35, and 75 kg, respectively. IRM and CP were 200 and 57 %Ppeak, respectively. The 130 %Ppeak (60 % IRM, test duration of 114.86 s) and 170 %Ppeak (75 % IRM, test duration of 71.02 s) WRs fell within the 95% CI, however, the 180 %Ppeak (85 % IRM, test duration of 46.39 s) did not. **CONCLUSIONS:** Our hypothesis was partly explained by the data. These data show that exercise bouts lasting less than 60 s deviate from the linear model of the power-duration relationship. However, time to exhaustion greater than 60 s can be predicted using the power-duration relationship. This suggests that mechanisms that may not have had a significant role at lower intensities become the limiting factor to exercise tolerance at intensities greater than ~170 %Ppeak (75 %IRM).

2197 Board #210 June 1 2:00 PM - 3:30 PM
Body Composition, Nutritional Profile And Muscular Fitness Affect Bone Health In A Sample Of Schoolchildren From Colombia: The Fuprecol Study

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PURPOSE: The objective of the present study is to investigate the relationships between body composition, nutritional profile, muscular fitness (MF) and bone health in a sample of children and adolescents from Colombia. **METHODS:** Participants included 1,118 children and adolescents (54.6% girls). Broadband ultrasound attenuation (BUA) was obtained by using quantitative ultrasound technique at the calcaneus as a marker of bone health. Body composition (fat mass and lean mass) was assessed using bioelectrical impedance analysis. Furthermore, height, weight, waist circumference and Tanner stage measured and body mass index (BMI) was measured. Standing long-jump and isometric handgrip dynamometry were used as indicators of lower and upper body muscular fitness, respectively. Also, a muscular index score was computed by summing up the standardised values of both standing long-jump and handgrip strength. Dietary intake and degree of adherence to the Mediterranean diet were assessed by a 7-day recall questionnaire for food frequency and the Kidnet questionnaire, respectively. Poor bone health was considered using a Z-score cut off of ≤ -1.5 . **RESULTS:** Once the adjustment was performed (by age and Tanner stage), the predisposing factors of having a c-BUA z-score ≤ -1.5 SD included: being underweight [OR 2.30 (95% CI 1.53 to 1.69)], or being obese [OR 0.17 (95% CI 0.04

to 0.69)], having an unhealthy lean mass [OR 2.51 (95% CI 1.74 to 3.60)], unhealthy levels of fat mass [OR 0.46 (95% CI 0.29 to 0.74)], unhealthy SLJ performance [OR 1.55 (95% CI 1.09 to 2.19)], unhealthy handgrip performance [OR 3.77 (95% CI 2.29 to 6.20)], and unhealthy muscular index score [OR 2.22 (95% CI 1.42 to 3.47)]. **CONCLUSIONS:** In conclusion, body composition and MF influence bone health on a sample of children and adolescents from Colombia. Thus, promoting strength adaptation and preservation in Colombian youth will help to maximize bone health, an important protective factor against osteoporosis later in life.

2198 Board #211 June 1 2:00 PM - 3:30 PM
Relation between Hand Grip Strength and Body Composition Associated with Cardiovascular Risk in University Students

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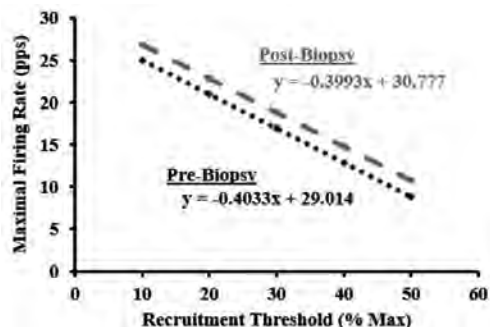
The measurement of Hand Grip Strength (HGS) is one of the methods for evaluating the maximum isometric strength of the hand and forearm muscles, that is related to predictive factors of health conditions of people. In addition, this is an indicator that relates the physical condition of young people with their Body Composition (BC), identifying Cardiovascular Risk (CR) factors in the university population. **Purpose:** The purpose of this study is to relate the HGS and the BC associated with the CR in the Students of Elective Course of Physical Activity and Sports (SECPAS) of the Pontificia Javeriana University (PJU) Bogota, D.C. Colombia. **Methods:** Descriptive correlational study, which 91 students aged an average of 22.5 ± 4.5 years old, were assessed n=40 (44%) males and n=51 (56%) females. To evaluate the HGS was used an hydraulic hand dynamometer owner's manual JAMAR[®], it was registered two measurements of Right Hand (RH) and Left Hand (LH) in seated position, using the best result for analysis. A bioelectrical impedance scale OMRON[®] HBF-510LA, was used to evaluate the BC, which shows the percentage of Body Fat (BF) and Skeletal Muscle (SM). **Results:** Values of HGS for RH and LH were compared, demonstrating that in the RH were higher than the LH for both genders, the difference of HGS was 8.4% (4.5 kg). For 78% of students (n=71), are in an average classification of low HGS for the population. BC shows that the BF was classified as high, 24.2% (n=22) and very high, 35.2% (n=32) for both genders. It was evidenced that the BF of females 23.1% (n=21) was classified as very high in comparison to males, 12.1% (n=11). The SM, had a behavior classified as normal 65.9% (n=60), with a trend to the lower limit of SM with low level in males 62.5% (n=25), according to OMRON[®] parameters. **Conclusion:** For males, was found a relation between HGS and BC, lower SM, greater BF and less HGS, become predisposing factors to develop CR. On the other hand, females showed a normal SM, higher BF and less HGS, it looks apparently normal, but hides a healthy appearance that prevents the CR control. Those indicators are useful to reorient the objectives of integral formation towards create healthy habits to SECPAS.

2199 Board #212 June 1 2:00 PM - 3:30 PM
The Effects Of A Muscle Biopsy On Motor Unit Firing Properties

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INTRODUCTION: Muscle biopsies have played a large role in the understanding of skeletal muscle physiology. While discomfort from the biopsy process is often reported, it is unknown if the activation of pain pathways and/or the administration of lidocaine during the procedure affects the motor control of the same muscle. **PURPOSE:** To examine the effects of a skeletal muscle biopsy on the motor unit firing properties of the vastus lateralis (VL) in young men. **METHODS:** Fifteen young men (Age: 22 ± 2 years) underwent skeletal muscle biopsies of the VL of the right leg. Prior to and following the biopsy, subjects completed a maximal effort contraction. Four surface electromyographic signals were detected from the VL during the maximal contraction and decomposed into their constituent motor unit action potential trains. The relationship between maximal motor unit firing rate (FR_{max}) and recruitment threshold (RT) were calculated for each subject pre- and post-biopsy. Separate Paired-Samples T-Tests were run to examine for changes in slope coefficients and y-intercepts. **RESULTS:** Our findings showed no significant change in slope (Pre: -0.40 ± 0.32 ; Post: -0.40 ± 0.21 ; p = 0.96) or y-intercept (Pre: 29.0 ± 7.3 ; Post: 30.8 ± 7.6 ; p =

0.26) following the biopsy process. Figure 1 below depicts the relationship between group mean FR_{max} (x-axis) and group mean RT (y-axis) both pre- and post-biopsy. **CONCLUSION:** Despite reports of discomfort, the results of the present investigation suggest that the motor unit firing properties of the VL of young males are minimally affected by the process of a skeletal muscle biopsy. Specifically, our data shows no significant change in the relationship between FR_{max} and RT. Researchers and scientists that utilize muscle biopsies can take comfort in knowing that the process does not affect the motor control of the muscle during subsequent contractions.



2200 Board #213 June 1 2:00 PM - 3:30 PM

Hormonal Responses After Eccentric Exercise In Humans

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Following muscle damage, multiple responses associated with an inflammatory and degenerative phase are activated before the completion of muscle repair or regeneration. The final outcome of those responses is influenced by a crucial balance between anabolic and catabolic, among others, factors. Nevertheless, less is known about the responses of the competitive (anabolic vs catabolic) hormones growth hormone (GH) and cortisol (CORT) following muscle damaging exercise. **PURPOSE:** The purpose of this study was to investigate serum levels of CORT and GH during muscle degeneration/regeneration after eccentric exercise-induced muscle damage in humans. **METHODS:** Ten healthy men volunteers (age: 25±5 yrs, height: 180±5 cm, mass: 77±8 kg) performed 50 maximal eccentric muscle actions using the knee extensor muscles of both legs on an isokinetic dynamometer. Blood samples were withdrawn before and at 6, 48 and 120 hrs post-exercise, while muscle soreness was evaluated at 24, 48 and 120 hrs post-exercise. Serum levels of CORT and GH were measured by ELISA using commercially available kits. One-way ANOVA was used for statistics. **RESULTS:** The participants reported significant muscle strength decrement and muscle soreness post exercise (p<0.01-0.001). Serum CORT levels showed a 40% increase 6 hours post exercise and remained elevated throughout the experimental period, however without reaching significance (393.0±66.6 ng/ml, 362.8±48.5 ng/ml and 370.7±34.9 ng/ml, at 6, 48 and 120 hours after exercise, respectively, compared to 306.5±29.8 ng/ml at baseline; mean±SE, p>0.05). Serum GH levels exhibited a more than 2.5-fold increase 6 hours post exercise and then gradually decreased (506.7±144.5pg/ml, 701.1±161.4 pg/ml, 647.0±205.5pg/ml and 509.5±144.1pg/ml at baseline, 6, 48 and 120 hours post-exercise, respectively). However, those GH changes also failed to reach significance (p>0.05) due to a large variability shown between the subjects' responses. **CONCLUSION:** Our findings suggest that muscle damaging eccentric exercise triggers mild adaptive responses of CORT and GH, which may reflect a specific drive towards a balance between anabolic and catabolic processes during muscle regeneration. More studies are needed to further characterize the hormonal responses to eccentric exercise in humans.

2201 Board #214 June 1 2:00 PM - 3:30 PM

Evidence Of A "Male Athlete Triad" In Competitive Triathletes

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PURPOSE: To look for low energy availability, hormonal dysfunction and low bone mineral density in male triathletes, a group not previously well described with this disorder.

METHODS: Blood, urine and DXA testing were assessed on a series of 4 male triathletes who presented to our Sports Medicine/Metabolic Bone Clinics at University of Colorado for repeated or poorly healing lower extremity stress fractures.

RESULTS:

Age	BMI	Stress fracture type	DXA (g/cm2) and Z-score spine	DXA (g/cm2) and Z-score hip	Total T (ng/dL)	Vitamin D (ng/mL)	Serum Ca (mg/dL)	PTH (pg/mL)	24 hour urine Ca (mg/day)
40	22.0	Femoral neck	.882 -2.2	-858 -0.9	372	59	9.8	21	259
47	27.7	Tibial metatarsal	0.982 -0.7	0.691 -1.1	216	48	9.4	33	440
44	23.5	Tibial	1.092 -1.1	1.116 0.4	230	23	9.8	32	188
22	23.1	Metatarsal	1.024 -1.1	1.002 -0.4	242	36	10.0	24	476

Levels of testosterone (T) were low normal in 3 of the 4 men. 24 hour urine calcium was elevated in 2 of the 4 men. DXA Z-score at the spine was frankly abnormal in 1 man with a femoral neck stress fracture.

The remaining 3 of 4 men had Z-scores within normal limits, however lower than expected for an endurance athlete (less than -1.0.)

CONCLUSIONS:

Alterations in testosterone as well as pituitary gonadotrophins (FSH and LH)[1] have mainly been reported in long distance runners [2], but we suspect such alterations exist in endurance athletes of all types. With the increase in US participation in triathlons, this finding may become more prevalent.

Studies at our institution have suggested concerns for low BMD in competitive cyclists with increases in markers of bone resorption. [3, 4] However, abnormal T levels have not been found in this cohort. There may be alterations in urinary calcium and transient changes in PTH playing a role.

The combination of endurance activities coupled with limited energy availability may lead to low T and stress fractures, features of a "male athlete triad." Patients may not complain of hormonal symptoms such as muscle loss or low libido at these levels.

Thus, we urge our colleagues to ask endurance male athletes about energy balance and nutrition.

References

- De Souza, M.J., et al Int J Sports Med, 1994. 15(7): 383-91.
- MacConnie, S.E., et al, N Engl J Med, 1986. 315(7):411-7.
- Barry, D.W. and W.M. Kohrt J Bone Miner Res, 2008. 23(4): 484-914.
- Barry, D.W., et al., Med Sci Sports Exerc, 2011. 43(4):617-23.

THURSDAY, JUNE 1, 2017

2202 Board #215 June 1 2:00 PM - 3:30 PM
Circulating Sclerostin Responses To Acute Weight And Non Weight Bearing Sport Activity In Pre Adolescent Males

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Mechanical loading, i.e. physical activity and/or exercise, promotes bone formation during growth. Sclerostin, a glycoprotein, mediates osteocytes' response to mechanical loading by inhibiting the Wnt/ β -catenin pathway thereby inhibiting bone formation. **PURPOSE:** to examine the response of circulating sclerostin following an acute session of three different sport activities. **METHODS:** Fifty-five pre-adolescent boys (age 10.1 \pm 1.2yrs) participated in a single practice of either soccer (N=20), running (N=17) or swimming (N=18). Anthropometry, habitual PA, nutritional intake, biological maturity, bone mineral density and content, and fitness status were measured at baseline. Blood samples were collected before and within 30 min post-exercise. Participants did not differ in any baseline measures. **RESULTS:** Sclerostin showed a modest decline (P<0.5) in response to soccer (pre: 213 \pm 45 pg/ml vs. post: 189 \pm 41 pg/ml) and running (pre: 221 \pm 56 pg/ml vs. post: 193 \pm 49 pg/ml) but not in response to swimming (pre: 209 \pm 45 pg/ml vs. post: 203 \pm 58 pg/ml). Sclerostin changes (independent of group) were correlated with mean speed (r=-0.41; P<0.05), total number of accelerations and decelerations (r=0.51; P<0.05) and number of jumps (r=0.6; P<0.05). **CONCLUSION:** Results of this study suggest that acute weight bearing exercise inhibits sclerostin levels slightly. Further work is needed to determine if this slight reduction alters bone mineral content.

2203 Board #216 June 1 2:00 PM - 3:30 PM
Foot Posture and Mobility in Normal and Pronated Feet during Gait using High-Speed Stereo Radiography

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 (No relationships reported)

Background and Purpose: Individuals with extremely flat or high arch foot postures have been shown to be at risk for the development of orthopaedic foot disorders. The longitudinal arch angle (LAA) as quantified by video camera and 3D motion capture has been used to measure change in the medial longitudinal arch associated with midfoot motion (Fig 1). The purpose of this study was to use high-speed stereo radiography to assess midfoot posture and mobility in normal and pronated feet throughout the stance phase of gait. **Methods:** A total of 13 feet from 7 subjects (mean age = 24 years; range 22 to 29 years) were examined in this study. Clinical LAA measures assessed with a goniometer were used to select 7 pronated feet (129.6°) and 6 normal feet (140.5°). Radiopaque beads (2 mm dia) were taped to the navicular tuberosity, the medial aspect of head of the first metatarsal, and the medial malleolus prior to static loaded and walking trials. 3D coordinates of the beads were captured during gait using a high-speed stereo radiography system. The LAA in the sagittal plane was measured throughout the stance period (Fig 3).

Results: Static loaded LAA compared to clinical LAA values were identical for pronated feet and similar for normal feet (2.5° diff). The LAA decreased throughout stance period indicating a decrease in medial arch height. The static loaded LAAs were different than the dynamic measures (p<0.05) between 42% to 80% in the normal feet, and between 57% to 79% in the pronated feet. Both groups experienced similar LAA excursion (10.7° and 10.3° for the normal and pronated feet respectively), while the normal group had a higher average LAA than pronated (136.2° and 128.0° respectively) (Fig 2).

Conclusions: The results indicate that LAA measured with stereo radiography is a responsive metric to assess midfoot posture during walking and is sensitive to foot type differences. This methodology can be effectively used to assess the effect of foot orthoses on midfoot posture when using shoes.

D-70 Free Communication/Poster - Interval Training

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2204 Board #217 June 1 2:00 PM - 3:30 PM
The Effects Of A Six-week HIIT Program On CVD Risk Factors In Sedentary Individuals

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 (No relationships reported)

Regular physical activity is linked to improved cardiovascular (CV) health. High intensity interval training (HIIT) is a type of CV exercise that involves interchanging intervals of high intensity exercise (usually 80-100% of maximum heart rate) with lower intensity recovery periods. **PURPOSE:** The purpose of this study was to assess the effect of a six-week HIIT program on modifiable cardiovascular disease (CVD) risk factors. **METHODS:** Total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, fasting plasma glucose (FPG), blood pressure (BP), resting heart rate (RHR), and body fat percentage (BF %) were assessed before, halfway through, and after the six-week program in nine sedentary young adults. Subjects performed three sessions per week for six weeks at a work-to-rest (W:R) ratio of 1:4, where they were required to sprint and walk. **RESULTS:** There was a significant increase in FPG from the pre-program to the post-program assessment (P=0.03). There was also a significant decrease in diastolic BP (DBP) (P=0.03) and RHR (P=0.04) from the pre-program to post-program assessment. **CONCLUSIONS:** These data suggest that HIIT is effective in significantly reducing DBP and RHR. However, a six-week, 18 session HIIT program at a 1:4 W:R ratio may not be effective for reducing the risk for CVD through idealizing blood lipids, SBP, body composition, or anthropometry measurements in this population. This study contributes to the necessity to find an optimal HIIT program length, training session duration, and W:R ratio to help establish the most advantageous training program to reduce the risk of CVD.

2205 Board #218 June 1 2:00 PM - 3:30 PM
High-Intensity Interval Training Elicits Higher Enjoyment Than Moderate Intensity Continuous Exercise

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Lack of adherence to exercise programs is widespread in the United States, with approximately 50% of individuals withdrawing within 6 mo of initiation. Insufficient time is cited as the greatest barrier to adherence, yet in order to improve overall health, 150 min/wk of moderate-intensity continuous exercise (MICT) is recommended for all adults. Recently, scientists have identified superior health-related adaptations in response to high-intensity interval training (HIIT) compared to MICT. In addition, some data show higher enjoyment with HIIT compared to MICT; however, these findings are not universal. **PURPOSE:** To examine potential differences in enjoyment of low-volume high-intensity interval training (HIIT) compared to MICT in an attempt to elucidate the feasibility of HIIT as a component of regular exercise programming. **METHODS:** Differences in enjoyment, affect, and perceived exertion between MICT and HIIT were monitored in 12 recreationally active men and women (age=29.5 \pm 10.7 yr, VO₂max=41.4 \pm 4.1 mL/kg/min, BMI=23.1 \pm 2.1 kg/m²). Initially, maximal oxygen uptake was determined to establish workloads for two subsequent exercise bouts, whose order was randomized: HIIT (eight 1 min bouts of cycling at 85% maximal workload (Wmax) with 1 min of active recovery between bouts) and MICT (20 min of cycling at 45% Wmax). Rating of perceived exertion (Borg 1-10), affect, heart rate (HR), and blood lactate concentration (BLA) were measured during exercise. Additionally, the Physical Activity Enjoyment Scale was completed 10 min after

exercise. **RESULTS:** Higher enjoyment ($p=0.013$, Cohen's $d=1.54$) in HIIT (103.83 ± 9.44) versus MICT (84.17 ± 19.11) was observed, with 11/12 participants (92%) preferring HIIT to MICT. Affect was lower ($p<0.05$, $d=0.78$) and HR, RPE, and BLA were higher ($p<0.05$) in HIIT versus MICT. **CONCLUSIONS:** Despite greater physiological strain, HIIT was cited as more enjoyable than MICT due to its ever-changing stimulus, greater sense of accomplishment, and relative time-efficiency. Future studies in various populations are merited to examine the potential for greater adherence to HIIT compared to MICT, and whether this leads to superior adaptations and concurrent health-related benefits.

2206 Board #219 June 1 2:00 PM - 3:30 PM
Aerobic and Anaerobic Effects of Manipulating Sprint Interval Training Work and Rest Period Durations
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 (No relationships reported)

Performance benefits resulting from short (10-15 s) sprint interval training (SIT) bouts suggest that peak speed generation may be an important adaptive stimulus, though the optimal work and rest period duration has not been established. **PURPOSE:** To determine the effects of manipulating SIT work and rest period durations while maintaining total exercise duration on aerobic and anaerobic performance. **METHODS:** Thirty-four recreationally active males ($n=20$) and females ($n=14$) trained for four weeks (3 times/week) using one of the following SIT protocols: 1) 30:240 (4-6 x 30 s work, 4 min rest); 2) 15:120 (8-12 x 15 s work, 2 min rest); 3) 5:40 (24-36 x 5 s work, 40 s rest). Protocols were matched for total work (2-3 min) and recovery (16-24 min) duration, as well as the work-to-recovery ratio (1:8 s). Pre- and post-training measures included a graded $\dot{V}O_{2max}$ test, 5-km running time trial, and 30 s running sprint test. Post-training psychological measures of task self-efficacy, enjoyment, and intentions were assessed immediately following the last training session. **RESULTS:** Training improved $\dot{V}O_{2max}$ (5.5%; $P<0.001$), 5-km time trial performance (5.2%; $P<0.001$), peak speed (2.6%; $P<0.05$), and time to peak speed (32.4%; $P<0.001$) with no differences between groups. There were no anaerobic effects. There were no main effects for group on measures of perceived self-efficacy ($P=0.926$), enjoyment ($P=0.249$), or intentions to perform SIT three ($P=0.533$) or five ($P=0.951$) times/week over the coming month. **CONCLUSION:** Manipulating the SIT work and rest period duration while maintaining total exercise duration does not compromise aerobic and anaerobic benefits typically observed with traditional, longer SIT work bouts. This suggests that the generation of peak speed sufficiently stimulates adaptive mechanisms that lead to increases in aerobic and anaerobic capacity. However, psychological perceptions of self-efficacy, enjoyment, and intentions to participate were not different between groups post-training. Future research should investigate these perceptions throughout the training program duration.

2207 Board #220 June 1 2:00 PM - 3:30 PM
Effects Of 5 Days Of HIIT On Exertional Rhabdomyolysis In Trained And Untrained Individuals
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 (No relationships reported)

Exertional Rhabdomyolysis is potentially life threatening, and has been diagnosed in individuals who overexert themselves during exercise. Individuals who participate in exercise beyond their level of physical fitness may be at higher risk for excessive muscle breakdown due to overexertion. **PURPOSE:** To measure the severity of skeletal muscle breakdown via myoglobin and creatine kinase after five days of high and low intensity interval training in previously trained and untrained individuals. **METHODS:** 18 males and females (9 trained (TR) and 9 untrained (UT); Age: 22 ± 1) completed five consecutive days of high intensity interval training and five consecutive days of low intensity interval training with a two week washout period between. Blood was drawn at the initial visit and immediately after completion each exercise intensity period. Individuals rated their perceived muscle soreness before each exercise session. **RESULTS:** Levels of myoglobin in UT were significantly higher after high intensity exercise (65.2 ng/ml; $p=0.05$); however, there was no significant difference between myoglobin in TR after high intensity exercise vs. baseline (41.0 ng/ml). While CK was elevated post exercise training for both groups ($p<0.01$), this was higher for trained individuals (UT: 143.4 vs. TR: 203.6 ng/ml; $p<0.01$). There was no significant difference in perceived muscle soreness between TR and UT individuals; however, UT individuals experienced soreness significantly sooner ($p<0.01$). Specifically, UT individuals had significantly higher perceived soreness after one day of high intensity exercise, while TR individuals experienced significant soreness after 3 and 4 days of exercise ($p=0.04$, $p=0.02$). There were no significant differences in perceived muscle soreness in either TR or UT individuals after low intensity exercise.

CONCLUSIONS: The current study suggests that high intensity exercise results in greater muscle damage in both previously trained and untrained individuals vs. low intensity exercise; however this is greater in untrained individuals. Therefore, previously untrained individuals should take caution when beginning exercise programs that require consecutive sessions of high intensity exercise.

2208 Board #221 June 1 2:00 PM - 3:30 PM
Effects of High Intensity Interval Training Frequency on 1.5 Mile Run Times in Air Force Cadets
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 (No relationships reported)

SCIENTIFIC ABSTRACT

High intensity interval training has gained popularity in military settings in recent years, but no research has investigated how varying HIIT frequency impacts performance in the cardiovascular fitness component of an official military physical fitness test. **PURPOSE:** Effects of varying high intensity interval training (HIIT) frequency on 1.5 mile (2.4 km) run performance in U.S. Air Force Reserve Officer Training Corps (ROTC) cadets was studied. **METHODS:** Twenty-seven cadets (21.6 ± 2.8 years) were stratified then randomly assigned to 3 groups: a high frequency group (HF) that performed HIIT 3x week, a low frequency group (LF) that performed HIIT 2x week, and a continuous training group (CG) that performed moderate intensity training 3x week. HIIT protocols consisted of 4 x 3 min intervals at 90-100% of velocity at maximal oxygen consumption ($\dot{V}O_{2max}$) with 4 min of recovery and 4 x 30s all out sprints with 4 min recovery. Baseline 1.5 mile run performance was measured, then retested at 6 and 10 weeks. **RESULTS:** All groups significantly improved in mean run time (LF, $7.3\% + 4.2$, $p<0.001$; HF, $9.7\% + 3.5$, $p<0.001$; CG, $8.7\% + 4.8$, $p<0.001$). No significant differences between groups were found ($p>0.05$). Additional workouts beyond the 6-week point yielded no significant gains in run performance for any group. **CONCLUSION:** Two days per week of HIIT training was as effective at improving 1.5 mile run performance as either 3 days/week of HIIT or continuous training.

2209 Board #222 June 1 2:00 PM - 3:30 PM
Effects of Different Tempos of a Side-step Interval Exercise on Heart Rate and Muscle Activation
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One barrier to meeting fitness recommendations may include time constraints. Finding exercises that can promote improvements in both aerobic and muscular fitness while minimizing the duration of the exercise and the required equipment are needed. One such exercise may be the side-step interval exercise. Currently, it is unknown how different tempos influence this exercise and how heart rates and muscle activation differ between tempos. **PURPOSE:** To investigate how different tempos of a side-step interval exercise influence heart rate and muscle activation responses. **METHODS:** Recreationally active men ($n=8$) and women ($n=2$) participated in this study. The average maximum oxygen uptake ($\dot{V}O_{2max}$) of participants was 50.1 ± 10 yrs and age was 21 ± 3 yrs. The side-step interval exercise consisted of moving from side to side repetitively over a two-meter distance for 1 minute with 1-minute rest periods in between sets. Four sets of these exercise intervals were performed. The fast (112 bpm) or slow (84 bpm) tempo was randomly assigned during the first exercise session with the other tempo being used in the next visit. Surface electromyography (EMG) measured muscle activation of the vastus lateralis and a heart rate monitor (Polar) measured heart rate (HR). Two-way repeated measures ANOVA analyzed differences between tempos and sets. Pearson product moment correlations analyzed associations between $\dot{V}O_{2max}$, HR response and muscle activation. Statistical significance was set at $p<0.05$. **RESULTS:** Slow tempos produced significantly lower amounts of muscle activation compared to the fast tempos [46% vs. 59% of the maximum isometric voluntary contraction muscle activation (EMG_{max}), $p=0.002$]. HR significantly increased at the end of sets 3 (150 ± 8 bpm, $p=0.012$) and set 4 (152 ± 8 bpm, $p=0.001$) when compared to set 2 (146 ± 8 bpm). The fast tempo produced significantly greater HR than the slow tempo (82% HRmax vs. 70% HRmax, $p<0.001$). A significant inverse relationship was also found between $\dot{V}O_{2max}$ and vastus lateralis muscle activation ($r=-0.855$, $p=0.003$), fast tempo HR ($p=-0.896$, $p<0.001$) and slow tempo HR ($p=-0.924$, $p<0.001$). **CONCLUSIONS:** Side-step interval exercise acutely produces sufficient levels of HR and muscle activation to promote improvements in aerobic and muscular fitness but future chronic studies are needed.

2210 Board #223 June 1 2:00 PM - 3:30 PM
Sprint Interval Training and Power Output In College Age Females

Jenna Thompson, Sophie Olson, Leigha Embertson, Mark Blegen, FACSM. *St. Catherine University, St. Paul, MN.*
 (Sponsor: Mark Blegen, FACSM)
 (No relationships reported)

High intensity interval training (HIIT) is a rapidly growing area of research due to the beneficial physiological outcomes achieved in a time efficient manner. Sprint interval training (SIT) decreases exercise duration even more by utilizing supramaximal intensity intervals of even shorter duration while still maintaining significant improvements. However, research on effects of SIT in women is lacking. **PURPOSE:** The present investigation focuses on SIT and power development in college-aged (21.1 ± .62 years), recreationally active women. **METHODS:** Participants (n=11) were randomized into one of three groups: two intervals (2INT), three intervals (3INT), or endurance group (END). All groups completed their assigned protocols three times a week for eight weeks for a total of 24 sessions. 2INT sprinted two 20-second all-out bouts with active recovery between sprints for a total of 5 minutes. 3INT sprinted three 20-second all-out bouts with active recovery between sprints for a total of 10 minutes. END cycled continuously for 20 minutes at 60% of their $\dot{V}O_{2max}$. Wingate testing (anaerobic power) was completed at baseline, mid-, and post-intervention. **RESULTS:** Average power in both 2INT ($6.9 \pm 0.17 \text{ v } 7.1 \pm 0.41 \text{ watts}\cdot\text{kg}^{-1}$) and 3INT groups ($7.03 \pm 0.53 \text{ v } 7.02 \pm 0.265 \text{ watts}\cdot\text{kg}^{-1}$) remained unchanged while the END group average power ($6.6 \pm 0.44 \text{ v } 5.89 \pm 0.914 \text{ watts}\cdot\text{kg}^{-1}$) decreased by 10.7%. **CONCLUSIONS:** Although not significant, it is important to point out that 2INT and 3INT were able to maintain their average power; even though exercising for a limited duration. The findings of this study demonstrate that SIT may be utilized to maintain anaerobic fitness in women.

2211 Board #224 June 1 2:00 PM - 3:30 PM
Sprint Interval Training and Development of Peak Power in Females

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 (Sponsor: Mark Blegen, FACSM)
 (No relationships reported)

Interest in interval training has been expanding rapidly while it has been shown to induce numerous beneficial physiological outcomes. High intensity interval training (HIIT) is comprised of submaximal high-intensity interval training lasting >30 seconds. A subset of HIIT is sprint interval training (SIT) and consists of supramaximal sprints of very short durations (10-20 seconds). This study aimed to investigate the responses of SIT on peak power output in females. Recreationally active females (n=11) (21.1 ± 0.62 years) performed a Wingate Cycle Test at baseline, mid-intervention (4 weeks), and post-intervention (8 weeks) to measure peak power. Subjects were randomized into one of three groups: two intervals (2INT), three intervals (3INT), or endurance group (END). All groups cycled three times a week for eight weeks, for a total of 24 sessions. 2INT sprinted two 20-second bouts and cycled five minutes total and 3INT sprinted three 20-second bouts and cycled ten minutes total. The END group cycled 20 minutes at 60% of their $\dot{V}O_{2max}$. Upon completion of the study, subjects completing 2INT had a modest, but significant improvement of 2.3% in peak power ($9.10 \pm .62 \text{ v } 9.22 \pm 0.73 \text{ watts}\cdot\text{kg}^{-1}$), compared to both the 3INT ($8.45 \pm .57 \text{ v } 8.30 \pm 0.71 \text{ watts}\cdot\text{kg}^{-1}$) and the END group ($8.54 \pm .43 \text{ v } 7.99 \pm 0.93 \text{ watts}\cdot\text{kg}^{-1}$). The present data demonstrate the importance of SIT on power development in females. In addition, more research is needed into SIT and its impact on performance measures specific to women.

2212 Board #225 June 1 2:00 PM - 3:30 PM
Changes in $\dot{V}O_{2max}$ and Muscular Strength Over A 24-Week Cycle Ergometer Interval Program Among Active Middle-Age Adults

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 (No relationships reported)

Cycling training induces adaptive cardiovascular benefits both centrally and peripherally in previously sedentary individuals. Less is known about what exercise prescription is necessary to improve fitness in already active, healthy middle aged adults. Cycling is not a well-accepted exercise to enhance strength, especially in healthy active adults. **PURPOSE:** To determine if participation in a novel cycling

program affects aerobic fitness ($\dot{V}O_{2max}$) and leg strength. **METHODS:** Participants (N=41, M±SD age=45.5±8.1) were healthy adults recruited to complete a 6-day/wk exercise program on a cycle ergometer for 6-months. All participants self-reported at least 30 min of vigorous exercise, 3 times/wk prior to joining the study and met NASA developed fitness standards. Participants exercised 6 day/wk, using high intensity routines (SPRINT) developed and designed to protect fitness of middle aged active healthy astronauts. SPRINT includes (a) 30 min continuous aerobic cycling at or above 75% of max heart rate (HRmax), (b) long, 4x4 min intervals at or above 90% HRmax with 3 min active rest, (c) medium 6x2 min intervals at 70, 80, 90, 100, 90, and 80% of HRmax, respectively with 2 min active rest, and (d) short, 30 sec max sprint intervals with 20 sec active rest. Participants reported that they did not change other exercise behavior during the study. $\dot{V}O_{2max}$ was measured (via indirect calorimetry) pre, mid (3 month), and 6 month post intervention. Isometric leg strength, including peak torque extension (PTE) and flexion (PTF) was measured (pre and 6 month post intervention) on the right leg using the Biodex3 dynamometer. Results were assessed via repeated measures ANOVA. **RESULTS:** Average $\dot{V}O_{2max}$ increased from pre to mid-test ($33.8 \pm 6.2 \text{ ml/kg/min}$ vs. $38.5 \pm 6.8 \text{ ml/kg/min}$), and was maintained from mid to post-test ($38.5 \pm 6.8 \text{ ml/kg/min}$ vs. $38.3 \pm 7.3 \text{ ml/kg/min}$), $F(2,62) = 57.65$, $p < 0.001$. PTE increased significantly from pre to post test ($119.6 \pm 42.6 \text{ ft/lbs}$ vs. $131.7 \pm 48.8 \text{ ft/lbs}$), $F(1,35) = 8.00$, $p < 0.008$. PTF did not change from pre to post-test ($71.2 \pm 21.4 \text{ ft/lbs}$ vs. $70.2 \pm 21.7 \text{ ft/lbs}$), $F(1,35) = 0.13$, $p = 0.73$. **CONCLUSION:** SPRINT interval cycle ergometer training is effective for increasing aerobic fitness and muscular strength over a 6-month training period among physically active middle-age adults. Grant: NASA/NSBRI MA03401

2213 Board #226 June 1 2:00 PM - 3:30 PM
Metabolic Efficiency Between Two Types of High-Intensity Interval Training

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 (No relationships reported)

High intensity interval training (HIIT) is an effective and well-documented training method that utilizes periods of maximum effort followed by periods of moderate to low effort to achieve aerobic adaptations. CrossFit® (CF) is a novel training program defined as a strength and conditioning system built on constantly varied functional movements executed at high intensity aimed to improve both anaerobic and aerobic systems.

PURPOSE: To compare the total caloric expenditure between a traditional HIIT protocol and a best-matched CrossFit® protocol.

METHODS: Measurements were obtained from 22 CrossFit® male athletes (age = 34.8 ± 8.0 years, BMI = $28.3 \pm 3.7 \text{ kg/m}^2$). Graded exercise tests (GXT) were performed in order to determine speeds at which the HIIT protocol was performed. The protocol consisted of 20 total intervals, 10 at 90% of the max speed during GXT and 10 at 50% of the max speed of GXT. Participants also completed a Crossfit® protocol consisted of as many rounds as possible of a 15 calorie row, 10 pushups, and 5 deadlifts at 135 lbs. Caloric expenditure was measured using the Oxycon mobile metabolic system by multiplying the average oxygen consumed over the 20 minute trial by 5.0 kcal. Intensities were matched amongst all participants based on pre-exercise data, ensuring that all participants were performing the HIIT at the same relative intensities.

RESULTS: The high speed of the HIIT routine was $13.6 \pm 1.6 \text{ km/h}$, while the low speed was $7.5 \pm 0.9 \text{ km/h}$. The two routines did not differ in terms of caloric expenditure; 358.2 ± 47.2 calories during HIIT compared to 340.8 ± 41.0 calories during CF, $P = 0.2$. After controlling for history of CrossFit® exposure, no significant difference was observed between the two routines ($P = 0.3$). Respiratory exchange ratio was higher during the CF routine ($1.0 \pm 0.6 \text{ VCO}_2/\text{VO}_2$) compared to HIIT routine ($0.9 \pm 0.4 \text{ VCO}_2/\text{VO}_2$), $P = 0.04$.

CONCLUSIONS: These data suggest that CrossFit® routines have similar metabolic demands compared to HIIT. The CF routine appears to reflect a greater exercise intensity that may lead to higher blood lactate concentration from the high glycolytic pathways involvement. The constant variation seen during CF may challenge the energy systems differently than HIIT while creating similar total metabolic demands during exercise.

2214 Board #227 June 1 2:00 PM - 3:30 PM
Cardiovascular and Workload Responses to High Intensity Interval Training in Adolescents

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 (No relationships reported)

Despite the promising evidence supporting positive health benefits of high-intensity interval training (HIIT) in adults, there is limited research focusing on adolescents. **PURPOSE:** The purpose of this study was to describe the impact of HIIT training on

cardiovascular responses to exercise in male and female adolescents. **METHODS:** Ten (4 male, 6 female; Age=11.7±1.4 years; VO_{2peak} =27.33±6.89; BMI=28.6±6.6) adolescents, referred from local pediatricians, completed 16 HIIT sessions over an 8 week period. Each HIIT session consisted of a 5 min warm up, a 20 minute stimulus, and a 5 min cool down. During the stimulus period, subjects completed twenty 30 sec "on", 30 sec "off" intervals. During the initial session the "on" workload was set to be equivalent to 90% of maximal workload recorded during the VO_{2peak} test, while the "off" workload was set to be equivalent to 50%. Subsequent to this initial session, workload was adjusted so that RPE during the last 5 intervals was equivalent to at least 9 out of 10 on the Borg RPE scale. Workload, heart rate, and RPE were recorded at the end of each interval. **RESULTS:** Maximal workload during HIIT increased in all subjects from the first (152±8 watts) to the last (240±18 watts) session ($p<0.001$). In comparison, no differences were seen between the genders at any time point (Male: First Session=155±14 watts, Last Session=255±15 watts; Female: First Session=150±11 watts, Last Session=230±13 watts). Similarly, heart rate (Male: First Session=186±9 bpm, Last Session=185±6 bpm; Female: First Session=184±8 bpm, Last Session=177±7 bpm) and RPE (Male: First Session=9+1, Last Session=10+1; Female: First Session=9+1, Last Session=10+1) were maintained across the HIIT sessions. **CONCLUSION:** The results of this investigation indicate that HIIT is well tolerated and facilitates significant cardiovascular adaptation in both male and female adolescents.

2215 Board #228 June 1 2:00 PM - 3:30 PM
Mechanical Efficiency During Repeated Attempts of Indoor Rock Climbing

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 (No relationships reported)

Rock climbing is characterized by repeated short bouts of high-intensity climbs requiring upper body strength and muscular endurance. There is an inverse relationship between work rate and mechanical efficiency and it is hypothesized that mechanical efficiency would decrease from the first to the last climb during a series of repeated climbs. **Purpose:** To determine mechanical efficiency of repeated rock climbing attempts at a self-selected speed. **Methods:** Twenty-four experienced climbers volunteered to participate in this study (ages 18-40 years, 20 males, 4 females, at least one year of recreational climbing experience). Participants climbed up and down a vertical route (30 feet) on an indoor climbing wall at a self-selected pace for ten minutes. VO_2 was continuously measured during the upward portion of the climb using a portable COSMED device. Work was calculated from height climbed and body mass. **Results:** Four climbers' data were discarded due to incomplete data. From the remaining twenty subjects, there was no significant difference in mechanical efficiency from the first climb ($M=18.4\%$, $SD=11.3\%$) to the last climb (17.8% , $SD=11.0\%$); $t(20)=0.89$, $p=0.19$. **Conclusions:** The recreational climbers did not experience a significant decrease in mechanical efficiency. It was thought that fatigue would result in decreased mechanical efficiency due to an increased work rate from continuous climbing action. One possible explanation is the repeated attempts resulted in a learned effect causing the subjects to become more familiar with the route. The familiarity of the route likely led to improved technique and possibly offset the impact of fatigue on mechanical efficiency. Future studies should consider investigating the difference in mechanical efficiency on repeated climbs of varying routes.

D-71 Free Communication/Poster - Modeling

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2216 Board #229 June 1 2:00 PM - 3:30 PM
Comparing Daily Class Schedule and its Influence on Undergraduate Students' Physical Activity Patterns

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 (No relationships reported)

Full-time undergraduate students' daily physical activity patterns may be affected due to Penn State University's different class schedules -Monday/Wednesday/Friday (M/W/F) and Tuesday/Thursday (T/Th). A no class period (common hour: 1:00pm-2:30pm) on M/W/F is offered as scheduled breaks in the academic course schedule for student activities at different Penn State University Commonwealth campuses. **Purpose:** To objectively determine the differences in daily step count and energy

expenditure of Kinesiology students on different days of the week. **Methods:** Sixty eight (35M/33F, 21.6±2.9 years, average BMI 25.9±5.2 kg/m²) apparently healthy juniors and seniors were recruited from the Penn State Berks. A wrist-worn activity-tracker was deployed for one week to assess students' free-living physical activity levels. **Results:** M/W/F vs. T/Th (Mean±SD) step count (10387 ± 3560 vs. 9268 ± 2899 steps/day; $p=0.015$) and activity calories (1056.4±535.2 vs. 963.5±608.3 kcal/day; $p=0.097$) were measured. Students were most active on Mondays (10691±4531 steps/day) compared to the rest of the week. **Conclusion:** Students achieved the recommended 10,000 steps daily goal on M/W/F and did not meet the step goal on T/Th. This difference in steps could be attributed to the mandatory no class 'common hour' which may allow students to be more physically active than the T/Th schedule. In addition, the shorter class structure on M/W/F (50 min/class) might also provide opportunities for students to be more active than T/Th (75 min/class). These preliminary results may be useful for planning early physical activity interventions on specific days of the week among college students.

2217 Board #230 June 1 2:00 PM - 3:30 PM
Comparison of Effectiveness in Online vs. Hybrid Courses in College Wellness Courses

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Online courses have gained popularity in recent years; research has supported its effectiveness while also pointing out the limitations of online delivery. Hybrid courses have been developed in response to some of the challenges, with course content delivered both online and in a face to face setting. **Purpose:** The goal of this research was to determine whether 100% online or hybrid online courses are more effective in delivering a college-level wellness course. **Methods:** 47 students were enrolled in Fitness/Wellness courses; 23 students enrolled in the 100% online section which met in class only for fitness tests and written exams. The other 24 enrolled in the hybrid section, which met once per week for exercise in addition to class meetings for fitness testing and exams. Assignments were identical in both sections. All students were assessed for knowledge via weekly open-book online quizzes (QUIZ) and closed-book exams (EXAM) in the classroom. Fitness tests were performed before and after an 8-week self-prescribed, instructor-graded exercise program, and fitness improvement was analyzed. Students also responded to open-ended questions about course delivery preference. **Results:** There were very few differences between groups in written work or fitness outcomes. Written work between groups was statistically equal; (EXAM online mean = 79.9% ± 9.57; hybrid mean = 81.58% ± 7.55; $p=0.49$); (QUIZ avg. online mean = 83.7% ± 10.1; hybrid mean = 84.5% ± 10.7; $p=0.81$). Improvements in fitness parameters were calculated as post-score minus pre-score. Only the 1.5-mile run test yielded a significant difference, with the hybrid group (mean improvement = 2.3 ± 2.2 minutes) improving significantly more than the online group (mean improvement = 0.60 ± 0.96 minutes; $p=.003$). Improvement in pushups (Online = 4.45 ± 6.11, Hybrid = 2.67 ± 4.75; $p=0.28$), sit-ups (Online = 3.4 ± 3.59, Hybrid = 2.77 ± 5.82; $p=0.68$) and sit-and-reach (Online = 2.47 ± 3.42, Hybrid 2.05 ± 2.32; $p=0.64$) were statistically equal between groups. In the open-ended questions, students in both sections cited the value of weekly class meetings and face-to-face time with teacher and classmates, although online students expressed enthusiasm for the online format for convenience. **Conclusion:** Student outcomes in wellness courses with online and hybrid delivery are similar.

2218 Board #231 June 1 2:00 PM - 3:30 PM
Self-reported Measures Of Strength And Sport-specific Skills Distinguish Ranking Among Females In An International Online Fitness Competition

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PURPOSE: To determine if self-reported performance measures could distinguish ranking amongst female competitors in an international online fitness competition (OFC). **METHODS:** The top one-thousand five hundred female competitors (28.72 ± 4.87 y; 63.65 ± 5.80 kg; 163.71 ± 6.60 cm) of the OFC were split into quintile groups (Q1 - Q5) based upon their final OFC ranking. Then, self-reported performance scores for one-repetition maximum (1RM) squat (SQ), deadlift (DL), clean and jerk (CJ), snatch (SN), 400-m sprint, 5,000-m run, and benchmark workouts (Fran, Helen, Grace, Filthy-50, and Fight-gone-bad) were compared between quintiles using separate one-way analysis of variance. **RESULTS:** Q1 reported greater ($p < 0.05$) 1RM loads for DL (148.3 ± 14.5 kg), SQ (126.1 ± 13.0 kg), CJ (95.69 ± 8.42 kg), and SN (76.5 ± 7.6 kg) compared to all other quintiles (Q2 - Q5). In the 400-m sprint, though Q1 (71.0 ± 9.2 sec) was not different from any other quintile, Q2 (67.5 ± 8.8 sec) reported faster ($p < 0.05$) times than Q3 - Q5 (73.5 - 74.8 sec). For the 5,000-m run, differences were

only observed between Q1 (21.3 ± 1.8 min) and Q4 (22.6 ± 2.2 min, p = 0.008) and between Q1 and Q5 (22.6 ± 1.9 min, p = 0.016). In benchmark workouts, Q1 reported the fastest (p < 0.001) times in Fran (159.4 ± 28.3 sec) compared to all other groups and better (p < 0.005) performances compared to Q3 - Q5 in Grace (1.9 ± 0.5 min) and Fight-gone-bad (388 ± 45 repetitions). Differences between groups for Helen and Filthy 50 varied amongst quintiles. **CONCLUSIONS:** In female athletes, the most elite OFC competitors (i.e., Q1) possessed the greatest strength and power, and generally performed the best on benchmark workouts that emphasized muscle strength and endurance (i.e., Fran, Grace, and Filthy-50). Though aerobic and anaerobic fitness also appeared to be greater in higher-ranking competitors, distinctions between quintiles were more broad.

2219 Board #232 June 1 2:00 PM - 3:30 PM
Analysis Of Anthropometric Profiles And Long-term Career Progression In 24 Years Of German Junior Rowing

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 (No relationships reported)

Talent identification in rowing typically includes standing height (SH) and body mass (BM), because successful rowers are on average taller and heavier than their opponents. Moreover, successful elite senior rowers are significantly taller and heavier than Juniors, but it remains unclear if those athletes who became elite rowers later, were already taller and heavier as adolescents.

PURPOSE: We aimed to retrospectively analyze anthropometrical differences of national team junior rowers considering their long-term career progression level and to define minimal anthropometric requirements allowing for later success.

METHODS: 706 male German junior rowers (age 17.5±0.7 y) of the years 1991 - 2015 were grouped according to their highest progressive career level, more precisely U19-, U23-, Senior World Championships (WCh), or Olympic Games (OG). To analyze differences in SH and BM a one-way ANOVA with Post-Hoc test was calculated.

RESULTS: Distribution for highest progressive career level were 46.7% U19- (191.0±4.6 cm, 85.5±6.1 kg) 35.6% U23- (192.3±4.7 cm, 86.5±6.7kg), 6.9% Senior WCh (192.8±4.9 cm 87.4±6.5 kg) and 10.8% OG (193.7±4.4 cm, 88.2±6.4 kg). Significant small effects in SH (F(3,702) = 9.30, p = .000, η² = 0.038) and BM (F(3,702) = 4.31, p = .005, η² = 0.018) among progression levels were found. Rowers competing not higher than U19-WCh were smaller (-0.69 - -1.42%; p < .005) and exhibited less BM (-1.08 - -3.05%; p < .007) compared to higher progression levels. This effect increased by 0.45 % (R² = .97) for SH and 1.01% for BM (R² = .99) with rising progression level. No significant differences were found between U23, Senior WCh, and OG. Minimal anthropometric requirements within the higher progression levels can therefore be calculated as 188 cm SH and 80.3 kg BM.

CONCLUSIONS: This finding suggest that higher SH and BM within a homogenous group of adolescent elite junior rowers are already associated with long-term career progression in international elite rowing. Minimal anthropometric requirements could be established and can be interpreted as thresholds associated with later success. However, anthropometric variables must not be solely or exclusively used for talent identification, because maturation to elite status is inherently multi-dimensional.

2220 Board #233 June 1 2:00 PM - 3:30 PM
Bioelectrical Impedance Analysis and Skinfold Prediction of Percent Fat in Male College Athletes

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Determination of body fat (%fat) in athletes is now a common component of the preparation for competition. Various techniques have been developed to estimate %fat in athletes. However, some question may remain concerning the accuracy of these methods to accurately determine %fat in male college athletes. **PURPOSE:** To compare various methods of obesity classification in male college athletes. **METHODS:** NCAA Division II athletes (n = 183) from 6 sports were assessed during the off-season for skinfolds (SKF), BIA, and DEXA. Skinfold sites included biceps, triceps, subscapula, midaxilla, chest, suprailium, abdomen, thigh, and calf. Skinfolds were measured in triplicate and averaged for analysis. Eight SKF equations utilized to estimate %fat in athletes were evaluated. Single-frequency (50 Hz) hand-to-hand BIA (H-BIA) and foot-to-foot BIA (F-BIA) devices using an athletic setting were also assessed. **RESULTS:** All prediction methods significantly underestimated DEXA %fat (18.2 ± 5.8%, range = 9.5 to 36.3%) despite high correlations with the criterion (ICC = 0.78 to 0.93). Of the SKF equations, the Durnin-Wormsley equation produced

the closest estimate (16.2 ± 4.0%, ICC = 0.91). H-BIA (13.6 ± 4.9%) and F-BIA (13.4 ± 5.8%) were comparable in their underestimation of %fat (-4.8 ± 4.4%) with similar correlations with the criterion (ICC = 0.83). Significant negative correlations for the difference between SKF predicted and DEXA %fat (r = -0.71 to -0.97) indicated greater discrepancy between the two methods at higher %fat values. There were smaller but significant negative correlations for the difference between SKF predicted and actual %fat values and body mass (r = -0.22 to -0.56), suggesting greater underestimation of DEXA %fat by SKF at higher body masses. **CONCLUSIONS:** All prediction techniques produced significantly lower estimates of %fat in male college athletes than when measured by DEXA. Prediction error typically increased at greater actual %fat and body mass values. If DEXA is to be accepted as the new standard for assessing body composition, new prediction equations may need to be developed. Higher %fat values than previous accepted may need to become the new normal standard for college athletes when using DEXA as the criterion.

2221 Board #234 June 1 2:00 PM - 3:30 PM
Influence of Lower Extremity Strength on Physical Activity in Young Adults

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Decreased physical activity has been identified as a risk factor for many health related conditions. Lower extremity muscular strength is an important aspect for the completion of physical activity. Differences have been found to exist between males and females with their lower extremity strength. However, limited evidence exists evaluating the influence of strength of the hip and knee muscles on physical activity between sexes. **PURPOSE:** To explore if a relationship between lower extremity isometric strength and physical activity exists between male and female young adults.

METHODS: Isometric strength was recorded on the dominant limb in 47 college aged participants with a handheld dynamometer (30 females and 17 males). Strength was assessed for participant's hip flexors, extensors, external rotators, internal rotators, abductors, adductors and knee flexors and extensor muscle groups. Strength was normalized as a percentage of body weight. Physical activity was recorded with a commercial activity monitor over 2-weeks, with steps per day being the main outcome. Relationships between lower extremity muscle strength and activity level were explored with pearson product moment correlations, controlling for age and body mass. A linear regression was utilized to explore if lower extremity strength could predict physical activity.

RESULTS: Significant correlations were found between activity level and strength in females for their hip flexors (r = .484, p = .007), hip abductors (r = .629, p < .001), hip external rotators (r = .453, p = .012), knee flexors (r = .393, p = .032) and knee extensors (r = .421, p = .020). Isometric hip abductor strength was found to a significant predictor of physical activity when assessed by steps per day (p < .001), accounting for 39% of the variance in the model. No significant correlations were found in males between activity level and strength.

CONCLUSIONS: Lower extremity strength appears to play a role in physical activity levels in female college aged individuals, with hip abductor strength significantly predicting activity level. Intervention programs should evaluate strength training for females as one potential approach to improve physical activity.

2222 Board #235 June 1 2:00 PM - 3:30 PM
Predicting Maximal Oxygen Uptake in Adults Using a Walking Test

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Purpose: Maximal oxygen consumption (VO_{2max}) testing is not always feasible, practical, or safe. The purpose of this study was to find a good fitting VO_{2max} prediction equation using a 9-minute walking test. **Methods:** Healthy adults aged 18-79 years participated in this study. Resting heart rate (RHR) and a VO_{2max} test to volitional fatigue were assessed. Participants were asked to complete a 9-minute, ramped-intensity, over-ground walking test, where they were instructed to walk for 3-minutes each at a self-selected slower than normal, normal, and faster than normal walking speed. VO₂ and heart rate (HR) responses were collected using a portable metabolic device and averaged the last two minutes of each stage. These represent the main predictors of interest in this study. Other covariates were age, gender, body mass (kg) and change in HR from RHR (delta HR). A stepwise selection method with a p-value criterion of .05 for inclusion and exclusion was used to determine the predictive model. **Results:** The final sample (N=123) was 57.7% female, average age 46.4±17.2 years, BMI 25.8±4.6 kg/m², VO_{2max} 34.7±10.5 ml/kg/min, and RHR 60.5±9.2 bpm. A null model with only age (p<0.001), gender (p<0.0001), and body mass (p<0.0001)

was able to account for 73.5% of the variance in VO_{2max} ($R^2=.736$). The estimated prediction model using measurements from the normal walking speed stage including VO_2 ($p<0.0001$), HR ($p<0.0001$) and delta HR ($p=0.0051$) along with covariates age ($p<0.0001$), gender ($p<0.0001$) and body mass ($p<0.0001$) was able to achieve an R^2 of 83.3%. The addition of these variables increased the strength of the prediction model by ~10%. **Conclusion:** The results from this study indicate that a 3-minute over-ground walking test at a self-selected normal pace, where only VO_2 and HR are recorded in conjunction with demographic variables, is able to provide a good fitting model to predict VO_{2max} . Compared to other reported over-ground submaximal prediction equations, the model obtained in this study was able to achieve a similar fit in predicting VO_{2max} .

2223 Board #236 June 1 2:00 PM - 3:30 PM
Core Strength/Endurance and Inspiratory Muscle Performance - Are They Related?

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Core strength/endurance (CSE) is believed to be an important component of physical performance in sport and functional tasks. A standard measure of CSE is the side plank (SP) during which the duration it can be held is measured. **PURPOSE:** To examine the effects of a test of inspiratory muscle performance (IMP) done in the SP position on SP duration and several measures of IMP. **METHODS:** 28 healthy subjects (15 men, 13 women with a mean±SD age, height, and weight of 36±14 and 34±11 years, 176.0±8.6 and 165.6±6.1 cm, and 80.8±8.3 and 64.5±7.2 kg, respectively) underwent in random order two tests of SP duration (with and without IMP tests) and IMP (at the onset of SP and in sitting) with at least 5 minutes of rest between each of the tests. IMP was measured via the Test of Incremental Respiratory Endurance (TIRE) yielding maximal inspiratory pressure (MIP), sustained maximal inspiratory pressure (SMIP), and inspiratory duration (ID). MIP was measured from residual volume while SMIP and ID were measured from residual volume to total lung capacity. **RESULTS:** Men were found to have significantly ($p<0.05$) greater height and weight compared to women. The SP duration decreased significantly ($p<0.05$) for the entire cohort when IMP was tested during SP (104.2±41.5 sec to 81.1±33.0 sec), but no significant difference in SP duration between men and women under both test conditions was observed. MIP and SMIP also decreased significantly ($p<0.05$) for the entire cohort when IMP was tested during SP (117.9±21.8 to 92.6±18.3 cm H₂O and 683.9±191.0 to 535.6±173.9 PTU) and a significantly ($p<0.05$) lower MIP and SMIP was observed in the SP position of both men and women with men having significantly ($p<0.05$) greater values compared to women during both test conditions. Men were observed to have a significantly ($p<0.05$) different ID compared to women (16% increase versus 9% decrease, respectively) when IMP was tested in the SP position. **CONCLUSIONS:** SP duration and IMP decreased significantly when IMP was tested in the SP position with men having significantly greater MIP, SMIP, and ID compared to women. The increase in ID in men suggests that men use a different strategy to optimize CSE which may be due to their significantly greater height, weight, and IMP. CSE and IMP appear related, but further investigation of this relationship is warranted.

2224 Board #237 June 1 2:00 PM - 3:30 PM
Physiological Predictors of Fatigability in Healthy Adults

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 (No relationships reported)

Fatigability is represented by a decline in performance in relation to the frequency, intensity and duration of physical activity. The use of anaerobic threshold (AT) as an index of endurance is well accepted in the literature. In patients with cardiopulmonary disease, ventilatory efficiency is related to exercise capacity, and therefore may have clinical significance as a fatigability measure. However, this has yet to be determined in healthy individuals. **PURPOSE:** To characterize physiological determinants of the time to fatigue (TTF) during a vigorous bout of treadmill exercise. **METHODS:** Subjects were 19 healthy participants (13 females, 6 males; age 26.6±9.1 years; BMI 24.2±2.7 kg/m²) enrolled in the National Institutes of Nursing Research, Fatigue in Healthy Individuals Protocol. Subjects completed a ramp treadmill cardiopulmonary exercise test (CPET) to volitional exhaustion during the initial visit. The anaerobic threshold and two measures of ventilatory efficiency (lowest VE/VCO₂ ratio and VE/VCO₂ slope at AT) were determined from the CPET. A subsequent visit consisted of a constant work rate test at vigorous-intensity performed to exhaustion in which the TTF represented a measure of performance fatigability. Data are presented as mean ± SD. **RESULTS:** The TTF was 436.12 ± 175.9 seconds at 240.05 ± 66.48 watts. Subjects achieved an AT of 18.1 ± 4.56 ml/min/kg, lowest VE/VCO₂ ratio of 24.72 ± 2.18

and VE/VCO₂ slope of 22.49 ± 2.16. Pearson product-moment correlation analysis suggests that both measures of ventilatory efficiency were not significantly correlated to the TTF. The anaerobic threshold was found to be the best predictor of the TTF, with a strong effect size ($d=0.865$) suggesting that AT is a reliable predictor of TTF explaining 15% of the variance. **CONCLUSIONS:** Results from this study suggest that AT remains a better predictor of fatigability compared to measures of ventilatory inefficiency. Further research is needed to determine other objective measures of fatigability.

Funding: Intramural Funds from the National Institutes of Nursing Research

2225 Board #238 June 1 2:00 PM - 3:30 PM
Step Test as a Predictor of Law Enforcement Pursuit Requirement

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 (No relationships reported)

PURPOSE: Develop a simple, field expedient, pre-hire aerobic fitness tool to predict success in effecting a standardized foot pursuit and job-simulation arrest scenario as well as the job-related graduation criteria of 10 METs.

METHODS: A Job Task Analysis (JTA) was conducted via survey, on-site observations, and interviews of incumbent federal officers (n=1025) with the objective of establishing an aerobic fitness standard for the essential function of foot pursuit and effecting arrest. Respondents were asked to provide best estimates of distances, heights, and weights associated with critical and arduous tasks. Graduation criteria were based upon previously published research of a 2.6 l·min⁻¹ requirement for a foot pursuit and arrest scenario, nominally determined to be 10 METs.

SUBJECTS: Applicants (N=756, including 99 females (13%)) who presented for employment from October of 2005 through May of 2007 served as subjects for this study. Because they had received no prior physical screening these subjects represent a sample of applicants that was not range restricted on physical ability. A pass-fail, 5-minute step test (ST) (40cm, 24 repetitions·min⁻¹) was administered prior to starting a 13.5-week training program. Subjects embarked on their customary program of instruction (POI) and were tested on 1.5-mile run pre/post training. **RESULTS:** Students improved their run time by an average of 12%. Individuals who passed the ST had a 98% probability (sensitivity) of completing a 1.5-mile run in less than 16:30 min ($p<0.001$). Of the 57 applicants (9% of total sample) who could not complete the ST, performance on the 1.5-mile run was generally poor, with 89% (55/62) failing (specificity) to complete the run in less than 16:30 min (≈8METs). **CONCLUSIONS:** The ST is an easy to administer, job-related, valid field expedient test of aerobic fitness for predicting a 1.5 mi run graduation standard in a law enforcement setting. This study funded by the Department of Homeland Security

Descriptive Statistics

Gender	Frequency	Percent				
female	99	13.1				
male	657	86.9				
Total	756	100.0				
	N	Minimum	Maximum	Mean	Std. Deviation	
Push up Trial 1	614	0	94	37.02	16.998	
Push Up Trial 2	533	0	103	39.07	18.189	
average pushup (1&2)	609	.5	94.5	37.933	17.0524	
Push up Post trial	529	0	104	51.89	18.456	
CAT1 (sec), total	669	42	416	74.57	39.492	
CAT2 (sec), total	692	38	312	69.51	32.917	
run1 (sec), total	756	567	1514	868.92	163.857	
run2 (sec), total	756	525	1215	764.01	121.654	
% body fat	592	2.04	63.07	24.6151	7.86330	
height (cm)	592	144.8	200.7	176.19	8.988	
hips (cm)	83	81.2	139.7	101.36	11.857	
neck (cm)	592	27.9	50.8	38.89	3.858	
waist (cm)	592	60.9	149.9	94.97	14.08	
weight (kg), pre	736	44.9	165.5	87.64	17.76	
weight (kg), post	707	45.8	156.4	87.00	16.894	
Valid N (listwise)	34					

2226 Board #239 June 1 2:00 PM - 3:30 PM
Predicting 2015 NBA Rookie Class On-Court Contribution Using Draft Combine and Performance Measurable's

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PURPOSE: The National Basketball Association (NBA) conducts an annual combine to assess anthropometric and athletic ability of collegiate and international prospects in preparation for the draft. Additionally, in-game performance variables are tracked

and used by scouting and personnel departments to determine players to draft. The purpose of this study was to determine how well the variables measured of the athletes invited to the 2015 NBA Combine predicted on-court contribution during their rookie season, as measured by Player Impact Estimate (PIE) (player's overall statistical contribution against the total statistics in played games). **METHODS:** Data from 12 tests (six anthropometric, six performance) recorded during the NBA Combine and data from 7 in-game performance variables recorded during the 2014 collegiate/international season were used for analysis. 64 athletes' rookie season player contribution was measured in PIE. A multiple linear stepwise regression was calculated to predict on-court contribution based on the 19 variables recorded during the NBA Combine and 2014 season. **RESULTS:** A significant regression equation was found among three variables (three quarter court sprint, 2014 assist:turnover ratio, 2014 field goal percentage) ($F(3,21) = 6.080, p = 0.005; R^2 = 0.503$). The three predictor model was able to account for 50.3% of the variance in PIE. $PIE = -37.208 + 9.245(\text{three quarter court sprint}) + 9.245(2014 \text{ assist:turnover ratio}) + 0.254(2014 \text{ field goal percentage})$, 95% CIs [-68.196, -6.220], [-0.455, 18.944], [0.593, 3.143] and [0.210, 22.843], respectively. **CONCLUSIONS:** The findings of this study suggest that the performance testing conducted at the 2015 NBA Combine and in-game performance variables could partially predict on-court contribution during the 2015 NBA regular season, though R^2 prediction was varied. However, of the 19 variables assessed, only three provided significant predictive value. These findings may help teams and scouts to assess performance and determine potential on-court contribution of draftees and undrafted free agents.

2227 Board #240 June 1 2:00 PM - 3:30 PM
Comparison Of Physiological Demands Of Basketball Practice Sessions To A Pre-season Game
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 (No relationships reported)

An athlete's practice is ideally constructed to prepare them for game-type conditions. Training volume however, can be influenced by several factors including frequency, intensity, time, type, and volume of practice. Differences between basketball practices, scrimmages, and games are already illustrated (Montgomery et al., 2010 & Klusemann et al., 2013). The ability to improve practices to mimic game-type conditions could better prepare the athletes to perform in games. **PURPOSE:** To compare the physiological demands of practice to a pre-season game. **METHODS:** Ten Division II men's basketball players participated in this study (20.7 ± 0.9 yrs, 94.0 ± 13.2 kg, 1.90 ± 0.09 m). All players wore Hexoskin activity monitors (Hexoskin, Montreal, CAN) which measure heart rate (HR) via ECG, g-force (above that of the earth's gravity) via triaxial accelerometry, and time of day (including time spent wearing the monitor). Monitors were worn at practices for the week leading up to and the week following a pre-season game. A dependent, two-tailed t-test compared the average of twelve days of practice (P) to the pre-season game (G). Coefficient of determination was utilized to compare change in time while wearing the monitor to change in training volume (total g-force). **RESULTS:** Time spent in practice was significantly greater than the game ($P = 144 \pm 2; G = 126 \pm 2$ min; $p \leq 0.05$). While average HR did not differ ($P = 121 \pm 5; G = 121 \pm 17$ bpm), maximal HR was higher in the game ($P = 180 \pm 6; G = 189 \pm 7$ bpm; $p \leq 0.05$). Average g-force was higher in practice ($P = 0.38 \pm 0.05; G = 0.30 \pm 0.11$ m/s²; $p \leq 0.05$), however maximal g-force did not differ between the two ($P = 3.64 \pm 0.42; G = 3.97 \pm 0.71$ m/s²; $p = 0.10$). Total g-force (average g-force of the session multiplied by the minutes of the session) differed between the two conditions ($P = 55.2 \pm 7.7; G = 37.4 \pm 13.6$ min-m/s²; $p \leq 0.05$). A coefficient of determination elucidated an $r^2 = 0.175$, indicating that only 17.5% of the change in total g-force was explained by the difference in time between P and G. **CONCLUSION:** Practices were longer, less intense based on maximal HR and a trending maximal g-force, with a higher average g-force and total g-force compared to the pre-season game. Volume of training for practices could be better tailored to more closely mimic game-type conditions, although the goals of practice should be considered.

2228 Board #241 June 1 2:00 PM - 3:30 PM
Comparisons Between Jump Power, Swing Velocity, and Hitting Measures in Collegiate Baseball and Softball Athletes
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 (No relationships reported)

Successful performance in baseball and softball requires the ability to perform multiple skills efficiently. The skills most critical to the game include fielding, throwing, and hitting and each have components of strength, agility, and muscular power. **PURPOSE:** To evaluate the relationships and differences between maximal leg power and swing velocity in collegiate baseball and softball players. **METHODS:**

Thirty-four subjects (20.4 ± 1.3 yrs, 176.8 ± 9.8 cm, and 77.7 ± 13.9 kg) were assessed for vertical jump power and swing velocity using a force plate and visual 3D technology, respectively. Mean differences were calculated by independent t-tests and relationships between parameters of interest were calculated using Pearson Correlation coefficients. Statistical significance was set at 0.05 **RESULTS:** Baseball ($n=17$) and softball ($n=17$) player mean age, height (cm), and weight (kg) were 20.7 ± 1.2 yrs, 184.8 ± 4.1 cm, 88.3 ± 9.8 kg and 20.1 ± 1.4 yrs, 168.9 ± 6.7 cm, 67.0 ± 8.0 kg, respectively. Vertical jump power and swing velocity means were 1528.3 ± 169.7 W, 38.6 ± 1.4 m/s and 1045.4 ± 121 W, 29.8 ± 1.8 m/s, respectively. Baseball players were significantly taller ($p \leq 0.01$) and heavier ($p \leq 0.01$) than softball players. They also generated significantly more jump power ($p \leq 0.01$) and achieved higher swing velocities ($p \leq 0.01$) but no differences were revealed for hitting measures. Vertical jump power tests revealed moderate to strong relationships for baseball players ($r = .58-.96, p < 0.05$) between height, weight, swing velocity, batting average, and slugging percentage for baseball but only height and weight for softball players. Swing velocity revealed poor to moderate relationships for both groups ($r = -.28-.51$) for batting average, slugging percentage, and home runs. **CONCLUSION:** Statistical evaluation revealed moderate to strong relationships between vertical jump power and anthropometric measures for both groups. Furthermore, baseball players display moderate to strong relationships between vertical jump power, swing velocity, batting average, and slugging percentage. In conclusion, evaluating and predicting performance from physiological variables remains a challenge, however, maximal leg power could serve as a moderate indicator of performance in baseball athletes.

2229 Board #242 June 1 2:00 PM - 3:30 PM
Limb Mass And Passive Muscle Tension Contributions To Knee Flexion Torque At Long Muscle Lengths
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Purpose: During isokinetic and isometric strength testing it is important to correct torque for the contribution of limb mass and passive muscle tension. This is particularly important in testing hamstring strength since weakness at long muscle lengths is a factor in recurrent hamstring strains. The purpose of this study was to quantify the relative contributions of passive muscle tension and limb mass during strength testing with the hamstrings in a stretched position. **Methods:** Isometric strength tests were performed on 50 athletes (30 men, 20 women) prior to return to sport after a hamstring strain. Strength was assessed at 80°, 60°, 40°, and 20° knee flexion in sitting with the test thigh flexed 40° above horizontal and the seat back at 90° to the horizontal. In this set up the leg was horizontal at 50° knee flexion. Passive torque (limb mass + passive hamstring tension) was recorded at each angle. Passive torque at 80° was defined as limb mass with no muscle tension; limb mass at 80° and 20° were equal (30° below/above horizontal); limb mass at 60° and 40° were calculated [(passive torque at 80°/cos 30°) * cos 10°]. Torque due to passive muscle tension = measured passive torque - limb mass. **Results:** Passive muscle tension contributed 21%, of total torque at 20° with limb mass contributing 16% and contractile torque accounting for only 63% of total torque. Angle of peak torque occurred at a significantly shorter muscle length ($P < 0.01$) when calculated from contractile torque (62°) versus total torque (49°).

Table 1	Total Torque (Nm)		Contractile Torque (Nm) (% of Total Torque)		Passive Muscle Tension (Nm) (% of Total Torque)		Limb Mass Torque (Nm) (% of Total Torque)		
	INV	NON	INV	NON	INV	NON	INV	NON	
Knee Flexion	20°	73±32	74±27	48±27	48±22	15±6	14±7	11±3	11±4
		100%	100%	63%	63%	21%	21%	16%	16%
40°		79±31	81±28	60±28	62±25	6±4	6±5	12±4	12±4
		100%	100%	74%	76%	8%	8%	17%	16%
60°		78±31	82±28	64±28	67±25	2±2	2±3	12±4	12±4
		100%	100%	80%	81%	3%	3%	17%	16%
80°		72±31	73±25	61±28	62±23	0±0	0±0	11±3	11±4
		100%	100%	84%	85%	0%	0%	16%	15%

INV=involved, NON=noninvolved
Conclusions: Currently "gravity correction" functions for isokinetic testing measure passive torque at only one joint angle and therefore cannot account for changing passive muscle tension from short to long muscle lengths. This invalidates isokinetic assessment of hamstring angle of peak torque or weakness at long muscle lengths where passive muscle tension is considerable.

2230 Board #243 June 1 2:00 PM - 3:30 PM
Predicting Success in Division I College Football Players Based on Initial Physical Performance Tests
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 (No relationships reported)

A recent study looked at the relationship between performance variables and success in the NFL among players who participated in NFL combine events, which features college seniors aspiring to make an NFL roster. To date no studies have looked at a similar relationship among high school seniors entering college, who aspire to make an NCAA Division I football roster. **Purpose:** The purpose of the study was to identify initial performance variables that predict success among aspiring Division I college football players. **Methods:** Archival data were analyzed from 310 college football players, which focused on their initial testing as they entered the program, who played during the decade from 1999-2009 at an NCAA top 5 nationally ranked university. Players were categorized by training group with skill players (G1; n=124) including running backs, defensive backs and wide receivers; fullbacks, tight ends and linebackers (G2; n=76); and offensive and defensive linemen (G3; n=110). Tests were conducted within a week of each player joining the program included height (HT), body mass (BM), 1 repetition maximum (1RM) in the squat (SQ), bench press (BP), power clean (PC), push jerk (PJ), vertical jump (VJ), sit and reach test (SR), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same strength coach over the ten-year period. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. **Results:** The best predictors by training group were as follows: Skill players (G1) by 10YD ($p = 0.001$); Linebackers and related positions (G2) by BP1RM ($p=0.026$) and 20YS ($p=0.044$); Linemen (G3) by BM ($p=0.32$), PC ($p=0.043$), and 40YD ($p=0.043$). **Conclusions:** These results suggest that it may be possible to predict the success of high school recruits entering a NCAA Division I football program by position grouping, by looking at selected performance parameters. Our data suggests that for G1 acceleration is important, G2 upper-body strength and lateral speed are paramount, and G3 size combined with speed and explosive hip extension predicts success.

2231 Board #244 June 1 2:00 PM - 3:30 PM
Relationship Between Dynamic Postural Control And Core Strength In Collegiate Women's Basketball Players
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RELATIONSHIP BETWEEN DYNAMIC POSTURAL CONTROL AND CORE STRENGTH IN COLLEGIATE WOMEN'S BASKETBALL PLAYERS

Hardman, Brenda, Burns, Karlee, Vargas, Tiffany, Wu, Wilbur, Nakajima, Mimi. Center for Sport Training and Research, California State University, Long Beach. **Context:** Core strength and balance have been emphasized as important pieces to injury prevention, however, there is limited research regarding the relationship between the two. The Star Excursion Balance Test (SEBT) has been used to predict injury rate in athletic populations. **Purpose:** The purpose of this study was to evaluate the relationship between dynamic postural control using the modified SEBT and core strength in NCAA Division I women's basketball players. **Methods:** Fourteen Division I collegiate women's basketball players (age 19.71 ± 1.20 years; height 175.26 ± 7.32 cm; mass 71.36 ± 12.76 kg) completed a modified SEBT and core strength tests in a single testing session. Reach distance during the modified SEBT was collected in the anterior, posteromedial, and posterolateral directions and normalized by leg length. Composite score was calculated by adding individual directions. Core strength was measured using endurance tests for back extension, trunk flexion, and single leg wall sits, all for time. **Results:** There was a significantly moderate correlation $r(12) = 0.599$, $p = 0.024$ between combined composite SEBT score and trunk flexion holds. There was a significantly moderate correlation $r(12) = 0.568$, $p = 0.04$ between right leg anterior reach and back extension holds. A regression analysis was performed and determined that back extension holds was a good predictor of right anterior reach $R^2 = 0.460$, $p = 0.009$. **Conclusion:** This study corresponds with previous studies that shows the positive relationship between core strength and dynamic balance. Despite sample-size limitations, this study showed that increase in some core strength parameters may influence dynamic postural control.

2232 Board #245 June 1 2:00 PM - 3:30 PM
Comparison of Lung Volumes and Estimated VO₂MAX in College-aged Wind Musicians Versus Aerobic Athletes
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 (No relationships reported)

It is well known that aerobic athletes and musicians have higher dynamic lung functions than the general population. There is a gap in the current literature comparing the lung volumes of college-aged aerobic athletes to the lung volumes of college-aged wind musicians. **PURPOSE:** To compare the lung volumes (SVC, FVC, FEV₁, MVV) and VO₂MAX between college-aged Division II athletes and physically inactive wind musicians. **METHODS:** Subjects (n=21) were recruited based upon age and medical criteria. Athletes (n=11) were defined as individuals who accumulated at least or more than 150 minutes of moderate intensity aerobic activity per week and participated on an aerobic based athletic team. Wind musicians (n=10) were defined as individuals who played a wind instrument at the collegiate level who did not meet aerobic exercise guidelines. Three respiratory tests (SVC, FEV₁, MVV) were performed to assess lung volume using a spirometer. VO₂MAX was also estimated using an 8-minute treadmill walk test that elicited a heart rate between 50% and 85% of their maximal heart rate. Collected results were analyzed using a two-tailed independent t-test and Pearson correlations. **RESULTS:** There was a significant difference in VO₂MAX ($p=0.013$) between groups with the athletes (42.1 ± 7.2) having higher values than musicians (30.44 ± 11.9). There were no significant differences in the other lung volumes between groups. However, there were strong positive correlations between FVC and SVC ($r=0.927$), as well as, MVV and SVC ($r=0.911$) with musicians. There were also strong correlations between FEV₁ and FVC ($r=0.980$), FEV₁ and SVC ($r=0.946$), and FVC and SVC ($r=0.937$). **CONCLUSION:** The VO₂MAX results were greater in athletes when compared to wind instrument musicians. Interestingly, physically inactive musicians had similar lung functions as athletes. This difference could be attributed to athletes training their cardiorespiratory system and not solely their respiratory system.

2233 Board #246 June 1 2:00 PM - 3:30 PM
Predictability Of Vo2max Using A Gps Watch
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Using accurate submaximal methodologies to estimate VO₂max is a convenient alternative to maximal exercise testing. Submaximal testing is practical because it provides a cheaper, more time-efficient alternative to maximal testing and allows a wider range of individuals to be tested. **PURPOSE:** To examine the predictability of VO₂max based on a submaximal 15-minute outdoor run using a GPS sports watch compared to measured VO₂max. **METHODS:** Twenty-three participants (16 M, 7 F; 20-55 years old) volunteered for this study. Participants came to the laboratory on two separate occasions. On day 1, participants arrived in a fasted state (no intake in the past 3 hours) and completed a treadmill graded exercise test (GXT) to determine VO₂max. Participants completed the test using a self-selected pace (mph). The self-selected pace remained constant throughout the test while the grade increased 2% every 2 minutes until volitional exhaustion. During the test, heart rate (HR) and VO₂ (ml/kg/min) were recorded every minute. On day 2, participants completed a 15-minute submaximal outdoor run. Participants were fitted with a GPS sports watch, which was used to estimate VO₂max based on subject characteristics (gender, age, height (in), weight (lbs.), maximal HR (recorded on day 1 of testing)) as well as total distance of the run, pace, time (15 minutes), and HR. A paired samples t-test was used to determine if there was a significant difference between directly measured VO₂max and estimated VO₂max using the GPS watch. Statistical significance was determined by $p < 0.05$. **RESULTS:** Five participants (3 males, 2 females) were excluded from the analysis due to the GPS watch malfunctioning, not reaching a true max, or dropping out of the study. The remaining 18 participants were 27.61 ± 7.94 years old, had a height of 172.28 ± 5.23 cm, and weighed 75.44 ± 12.67 kg. A significant difference was found between measured VO₂max (52.41 ± 8.61 ml/kg/min) and estimated VO₂max (49.33 ± 4.88 ml/kg/min) from the GPS sports watch. **CONCLUSIONS:** The GPS sports watch was not a valid estimate of VO₂max. Variability of HR could have potentially influenced the results from the GPS watch.

2234 Board #247 June 1 2:00 PM - 3:30 PM
Effect of Plyometrics and Whole Body Vibration on Vertical Jump Height: A Meta-analysis
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PURPOSE: the purpose of the study was to analyze the effect of plyometric and whole body vibration training methods on vertical jump height in athletes. **METHODS:** A meta-analysis was performed where the inclusion criteria for the studies were: (a) only athletic population, (b) active control group, (c) only one experimental intervention, (d) statistical data necessary to calculate effect sizes (ES). Hedge's standardized mean difference ES was calculated for each result; then, ESs pooled using random-effects models. On-overlapping 95% confidence intervals (CI_{95%}) were considered statistically significant. Heterogeneity was assessed using Q and I², while funnel plots and Egger's regression test were used to assess small-study effects (potential bias). **RESULTS:** One hundred and fifteen effect sizes were calculated from 36 studies. Global effect sizes (ES) were statistically different from zero in both training methods. Plyometric training had an ES = 1.046 (CI_{95%} = 0.82 to 1.27, p < 0.001) and the control group an ES = 0.032 (CI_{95%} = -0.12 to 0.18, p = 0.73). The ES for the experimental group in the whole body vibration training method was 0.652 (CI_{95%} = 0.3 to 1.0, p = 0.001) and the control group an ES = 0.038 (CI_{95%} = 0.3 to 1.0, p = 0.75). ESs were correlated to age (r = 0.454, p = 0.002), number of weeks of training (r = 0.309, p = 0.039), final number of sessions per week (r = 0.348, p = 0.019), final duration of sessions (r = 0.619, p = 0.014), initial series of exercises (r = 0.572, p = < 0.00), final series of exercises (r = 0.601, p = < 0.00) and initial number of jumps per session (r = 0.633, p = 0.027) in the plyometric experimental method. No significant associations between ESs and moderator variables were observed in the whole body vibration method. **CONCLUSIONS:** The overall results showed a statistically significant improvement on the vertical jump height of athletes when plyometrics or whole body vibration were used as training methods.

2235 Board #248 June 1 2:00 PM - 3:30 PM
Relationships Between Assessments Of Athletic Ability In NAIA Athletes
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 (No relationships reported)

PURPOSE: To examine the relationships between flexibility, body composition, and several field methods indicative of athletic ability in a population of National Association of Intercollegiate Athletics (NAIA) athletes. **METHODS:** Shoulder flexion (SF), hip flexion (HF), and ankle plantar flexion (APF) were assessed by goniometry. %BF and FFM were assessed using BodPod. Athletic ability was assessed by the Illinois Agility Test (IAT), Queens College Step Test (QCST), vertical jump (VJ), isometric handgrip (IH), and a push-up muscular endurance test (PU). Subjects (n = 18) included both sexes across a variety of sports. Relationships between range of motion at each site, %BF, FFM, and all indicators of athletic ability were examined using Spearman's correlation coefficients. For relationships involving IAT and QCST, only 10 subjects are reported as the others did not complete this assessment. **RESULTS:** Relationships between variables are presented in Table 1. Means and standard deviations for each variable were as follows: SF (191 ± 22°), HF (77 ± 11°), APF (37 ± 13°), FFM (73 + 8 kg), %BF (16.8 ± 6.6 %), VJ (66 ± 10 cm), IH (45 + 6 kg), PU (41 ± 19 PU/min), QCST (55 + 14 steps), IAT (17.4 ± 1.2 s).

	SF	HF	APF	FFM	%BF	VJ	IH	PU	QCST	IAT
SF	1	.34	.15	.65 p=.003	.41	-.06	-.23	.05	.20	.41
HF	-	1	-.21	.45	-.03	-.09	-.05	.14	.35	-.19
APF	-	-	1	.06	.08	.33	-.15	-.03	-.37	-.16
FFM	-	-	-	1	.55 p=.017	-.14	.01	.25	-.02	-.25
%BF	-	-	-	-	1	.05	-.13	-.17	-.27	-.24
VJ	-	-	-	-	-	1	.32	.04	-.12	.23
IH	-	-	-	-	-	-	1	.24	-.85 p=.002	.19
PU	-	-	-	-	-	-	-	1	.23	.45
QCST	-	-	-	-	-	-	-	-	1	.20
IAT	-	-	-	-	-	-	-	-	-	1

Table 1. Spearman's correlations (r). Significant p values (< 0.05) are included. **CONCLUSION:** These data suggest that flexibility, body composition, and indicators of athletic ability are not greatly related in this population. Thus, it would be beneficial for NAIA coaches to perform all of these assessments when evaluating an athlete as any single measure is likely to provide unique information.

2236 Board #249 June 1 2:00 PM - 3:30 PM
Low Correlation Between Bench Press One-Repetition Maximum and Angle Specific Isometric Bench Press
 Cameron N. Munger, David C. Archer, RoQue A. Harmon, Kylie K. Harmon, Derek N. Pamukoff, Jared W. Coburn, FACSM, Lee E. Brown, FACSM. *California State University, Fullerton, Fullerton, CA.*
 (No relationships reported)

Administration of bench press 1-repetition maximum (1RM) tests can be time consuming, require trained personnel, and are risky for beginners. Therefore, alternative testing procedures for upper body push strength should be considered. **PURPOSE:** To quantify strength and determine the relationship between dynamic bench press 1RM and angle specific isometric bench press. **METHODS:** Twelve recreationally trained males (age=24.83±2.89yrs, height=172.33±6.6cm, mass=83.18±8.53kg), capable of bench pressing a minimum of 1.25x their bodyweight, volunteered to participate. On day 1, subjects performed a bench press warm-up and had 5 attempts to reach their 1RM using a self-selected grip that remained the same for the entire study. On day 2, subjects performed an isometric bench press warm-up, then completed 2 max effort repetitions at 4 different angles of elbow flexion (60, 90, 120, and 150 degrees) and at 50% of their arm length in randomized order. **RESULTS:** Pearson correlations were very low and not-significant (P>0.05) between dynamic bench press 1RM (115.43±12.68kg) and isometric bench press at all angles (60°=56.60±9.72kg, r = -.04; 90°=65.25±9.77kg, r = -.26; 120°=110.39±20.79kg, r = -.11; 150°=121.46±29.83kg, r = -.24; 50% arm length=57.72±8.09kg, r = -.25). **CONCLUSIONS:** Traditionally, dynamic movements are the focus of strength testing. The 1RM bench press is dynamic while the isometric bench press produces no movement. Thus, muscular length-tension or force-velocity differences between modes may explain the low relationships. Therefore, isometric bench press may not be a proper substitute for a 1RM bench press test.

2237 Board #250 June 1 2:00 PM - 3:30 PM
Prediction Of Lactate Threshold By Physiological Variables Utilizing Human Motion During Exercise
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 (No relationships reported)

Running at Lactate threshold (LT) for training is a frequent training method used by healthy and elite athletes. However, LT determination is usually done in the laboratory with an invasive method. **PURPOSE:** To predict LT by physiological variables utilizing human motion during exercise. **METHODS:** 12 male athletes (Age: 23.6±1.8years, Percentage (%) body fat: 12.4±3.3%, height: 173.4±4.7cm, weight: 68.2±5.8kg, bone mineral content: 2738.6±252g and lean mass: 56233.7±4751.4g) completed an incremental discontinuous submaximal to exhaustion protocol on the treadmill. VO₂ ml*kg⁻¹*min⁻¹ was determined at every stage and VO₂max ml*kg⁻¹*min⁻¹ was determined at volitional exhaustion. Human motion, blood lactate, heart rate (HR), VO₂ and Rate of Perceived Exertion (RPE) were constantly measured. **RESULTS:** Among the 32 human motions, 8 human motions (4 on left leg and 4 on right leg) demonstrated strong relationship (correlation r > 0.700) to human bioenergetics during running. The range of human motion on left leg (10% - 70%) significantly varies than right leg (5% - 15%) due the right leg being dominant. Two human motions had the highest correlation with human bioenergetics 1) the angle between left (thigh & leg) phase 1 and 2) (r = 0.908) and angle between right (thigh & leg) phase 3 (r = 0.858). The equations derived with human motions (A) VO₂ = (VO₂ - 7.56)±10.83ml*kg⁻¹*min⁻¹ and (B) VO₂ = (VO₂-15.81)±15.76ml*kg⁻¹*min⁻¹ can be used to predict the VO₂ at LT if VO₂max is known. **CONCLUSIONS:** Results indicated that human motions have significant relationship with HR, VO₂, and blood lactate during running at submaximal intensities. The human motion derived equation can predict VO₂ at LT if VO₂ at exhaustion is known without using an invasive method.

2238 Board #251 June 1 2:00 PM - 3:30 PM
Comparison of Prediction Models for Cardiorespiratory Fitness from Maximal Anaerobic Capacity in Young Adults
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 (No relationships reported)

The superior method of cardiorespiratory fitness assessment is often considered an incremental treadmill VO₂max protocol. During these protocols energy production pathways switch from primarily aerobic to anaerobic by the point of VO₂max

attainment. Similarly, the Wingate cycle test is a commonly accepted method of anaerobic capacity assessment which stresses anaerobic energy pathways. Based on the energy systems utilized at the point of $\dot{V}O_{2\max}$ attainment and during a Wingate protocol it has been shown that peak power obtained from a Wingate cycle test is a good predictor of $\dot{V}O_{2\max}$. However, it is unclear whether a non-consecutive testing day protocol produces a more accurate predictive model compared to a same day testing protocol. **PURPOSE:** to develop and compare the predictive accuracy of the regression model for a non-consecutive day testing protocol and a same day testing protocol. **METHODS:** Participants (N=23) completed an incremental treadmill $\dot{V}O_{2\max}$ protocol and 30 second Wingate cycle test. Participants (n=12) completed testing on non-consecutive days (NON) and participants (n=11) completed testing on the same day (SAME). $\dot{V}O_{2\max}$ (L/min) and peak power (PP) were collected. All data were analyzed using simple linear regression. **RESULTS:** Linear regression analysis of NON revealed $R^2=0.808$ and prediction equation $\hat{Y}=1.499+0.004X$ and SAME showed $R^2=0.861$ and prediction equation $\hat{Y}=1.407+0.003X$. NON and SAME standard error of estimate percent (SEE %) were 15.23% and 10.98% respectively. **CONCLUSION:** These results indicate PP obtained the same day of $\dot{V}O_{2\max}$ testing is a better predictor of cardiorespiratory fitness. SEE % also shows the predictive accuracy of the SAME prediction equation is superior to the NON prediction equation. This may be due to the diminished effect of potential training adaptations that could occur 2-7 days between testing sessions during the NON testing protocol in healthy, active young adults.

2239 Board #252 June 1 2:00 PM - 3:30 PM
The Development Of A Metabolic Equation To Estimate Caloric Consumption On A Non-motorized Sport-performance Treadmill

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Reported Relationships: S. Zanuso: Honoraria; Receive honoraria from Technogym.

PURPOSE: To create a Metabolic Equation (ME) predicting caloric consumption in walking and running speeds on a new non-motorized treadmill, named as the 'Skillmill' (SK). On the SK the running surface is moved mechanically by the user, specifically designed to develop sports performance qualities.

METHODS. A group of 27 healthy individuals (18 male and 9 female; age 35.8 ± 9.3; BW 76.2 ± 19.1) were enrolled in the study. All subjects executed two familiarization sessions with the SK, one dedicated to walking and another to running. Each subject performed two trials, trial one required the subjects to walk at 4 and 6 km/h and trial two required the subjects to run at 8, 10 and 12 km/h. Each speed consisted of an 8 minute duration in order to obtain a steady state condition. The rest between speeds and trials consisted of 5 minutes. Oxygen consumption was continuously monitored with a metabolic cart (Cosmed Quark b², Rome, Italy). $\dot{V}O_2$ consumption was then measured when the subject achieved a steady state of metabolic intensity. Overall, 135 steady state points were collected.

RESULTS. The steady state $\dot{V}O_2$ ranged from 13.32 to 31.09 ml.kg⁻¹.min⁻¹ when walking and from 31.27 to 47.67 ml.kg⁻¹.min⁻¹ when running. To estimate the $\dot{V}O_2$ consumption expressed in ml.kg⁻¹.min⁻¹ related to a given speed, both Speed (S) in km/h and Body Weight (BW) in kg were considered. The equation that better predicts actual $\dot{V}O_2$ consumption is $p_{00}+p_{10} *BW+p_{01} *S+p_{20} *(BW^2)+p_{11} *BW*S$.

The different coefficients of this polynomial equation of the 2nd degree relative to BW are: $p_{00}= 16.42$; $p_{10}= -0.3036$; $p_{01}= 4.547$; $p_{20}= 0.001826$; $p_{11}= -0.01816$ with a Root Mean Squared Error of 1.751 when (S) is lower than 8 km/h.

$p_{00}= 0.808$; $p_{10}= 0.248$; $p_{01}= 4.21$; $p_{20}= -0.002509$; $p_{11}= -0.004976$ with a Root Mean Squared Error of 2.081 when (S) is equal to or higher than 8 km/h. The correlations between the values predicted by this equation and the $\dot{V}O_2$ measured with the metabolic cart are $r^2=0.83$ when (S) is lower than 8 km/h and $r^2=0.84$ when (S) is equal to or higher than 8 km/h.

CONCLUSIONS. The present Metabolic Equation that predicts oxygen consumption and caloric expenditure from the subject's speed and body weight, provides a good estimate of the actual values.

2240 Board #253 June 1 2:00 PM - 3:30 PM
Allometric Scaling for Endurance Variables in Croatian Army

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(No relationships reported)

Body mass bias is widely spread among physical performance testing and may confound the results often leading to misinterpretation. Endurance testing is a part of

physical performance testing in the army and is generally assessed by running distance time. Two such tests, 2-mile run (2MR) and 300 yards run (300YR), are used to assess soldiers' endurance. Also, incremental $\dot{V}O_{2\max}$ treadmill test is used as a measure of aerobic capacity. If expressed as a relative value (ratio of $\dot{V}O_{2\max}$ and body mass) or $R\dot{V}O_{2\max}$ it is a good predictor of endurance or long distance running time. Considering that longer distances running time and $R\dot{V}O_{2\max}$ are measures dependent of body mass, it is important to determine how to allow comparisons between subjects independent of their body mass. One practical solution is to determine body mass allometric exponent for distance running time. **PURPOSE:** To determine experimental body mass allometric exponent (eAE) for endurance variables and if it corresponds to proposed theoretical body mass allometric exponent (tAE) which equals 0.33. **METHODS:** 572 healthy male army recruits (mean age 29.4y) underwent endurance assessment comprised of a standard endurance testing battery in Croatian Army: 2-mile run (2MR), 300-yards run (300YR) and incremental $\dot{V}O_{2\max}$ treadmill test. Their body mass (BM) was also measured. Relative maximal oxygen uptake ($R\dot{V}O_{2\max}$) was taken as a measure of endurance since it is a better predictor of long distance running time. A regression technique was applied on the log-transformed data in order to determine the values of the allometric exponent for each particular test. One sample t-test was used to determine statistical differences between average eAE and tAE. **RESULTS:** Regression analysis yielded BM allometric exponents for 2MR, eAE=0.33 (95%CI=0.23 - 0.43); $R\dot{V}O_{2\max}$, eAE=-0.47 (95%CI= -0.55 - (-0.38)); 300YR, eAE=0.22 (95%CI=0.15 - 0.28). Mean eAE=0.34 and compared with tAE=0.33 was not significantly different ($p>0.05$) when tested by one sample t-test. **CONCLUSION:** The results indicate that experimentally derived mean AE for endurance variables correspond to theoretical one and as such should be used for scaling endurance variables and comparing results of endurance tests recorded as running times. Supported by Grant of Ministry of Defence of the Republic of Croatia

2241 Board #254 June 1 2:00 PM - 3:30 PM
Self reported Performance Measures Of Males Are Predictive Of Overall Performance In The Crossfit Open

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(Sponsor: Yuri Feito, FACSM)

(No relationships reported)

PURPOSE: To determine if measures of strength and skill, obtained from online athlete profiles, could distinguish overall performance in an international online fitness competition (OFC). **METHODS:** The highest ranking male competitors (n = 1500; 27.18 ± 8.4 y; 85.2 ± 7.88 kg; 177.01 ± 6.47 cm) were split into quintile groups (Q1 - Q5). Subsequently, quintile comparisons were made using self-reported performances for a one-repetition maximum (1RM), squat (SQ), deadlift (DL), clean and jerk (CJ), snatch (SN), 400-m sprint, 5,000-m run, and benchmark workouts (Fran, Helen, Grace, Filthy 50, and Flight-gone-bad) via separate one-way analysis of variance. **RESULTS:** Greater ($p < 0.011$) performance scores were reported by Q1 for DL (232.4 ± 20.5 kg), SQ (201.6 ± 19.1 kg), CJ (148.9 ± 12.1 kg), SN (119.4 ± 10.9 kg) and Fran (2.3 ± 0.2 min) compared to all other quintiles. For Grace, Q1 (1.7 ± 0.4 min) reported faster ($p < 0.001$) completion times than Q3 - Q5, while their performances in the 400-m sprint (59.3 ± 5.9 sec), Helen (7.6 ± 0.6 min) and Flight-gone-bad (430 ± 70 repetitions) were only better than Q3 (62.6 ± 7.3 sec, $p = 0.022$), Q4 (7.9 ± 0.7 min, $p = 0.007$) and Q5 (398 ± 73 repetitions, $p = 0.010$) respectively. No specific quintile differences were observed in 5,000-m or Filthy-50 performance. **CONCLUSION:** The data indicates that the most successful male athletes in this OFC possessed the greatest strength and power. Further, these athletes performed the best in a short-duration (< 3 min) sports-specific workout (i.e., Fran) that emphasized these characteristics. Lower ranking athletes should focus on emphasizing strength and power development once sufficient anaerobic, aerobic, and sports-specific proficiency has been attained.

2242 Board #255 June 1 2:00 PM - 3:30 PM
Increases in Maximum Oxygen Consumption and Lactate Threshold Predict Improvements in Race Performance during a Cross Country Season

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To our knowledge, the relationship between many physiological adaptations due to in-season training and their impact on racing performance remains unclear.

PURPOSE: To investigate multiple physiological variables that contribute to the greatest improvements in 6,000m cross country race performance. **METHODS:** Nine female collegiate cross country athletes (1.8±0.1m, 59.6±3.9kg) were evaluated twice during their competitive cross country season: pre-season (T1) and mid-season (T2). Subjects completed a graded exercise test to volitional fatigue on a motor driven treadmill. Oxygen consumption was measured by a Parvo TruOne 2400 Metabolic cart. Near-infrared spectroscopy (Portamon, Artinis Inc.) of the vastus lateralis was used to measure tissue saturation index (TSI) for each stage of the graded exercise

test. In this study, the slope of the decline in TSI was determined and used to quantify the muscle oxygenation response. Blood lactate was analyzed at each workload by a handheld lactate analyzer (Nova Biomedical) to determine the inflection point of lactate accumulation. Efficiency was determined from work output and energy input during running. Changes in these variables along with standardized race performance times were analyzed. **RESULTS:** $\text{VO}_{2\text{max}}$ significantly increased ($p < 0.05$) from T1 to T2 (51.6 ± 3.2 ml/kg/min to 56.6 ± 4.3 ml/kg/min) indicating an average gain of 4.9 ± 3.9 ml/kg/min or 9.7%. The slope of the TSI became more positive from T1 ($-14.8 \times 10^{-3} + 6 \times 10^{-3}$) to T2 ($-7.9 \times 10^{-3} + 7 \times 10^{-3}$), indicating less of a decline in muscle deoxygenation. The LT increased by one workload in four of the nine subjects. The subjects who experienced an increase in LT also experienced an increase in racing performance. Lastly, running efficiency did not significantly change between T1 and T2. **CONCLUSIONS:** On average, $\text{VO}_{2\text{max}}$, LT, and muscle oxygenation improved from pre- to mid-season. The greatest gains in $\text{VO}_{2\text{max}}$ and in LT from pre-season to mid-season correlated to the greatest improvements in racing performance. About 40% of the variance in race performance can be explained by the changes in $\text{VO}_{2\text{max}}$ whereas improvements in LT explained 32% of the variance in racing performance. These data suggest that improvements in $\text{VO}_{2\text{max}}$ are most important in predicting race performance in collegiate cross country runners.

2243 Board #256 June 1 2:00 PM - 3:30 PM
Comparison of Training Impulse and Training Load Estimation Among Soccer Players Using the Edwards Equation and Polar Team2 System

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 (No relationships reported)

Heart rate (HR) based methods are commonly used to monitor training stress and are referred to as training load (TL) or training impulse (TRIMP). Edwards TRIMP equation is based on time spent in HR training zones above 50% HR_{max} , whereas Polar's TL is measured via their Team2 system using a proprietary equation that incorporates anthropometrics and maximal oxygen consumption ($\text{VO}_{2\text{max}}$) combined with time spent in HR training zones. **PURPOSE:** To examine if TL estimates from proprietary Team2 software correlate with Edwards TRIMP in order to assess the training readiness of athletes. Secondly, the Beep test assessed fitness levels both pre and post-season to determine if training adjustments based on TL influenced post-season fitness. **METHODS:** Twenty-eight male Division III soccer athletes (19.8 ± 1.8 yrs) had their heart rates continuously monitored during the fall 2014 season, as well as pre and post-season testing using the Beep test to estimate $\text{VO}_{2\text{max}}$. In instances where TL was >300 per match, athletes had reduced intensity during practice sessions to aid in improved recovery. Data recorded included time spent in each of five heart rate zones, ranging from 50% to 100% HR_{max} , in 10% increments. **RESULTS:** When comparing Edwards TRIMP and TL, significant correlation coefficients were found for the first half, second half, and both halves combined ($r=0.992$, $r=0.972$, and $r=0.936$, $p < 0.01$). Although TRIMP and TL had high variability due to individual players playing for different time periods, mean TRIMP (190.9 ± 102.1) and TL (219.5 ± 92.4) for the season were similar. Estimated $\text{VO}_{2\text{max}}$ scores were not significantly different pre to post-season (52.0 ± 4.84 vs. 53.7 ± 3.14 ml·kg⁻¹·min⁻¹, $t=-1.794$, $p > 0.05$). **CONCLUSIONS:** Estimating TRIMP using the Edwards equation is a valid option for coaches to gauge training readiness. TRIMP may be used if TL is unavailable to determine athlete readiness. Subsequent training sessions may be modified based on the amount of TL/TRIMP undergone in order to maintain fitness levels of athletes throughout the season.

2244 Board #257 June 1 2:00 PM - 3:30 PM
Predictor Variables for Success in Collegiate Wrestling

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 (No relationships reported)

Upper body strength has been found to be greater in more successful wrestlers compared to their less successful counterparts. Additionally, elite high school wrestlers have shown a lower percent body fat (skinfold), and greater upper and lower body anaerobic power (Wingate tests) compared to non-elite wrestlers. **Purpose:** To determine if there are certain additional attributes that can predict success in wrestling. **Methods:** The study consisted of 6 NCAA division II collegiate level male wrestlers. Their ages ranged from 18-25 years. The following served as independent variables: Wingate arm cranking test, wrestling shot velocity, percent change in body weight, vertical jump height, and grip strength of the non-dominant hand. The dependent variable was percent wins during the wrestling season. A multiple regression with a stepwise progression was the statistical technique used to analyze the data. Significance was set at $p=0.05$. **Results:** The model summary only included one independent variable, percent change in body weight. Thus the model summary was: $r=0.838$, $r^2=0.702$, adjusted $r^2=0.627$, Beta=1.507, with $F=9.402$, and $p=0.037$. Therefore, based on this study, 70.2% of the percent wins in wrestling was accounted

for by increases in body weight throughout the season. The regression equation for predictive success is: $\hat{y}=62.148 + 1.507 \times \text{kg}$. Although not significant, the next most influential independent variable was shot velocity with $r=0.649$ and $p=0.148$. **Conclusion:** The results of our study indicate that for every 1 kg increase in body weight, there is an accompanied 1.507 increase in percent wins. The authors assume this profitable increase in body weight would be in the form of lean muscle mass, hydration levels, and possibly glycogen stores. Perhaps there would have been more significant predictors had there been more than 6 participants. Furthermore, only two of the wrestlers qualified for the NCAA national championships. Additionally, none of the wrestlers placed at the NCAA national championships. Therefore, the lack of success in our sample of wrestlers could have influenced the outcome.

2245 Board #258 June 1 2:00 PM - 3:30 PM
Validity of Commercial Electrical Impedance Myography as a Predictor of Grip Strength

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 (No relationships reported)

PURPOSE: Electrical impedance myography has gained recognition throughout the literature as an effective assessment of neuromuscular disorders. However, evidence regarding the efficacy of commercial electrical impedance myography (cEIM) devices is limited. Therefore, there were two aims of this independent research. First, the author aimed to assess the validity of a cEIM device as a predictor of grip strength. The second aim was to determine whether the number presented by the cEIM device was a direct representation of grip strength force produced. **METHODS:** Muscle quality and grip strength were measured in 17 female subjects ($M_{\text{age}} = 20$ years, $SD = 1.5$) via cEIM and a Jamar hand dynamometer, respectively. The cEIM device was placed on the volar surface of the dominant forearm midway between the medial epicondyle of the humerus and ulnar styloid on each participant. Grip strength measurements were then taken in accordance with recommendations from the American Society of Hand Therapists. True scores were documented as the results for each assessment before grouped into normative categories. The true scores for each assessment were compared using the Wilcoxon signed ranks test. The results were then categorized into either *normal* or *abnormal* according to their respective normative data. Spearman's ranked correlation (r_s) was utilized to assess the relationship between the true scores and the two categorical groupings of normal and abnormal. Statistical significance was accepted at $p < 0.05$.

RESULTS: The average grip strength score of all participants was 30.82 kilograms ($SEM = 1.20$, 95% CI [28, 33]). Muscle quality scores averaged 41.29 ($SEM = 3.70$, 95% CI [33, 49]). A strong correlation was observed between the categorical groupings of each assessment ($r_s = 0.618$, $p = 0.008$). No significant relationship was observed between the true scores of the cEIM device and grip strength ($r_s = 0.23$, $p = 0.38$). The true scores were observed as significantly different from each other (Wilcoxon test, $p = 0.015$).

CONCLUSIONS: Although the commercial electrical impedance myography device did not provide a direct representation of grip strength force produced, the device was effective at predicting normal versus abnormal grip strength.

2246 Board #259 June 1 2:00 PM - 3:30 PM
Relationship Between Physiological/Anthropometric Profiles and Future NHL Status Among Division I Collegiate Ice Hockey Players

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 (No relationships reported)

Measurement of physiologic and anthropometric variables can be conducted to assess training progress and to estimate an athlete's potential to perform at an elite level. However, the use of such measures for predicting ice hockey performance at the professional level has resulted in equivocal findings and to our knowledge, has not been assessed in collegiate ice hockey players. **PURPOSE:** The purpose of this study was to determine if the results of a discontinuous graded exercise test and selected anthropometric measures could predict a collegiate ice hockey player's likelihood of playing professionally in the NHL.

METHODS: Physiologic and anthropometric player profiles were obtained through yearly preseason fitness testing of a NCAA Division I men's ice hockey team from 1980 through 2015. Players participated in a discontinuous treadmill graded exercise test to volitional exhaustion, consisting of 3 min run stages and 90 sec rest stages. Aerobic capacity was measured (indirect calorimetry) and total test time (including treadmill stage completed) was recorded. Height, weight, and % fat were also measured for each athlete. Athletes who later played at least one game in the NHL ($n=55$) were compared to non-NHL athletes ($n=190$) to determine if any outcome variables of interest predicted their NHL status. Binary logistic regression was performed, and Odds Ratios (OR) and 95% Confidence Intervals (CI) were calculated for each variable. **RESULTS:** Average values for variables of interest were similar in future NHL vs non-NHL players across 36 years: height (182.0 ± 4.9 vs 181.5 ± 6.1 cm), weight

(83.8±5.3 vs 83.6±7.2 kg), body fat (11.2±2.9 vs 12.5±3.1 %), BMI (25.3±1.5 vs 25.3±1.6 kg/m²), VO₂max (59.0±4.1 vs 58.0±4.0 ml/kg/min), completing treadmill stage 5 (45% vs 40%), and year of last college season (1994 vs 1998). Entering all variables into the logistic model showed that the only significant predictors of achieving NHL status were %fat and playing year (OR=1.19; CI=1.06, 1.33). **CONCLUSIONS:** According to our findings, players with the lowest %fat values and earlier careers were 19% more likely to play in the NHL. These NCAA Division I players' physiologic profiles and overall size are very similar; therefore, NHL success may be more influenced by other factors such as player skill, other fitness variables, and mental focus.

2247 Board #260 June 1 2:00 PM - 3:30 PM

The Relationship between Hamstring/Quadriceps Strength and Field Test Measures in Collegiate Track Athletes

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(No relationships reported)

Hamstring strain injuries are one of the most common sports injuries, especially in sprinting sports (Liu, Garrett, Moorman, & Yu, 2012). Hamstring strength imbalance quantified via hamstring strength asymmetry or by a hamstring to quadriceps ratio is a commonly proposed risk factor for hamstring strains (Liu, et. al., 2012; Freckleton & Pizzari, 2012). Knowledge concerning the relationship among hamstring to quadriceps isokinetic ratios, speed, and power in sprinting athletes can assist in the development of training protocols and injury prevention strategies. **PURPOSE:** The purpose of this study was to identify the relationship between hamstring/quadriceps (H:Q) isokinetic strength ratios and its correlation with lower extremity power and speed field test measures. **METHODS:** Participants for this study included 10 NCAA Division I Track Athletes who compete in sprinting events. Peak torque (PT) was determined using an isokinetic dynamometer at speeds of 60 and 180 degrees per second in both hamstrings and quadriceps. Power was measured using the standing broad jump test and vertical jump test. Speed was assessed using light gates to measure sprint speed at 5, 10, 20, and 40 meter increments. A correlational approach was used to identify relationship between isokinetic measures with measures of lower extremity power and speed. **RESULTS:** Significant correlations ($p<0.05$) were found between peak torque (PT) values and most field tests (vertical jump, standing broad jump, and 40 meter sprint speed). However, there was no significant correlation ($p<0.05$) between H:Q ratios and field test measures (vertical jump, standing broad jump, and 40 meter sprint speed). **CONCLUSIONS:** The results of this study confirm that PT values correlate highly with field test measures used to assess power and speed. Unexpected findings include the lack of significant correlation between H:Q ratios and field test measures. Therefore, future research should focus on examining adjusted H:Q ratio values using body weight and lean mass of participants. Answering these questions could assist sport performance professionals in program development, and sports medicine personnel with injury prevention interventions.

D-72 Free Communication/Poster - Neuromuscular-Musculoskeletal

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2248 Board #261 June 1 3:30 PM - 5:00 PM

VO₂ Off-Kinetics Following Exhaustive Upper Body Exercise Test in Spinal Cord Injury

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(No relationships reported)

Introduction: People with spinal cord injury (SCI) present with impaired autonomic control when the lesion is above T6. This could lead to impaired recovery following vigorous physical activity. **Purpose:** To compare VO₂ off-kinetics following a maximal cardiopulmonary exercise test (CPET) in SCI and un-injured healthy individuals. **Methods:** Subjects were 13 patients with SCI who reported inability to voluntarily lift legs against gravity (age: 39.1 ± 10.9 years, paraplegic: 11, tetraplegia: 2, incomplete injury: 4) and 10 healthy controls (CON group; age: 30.5 ± 5.3 years). All subjects performed an arm ergometer cardiopulmonary exercise test (CPET) to volitional exhaustion followed by a 10-minute passive recovery. VO₂ off-kinetics

was determined using a mono-exponential model in which a time constant (τ_{off}) was calculated and amplitude of change in VO₂ (AMP) was measured over the recovery period. Student's t-tests were used to compare SCI vs CON group means and Pearson product moment correlation coefficients were used to assess the relationships amongst VO_{2peak} and the VO₂ off-kinetic variables. **Results:** CON had a significantly higher VO_{2peak} compared to SCI (22.41 ± 5 vs. 14.64 ± 6.36 ml/kg/min, $p=0.005$). Compared to CON, SCI had significantly longer τ_{off} (83.4 ± 34.7 vs. 54.7 ± 10.2 seconds, $p=0.021$). A significant difference in AMP was not seen between the subjects with SCI and CON (0.85 ± 0.57 vs. 1.31 ± 0.48 L/min, $p=0.054$) however the ratio of AMP/ τ_{off} was significantly smaller in the group with SCI than in CON (0.0126 ± 0.0108 vs. 0.0243 ± 0.008 L/min/sec, $p=0.011$). VO_{2peak} and τ_{off} were inversely related ($r=-0.524$, $p=0.01$). **Conclusions:** Potentially explained by the time taken to replenish muscle ATP stores and lactate clearance, VO₂ off-kinetics is one measure of cardiorespiratory fitness. Despite an observable decline in AMP, the prolonged VO₂ off-kinetics suggested that cardiorespiratory fitness was impaired in these subjects with SCI. Funding: DoD Award #W81XWH-14-1-0613

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The Effect Of Low Intensity Eccentric Exercise On Torque angle Relationship, Muscle Strength And Flexibility

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PURPOSE: The angle of peak torque (APT) with shorter muscle length tends to have high probability of muscle strain injury. It is conceivable that APT with longer muscle length might be desirable condition of injury prevention. Although high intensity eccentric exercise (Ecc-Ex) which transiently shift the APT to longer muscle length associated with weaken muscle strength and decrease flexibility is well known, the acute effect of low intensity Ecc-Ex is unclear. The purpose of this study was to investigate the effect of low intensity Ecc-Ex on APT, muscle strength and flexibility. **METHODS:** Thirteen healthy male college students (24.5±2.4 yrs., 68.5±5.9 kg) performed Romanian deadlift (RDL) without weight as a low intensity hamstring Ecc-Ex. Before and after RDL, muscle strength and APT during maximum eccentric knee flexion (60deg/s) and flexibility were measured on both legs. After the experiment, each leg were divided into two groups based on the change in APT after RDL: the group with increase in APT (16 legs) and decrease in APT (10 legs) after RDL. Variables of interest were compared before and after RDL. **RESULTS:** After RDL, muscle flexibility defined by range of motion in straight leg raise test increased significantly in both groups. The group with increase in APT, peak torque and power significantly decreased (141.3±37.8 vs. 127.9±26.4 %BW, 106.3±22.8 vs. 89.3±14.4 %BW/deg, $p<0.05$, respectively) and muscle stiffness increased significantly (0.85±0.22 vs. 0.89±0.22 Nm/deg, $p<0.05$). In contrast, the group with decrease in APT, there was no significant change in peak torque, power and muscle stiffness. **CONCLUSIONS:** These results suggest that the low intensity Ecc-Ex induced APT decrease has no harmful impact on the muscle strength and flexibility. Thus, low intensity Ecc-Ex might be a useful method of muscle strain injury prevention.

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The Effect of Rehabilitation with Blood Flow Restriction on Muscle Function Following Total Knee Replacement

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Low-load resistance exercise rehabilitation combined with blood flow restriction (BFR) has been suggested as an effective and safe alternative way to improve muscle strength and size compared to traditional high-load resistance exercise in clinical populations. However, there are few studies conducted to investigate the effect of low-load resistance exercise rehabilitation with BFR following total knee replacement. **PURPOSE:** To compare the result of rehabilitation with or without BFR on muscle function in the patients who were treated with total knee replacement surgery. **METHODS:** Twenty-one participants were randomized into two different interventions: low-load resistance exercise rehabilitation with BFR (BFR group, n=11) and without BFR (control group, n=10). Exercise sessions were performed 6 times per week, 30 minutes per session, for 2 weeks in all participants. Over the twelve exercise sessions in BFR group, an elastic cuff was worn on the subject's proximal thigh in its intensity being progressively increased from 160 mmHg at the first session

up to 240 mmHg at the end by adjusting the external compression. For the analysis, muscle strength, rate of torque development (RTD), range of motion (ROM), muscle mass, thigh circumference, the Timed Up and Go test, 10-m walking test and single-limb stance were measured. All outcome measures were assessed before and after the intervention.

RESULTS: In knee extensor strength, the degree of change in the BFR group was significantly larger than that in the control group (0.33 ± 0.21 vs. 0.11 ± 0.11 Nm/kg, $p < 0.05$). In knee extensor RTD, although there was no statistical difference between the two groups, it was nearly significant ($p = .051$). However, we found no significant results between groups in other outcome variables.

CONCLUSIONS: Low-load resistance exercise rehabilitation with BFR led to significant increases in knee extensor strength. Rehabilitation combined with BFR may be useful for the patients who are in need of fast recovery in muscle function following a total knee replacement surgery.

2251 Board #264 June 1 3:30 PM - 5:00 PM
Energetic and Hemodynamic Response to Electrical Stimulation Cycling in Persons with Paralysis

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Electronic stimulation can be used to stimulate contraction of paralyzed muscle, and when coordinated via computer processing, lower body muscles can power a cycle ergometer in a manner which increases whole-body energy expenditure. **Purpose:** When matched for charge input determine if calorie (kcal) expenditure and fuel partitioning measured during and immediately following a bout of functional electrical stimulation (FES) cycling differed when performed on two FES devices. **Method:** Six males with spinal cord injury (SCI; age: 49 ± 17 yr; weight: 76 ± 6 kg; level of injury: C4-T11) completed 30 min of steady-state FES exercise on four separate occasions at a charge-matched moderate stimulation intensity. Two sessions were completed on a commercially available unit (RT300, Restorative Therapies, MD) and two on a device that is in pre-production testing (MyoCycle, MYOLYN, FL) that employs a different electrical control paradigm. Before, during, and after cycling, energy expenditure and fuel homeostasis were calculated via pulmonary gas exchange (Oxycon, Jeager, CA), and central hemodynamics (for the MyoCycle device only) via impedance cardiography (PhysioFlow, Manatec Biomedical, FR). **Results:** Rate of oxygen consumption ($\dot{V}O_2$) and cardiac output (CO) during FES were $34 \pm 20\%$ and $49 \pm 23\%$ of their respective $\dot{V}O_{2peak}$ and CO_{peak} achieved during maximal effort arm cycling. Both FES devices elicited similar rates of exercise energy expenditure (1.06 ± 0.20 kcal/min) and fuel homeostasis (74:26 %CHO:%FAT). However, only the MyoCycle showed a statistically significant increase in energy expenditure at 20-30 min post-exercise time point (11.2% increase vs pre-exercise, $p = .02$), with this increase in energy expenditure accompanied by a 54% increase in CHO oxidation during the first 30 min of exercise recovery. **Conclusion:** Moderate intensity FES cycling qualifies as "low intensity" aerobic exercise according to authoritative guidelines, although increases in carbohydrate oxidation during and after cycling might have a meaningful impact on daily glucose regulation. Furthermore, the energetics of the recovery period seem to be influenced by the electrical control system.

2252 Board #265 June 1 3:30 PM - 5:00 PM
Insulin Resistance Adversely Affects Cutaneous Microvascular Perfusion Responses to Insulin Iontophoresis in Spinal Cord Injury

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Insulin is a vasoactive hormone and second messenger of nitric oxide that facilitates endothelial-mediated dilatation of the microvasculature with assistance by the sympathetic nervous system (SNS). The sensitivity or resistance of endothelial-mediated mechanisms that regulate skin blood flow may play an integral role in optimizing skin perfusion in vascular beds where SNS vasomotor impairment is present. Spinal cord injury (SCI) is characterized by interruption of supraspinal SNS control of sublesional vasomotor tone. **Purpose:** To determine the effects of insulin resistance (IR) on sublesional cutaneous perfusion responses to insulin provocation in persons with SCI. **Methods:** A prospective, open-label, non-randomized, placebo-controlled investigation was performed in persons with SCI and an able-bodied (AB) cohort. These groups were subdivided based on fasting plasma insulin (FPI) concentration cut-

offs for IR (≥ 13.13 mIU/ml) or insulin sensitive (IS: < 13.13 mIU/ml) designations into four subgroups: ABIS (n=21); SCIS (n=21); ABIR (n=9); SCIR (n=11). Laser Doppler flowmetry characterized the peak blood perfusion unit (BPU) responses (percent change from baseline) to insulin or placebo iontophoresis in the lower extremities, and the corresponding BPU responses were \log_{10} transformed to facilitate comparisons. The NetIns BPU response was calculated (Insulin-Placebo BPU responses) to provide the effect of insulin to that of the acetylcholine-mediated BPU response.

Results: The groups were matched for demographics. By study design, FPI was different between the IS and IR subgroups. In ABIS, the BPU responses to insulin were significantly greater than placebo ($p < 0.05$ and $p < 0.0001$, respectively). In ABIR and SCIR, insulin did not produce a BPU response that differed from placebo. In SCIS, the insulin BPU response was greater than placebo ($p < 0.0001$). The NetIns response was significantly greater in both IS groups compared to their corresponding IR group.

Conclusions: Persons with SCI have sublesional microvascular endothelial dysfunction. The presence of IR has a further confounding effect on endothelial-mediated changes to cutaneous perfusion and appears to be an important modifiable risk factor for the optimization of cutaneous perfusion in the lower extremities of persons with SCI.

2253 Board #266 June 1 3:30 PM - 5:00 PM
Within-Session Responses to High Intensity Interval Training in Spinal Cord Injury

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High intensity interval training (HIIT) has shown to be a robust alternative to traditional aerobic training (Gillen et al. 2014, 2016; Astorino et al. 2011). In most individuals, incorporation of HIIT elicits increases in maximum oxygen uptake and overall health status, yet its feasibility in persons with spinal cord injury (SCI) is unknown. **PURPOSE:** The aim of this study was to compare acute changes in cardiorespiratory and metabolic variables during different HIIT regimens versus moderate intensity continuous exercise training (MICT). **METHODS:** Nine habitually active men and women (injury duration = 6.8 ± 6.2 yr) with SCI initially underwent determination of peak oxygen uptake (VO_{2peak}) on an arm ergometer. During subsequent sessions, they completed MICT, HIIT, or sprint interval training (SIT). MICT consisted of 25 min of arm cycling at 45 %Wpeak. HIIT consisted of eight 60 s bouts at 70 %Wpeak separated by 90 s of active recovery at 10 %Wpeak, while SIT required eight 30 s bouts at 105 %Wpeak separated by 120 s of active recovery at 10 %Wpeak. Gas exchange data, heart rate (HR), and blood lactate concentration were measured. Each session was broken up into 16 phases (eight exercise and eight recovery data points for HIIT/SIT) for which mean oxygen uptake and HR were determined. **RESULTS:** Peak VO_2 was higher ($p = 0.03$) in response to HIIT (1.13 ± 0.44 L/min at bout 8) and SIT (1.02 ± 0.37 L/min at bout 8) compared to MICT (0.90 ± 0.29 L/min), but mean VO_2 was similar ($p > 0.05$) between MICT (0.86 ± 0.17 L/min), HIIT (0.89 ± 0.20 L/min), and SIT (0.82 ± 0.19 L/min). Peak HR was higher ($p < 0.05$) with HIIT (90 % VO_{2peak} and 99 % HRpeak) and SIT (80 % VO_{2peak} and 96 % HRpeak) versus MICT. There was no difference in mean HR across bouts ($p = 0.16$) which was equal to 130.7 ± 19.3 , 129.3 ± 18.6 , and 126.9 ± 14.9 b/min for HIIT, SIT, and MICT, equivalent to 79 - 82 %HRpeak. **CONCLUSION:** Despite a higher intensity, all participants preferred HIIT or SIT versus MICT. Compared to MICT, submaximal or supramaximal interval training elicits higher peak oxygen uptake and heart rate. The long-term efficacy and feasibility of HIIT in this population should be explored, considering that exercise intensity seems to be the most important variable manipulated in exercise programming to optimize maximal oxygen uptake. This study was partially funded by a University GPSM grant.

2254 Board #267 June 1 3:30 PM - 5:00 PM
Knee Extensor Asymmetry in Multiple Sclerosis Patients Before and After Single-Leg Cycling

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Multiple Sclerosis (MS) is an immune-mediated disorder of the central nervous system that is both chronic and progressive. MS is one of the most common neurological diseases that affect young adults; causing fatigue, debilitating ambulatory effects, as well as impacting quality of life. There have been clinical observations of bilateral differences (asymmetry) in lower extremity strength and function in people with MS. **Purpose:** Therefore the purpose of this study was to quantify lower extremity strength asymmetry before and after a bout of single-leg cycling exercise to failure. **Methods:** Eight individuals (6 women and 2 men) with mild MS (Age 51.6 ± 9.2 yrs, BMI 25.0 ± 3.9 kg/m², Extended Disability Status Scale 2.6 ± 1.6) and seven (5 women and 2

men) non-MS controls (CON) (Age 49.4 ± 14.3 yrs, BMI 26.0 ± 8.3 kg/m²) completed bilateral assessments of muscle knee extensor strength (KES) before and immediately after a single leg incremental cycling (SLC) test to induce localized musculature fatigue. KES asymmetry scores (weak/strong) were calculated for both groups (scores equal to 1.0 indicates symmetry between limbs). Body composition (lean and fat mass) was assessed using Dual X-Ray absorptiometry (DXA). Independent and dependent t-tests were used to detect between and within group differences respectively. Cohens d effect size (ES) was calculated, and level of significance was set to $p < 0.05$. **Results:** No significant differences in baseline demographic measures were observed. No significant differences were observed in lower limb lean mass and fat mass within or between groups. There was a significant between group difference for leg asymmetry before the SLC test (CON: 0.933 ± 0.131 , MS: 0.818 ± 0.0942 , $p < 0.034$, ES: 1.0); however, following the SLC test no between group differences were observed ($p > 0.05$). **Conclusion:** The group of individuals with MS exhibited asymmetry in KES that was significantly different than CON group. The SLC test did not appear to cause fatigue of the knee extensors in either group, and appeared to improve strength in the MS group. The increase in strength could possibly be related to potentiation from the SLC test. However, further studies should utilize different fatigue protocols to determine the effects of exercise on asymmetries in people with MS.

2255 Board #268 June 1 3:30 PM - 5:00 PM
Neuromuscular Electrical Stimulation Improves Walking Performance In People With Multiple Sclerosis: Double-blind, Randomized Trial

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Multiple sclerosis (MS) is a neurological disorder that afflicts ~400,000 people in the US. Common symptoms include sensory impairment, fatigue, and reduced mobility. Neuromuscular electrical stimulation (NMES) can be used to restore muscle function and improve mobility, but little is known about the relative influence of pulse width on treatment efficacy. Wider pulse durations (1 ms) activate a greater proportion of sensory axons, whereas narrower durations (0.26 ms) selectively activate motor axons. **PURPOSE:** To compare the effects of narrow- and wide-pulse NMES on the walking endurance of persons with MS. Wide-pulse NMES (WP) was expected to engage the nervous system more effectively and produce greater gains in walking performance than narrow-pulse NMES (NP). **METHODS:** Twenty-seven persons with MS (52.6 ± 7.4 yrs) participated in the study. Participants were randomly assigned to two groups: NP group (0.26 ms; 50 Hz; $n=13$; 54 ± 6.3 yrs), and WP group (1 ms; 100 Hz; $n=14$; 51.2 ± 8.3). NMES was applied at a tolerable level for 3 sessions/wk for 6 wks. Current was progressively increased to new tolerance and tapered to limit fatigue at testing. NMES was applied to the dorsiflexors and plantar flexors muscles (10 min each muscle, 4 s on and 12 s off) for both legs. Walking endurance (6 MWT) and walking speed (25-FWT) were assessed before (0 wk), after (6 wks), and after a 4 wk retention period (10 wks). **RESULTS:** Both groups (NP & WP) improved walking endurance and walking speed after the intervention (P values < 0.05). The 6MWT (m) results: NP - before (mean \pm SD) = 345 ± 138 , after = 387 ± 154 , retention = 396 ± 178 ; WP - before = 409 ± 131 , after = 442 ± 155 , retention = 450 ± 149 . Mixed ANOVA indicated no significant difference between NP and WP groups (P 0.302) in 6MWT. The 25-FWT (s) results (non-parametric test: Friedman test): NP - before (mean \pm SE) = 11.9 ± 5.5 , after = 9.9 ± 4.4 , and retention = 10.5 ± 5.1 ; WP - no significant differences. Wilcoxon signed rank tests for the changes in walking speed for both groups indicated no statistical difference between the two groups (P values 0.075, 0.173). **CONCLUSION:** 6 wks of either wide- or narrow-pulse NMES improved walking performance for persons with MS. Wide-pulse NMES didn't produce greater gain in walking performance than narrow-pulse NMES.

2256 Board #269 June 1 3:30 PM - 5:00 PM
Within- And Across-Day Reliability Of Mobility Measures In People With Multiple Sclerosis

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PURPOSE: Individuals with Multiple Sclerosis (MS) often exhibit slowed walking speed, foot tap speed, and longer Timed-Up-and-Go (TUG), and Six Spot Step Test (SSST) times. The goal of this study was to evaluate within- and across-day reliability of these measures in individuals with MS. **METHODS:** On 3 visits, each separated

by 7 days, women with MS ($n=11$; mean \pm SE, age: 53 ± 3 yrs; self-reported EDSS: median=4.5, range=0-6.5) completed two 25-foot walk and 2 TUG trials, and the fastest trial for each visit was used for analysis. Next, participants completed the SSST and the average time for 4 trials was recorded for each visit. Participants were instructed to complete all measures of mobility "as fast and safely as possible." They then performed 10 trials of the foot tap test (FTT, 10s rapid tapping) on each foot, with the distal half of their foot positioned on a force plate and the number of taps in each trial determined from the force data. Foot tap count from all 10 trials was used to assess within-day reliability of each foot using the coefficient of variation (CoV) and rmANOVA, with Bonferroni post-hoc analyses. The fastest trial for each mobility test was used to assess across-day reliability with intraclass correlations (ICC), CoV, and rmANOVA. **RESULTS:** Within-day CoV for the FTT showed good reliability for both feet (right: $7.4 \pm 1.1\%$, left: $6.5 \pm 1.0\%$). There was a significant within-day effect of trial number for the FTT ($p=0.02$) and post-hoc analyses revealed differences at visit 3 such that the right foot was faster in trial 1 than trial 8 (37.5 ± 2.4 vs. 33.8 ± 2.4 , $p=0.02$), and the left foot was faster in trial 1 than trial 10 (36.5 ± 3.0 vs. 33.6 ± 3.2 , $p=0.03$). No other within-day differences were observed. The ICC's for the 4 mobility tests varied across visits (25-foot walk: ≥ 0.95 ; TUG: ≥ 0.92 ; SSST: ≥ 0.94 ; FTT: ≥ 0.75). The CoV for the 25-foot walk (4.7%), TUG (6.7%), SSST (7.3%), and FTT (right: 6.5%, left: 7.3%) demonstrated good reliability. There were no differences across visits for the 25-foot walk, TUG, and FTT ($p > 0.05$). However, there was a difference across visits for the SSST ($p=0.02$), such that participants were quicker at visit 3 compared with visit 1 (8.0 ± 1.0 vs. 8.7 ± 1.0 s, $p < 0.05$). **CONCLUSIONS:** The 25-foot walk, TUG, and FTT appear more reliable than the SSST for quantifying mobility in the MS population.

2257 Board #270 June 1 3:30 PM - 5:00 PM
Effect of Exercise Training on Cellular Inflammation and Fitness in Individuals with Multiple Sclerosis

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Multiple Sclerosis (MS), an immune-mediated disease of the central nervous system (CNS), is characterized by chronic neuroinflammation and demyelination. Interleukin-6 (IL-6), a major cytokine released by monocytes and macrophages, promotes a robust downstream inflammatory cascade, including the release of C-Reactive Protein (CRP), a common clinical marker of inflammation. Physical activity is known to be protective against inflammation and recent evidence suggests that increasing soluble form of the receptor for advanced glycation endproducts (sRAGE) may be an additional mechanism by which this occurs. **PURPOSE:** To characterize the relationship between fitness and inflammatory markers (CRP, IL-6) in persons with MS, and to elucidate the effects of a 12-week home-based exercise program on inflammation, estimates of insulin resistance (HOMA-IR), circulating sRAGE, and fitness in persons with MS. **METHODS:** Forty-eight participants with MS (45 ± 2 yrs, 28.8 ± 0.9 kg/m², 35 females) were randomly assigned to either a home-based aerobic exercise program or an attention-control stretching group. The exercise intervention consisted of cycling 3-4 d/wk at 40-60% $\dot{V}O_{2\text{peak}}$ 30 min/d. $\dot{V}O_{2\text{peak}}$ was assessed using open-circuit spirometry on a cycle ergometer. Blood was drawn at baseline and following the 12-week intervention and plasma metabolites were assessed using commercially available ELISA kits. **RESULTS:** Baseline $\dot{V}O_{2\text{peak}}$ was negatively correlated with baseline plasma levels of CRP ($r=-0.43$, $p < 0.01$) and IL-6 ($r=-0.51$, $p < 0.01$). $\dot{V}O_{2\text{peak}}$ increased 8% in individuals with MS ($p < 0.001$), with no change in the attention-control group. No between or within group differences were observed for sRAGE, IL-6, CRP or HOMA-IR. **CONCLUSION:** Despite no effect of the exercise intervention, the relationship between $\dot{V}O_{2\text{peak}}$ and CRP, IL-6 at baseline suggest that higher fitness levels are advantageous to individuals with MS and may be related to the well-known anti-inflammatory effects of exercise. This relationship is promising for the use of exercise on modulating cellular inflammation in individuals with MS, however longer duration, higher intensity or supervised exercise may be necessary in order to elicit changes in circulating IL-6, CRP, sRAGE and HOMA-IR. Supported by the National Multiple Sclerosis Society RG 4702A1/2.

2258 Board #271 June 1 3:30 PM - 5:00 PM

Relationship Between Peak Power Asymmetry and Self-Reported Measures of Fatigue in People with Multiple Sclerosis

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Multiple Sclerosis (MS) is a disease of the central nervous system that has been associated with increased levels of fatigue. Recently, research has shown asymmetry in muscle function and performance in people with MS (PwMS) where one side of the body performs better than the other. Interestingly, and of clinical concern, would be how asymmetry might be associated with generalized fatigue. **Purpose:** The intent of this study was to correlate isometric knee extensor strength and peak power (PP) asymmetry scores to measures of fatigue in PwMS. **Methods:** Fourteen volunteers, eight with relapsing-remitting MS and six healthy controls without MS participated in the study. Participants completed a single leg incremental cycling test to determine peak power (PP) of each limb, as well as maximal voluntary isometric contractions of the knee extensors to determine strength (KES). The Modified Fatigue Impact Scale (MFIS), the Fatigue Severity Scale (FSS), and the Short Form Health Survey (SF-36) questionnaires were used to assess feelings of fatigue. A higher score on the MFIS and FSS indicates greater levels of fatigue, whereas a higher score on the SF-36 indicates better feelings of health. KES and PP asymmetry scores were calculated as weaker leg (more affected) / stronger leg; a lower score indicates a greater magnitude of imbalance. Pearson correlations were used to determine relationships between KES and PP asymmetry and all self-reported measures of fatigue. **Results:** The mean Expanded Disability Status Scale score was 2.6 ± 1.6 in the MS participants, indicating mild to moderate impairment. No significant correlations were observed between KES asymmetry scores and measures of self-reported fatigue. Significant correlations were observed between PP asymmetry scores and the MFIS physical sub-scale ($r = -0.554$; $p = 0.04$), the FSS ($r = -0.524$; $p = 0.05$), and the SF-36 (physical health subscale; $r = 0.606$; $p = 0.02$). **Conclusions:** Asymmetries in function (as measured by PP) and not strength appear to be significant contributors to self-reported measures of fatigue. This might suggest that assessments using a more dynamic measure such as peak power may be more appropriate compared to static strength. More importantly, preliminary findings suggest PP asymmetry appears to influence generalized fatigue in PwMS.

2259 Board #272 June 1 3:30 PM - 5:00 PM

Acute Effects of High-Intensity Interval Exercise on Physiological and Functional Outcomes in Multiple Sclerosis

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Multiple sclerosis (MS) is an immune-mediated disease of the central nervous system that results in physiological deconditioning and walking disability. High-intensity interval exercise (HIIE) has induced significant improvements in physiological conditioning in healthy and clinical populations. However, the effects of engaging in HIIE on cardiorespiratory functioning, gait, and walking performance in persons with MS who have mobility disability are relatively unknown. **PURPOSE:** To examine the effects of single sessions of recumbent stepping (HIIE) and continuous (CON) exercise on physiological and functional outcomes in persons with MS. **METHODS:** 5 participants with mild-to-moderate MS underwent HIIE and CON exercise bouts. The HIIE bout included 10 cycles of 1-min intervals at the wattage associated with 90% VO_{2peak} followed by 1-min recovery intervals at 15W, totaling 20 min in length. The CON bout consisted of 20 min at the wattage associated with 50-60% VO_{2peak} . Physiological measures were collected within session, and functional measures were collected pre-, immediately-post, and 10-minutes post-exercise. **RESULTS:** We observed significant differences between the CON and HIIE protocols for VO_2 ($t = -4.36$, $P = 0.01$), power output ($t = -4.20$, $P = 0.01$), and RER ($t = -7.24$, $P < 0.01$), with the HIIE condition inducing higher values than the CON condition. Heart rate approached a statistically significant difference between conditions ($t = -2.61$, $P = 0.06$). There were no significant interaction effects or effects of time or condition on walking speed and gait kinematics ($P > 0.05$). **CONCLUSIONS:** We determined that HIIE exercise taxes the cardiorespiratory system significantly more than CON exercise, yet without deleterious effects on walking and gait in persons with MS. This has important implications for informing an evidence-based exercise prescription in persons with MS who have walking impairments that is appropriate for improving physiological conditioning.

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Acute Physiologic Responses During Alternative Modes of Treadmill Exercise in Adults with Parkinson's Disease

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Parkinson's disease (PD) is a neurodegenerative condition characterized by muscle tremors, rigidity and dyskinesia leading to balance and gait abnormalities that could alter physiologic responses during exercise. Locomotion on an aquatic treadmill (ATM) or anti-gravity treadmill (AGTM) may be a safe alternative to exercise on a traditional land treadmill (LTM) in those with PD. **Purpose:** To determine the acute cardiovascular and metabolic responses to three different modes of treadmill exercise in older adults diagnosed with Parkinson's disease. **Methods:** Eight adults diagnosed with PD (68 ± 3 years of age) completed one exercise session on an LTM, one session on an ATM, and one session on an AGTM at 50% body weight. Participants walked from 1 to 3 mph in 0.5 mph increments at 0% grade during each exercise session. Heart rate (HR), energy expenditure (EE), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured at rest and during steady-state exercise at each speed on each treadmill. Rate of perceived exertion was also measured during steady-state exercise. Rate pressure product (RPP) was calculated. **Results:** All variables, with the exception of DBP, increased as speed increased across all treadmill modes ($p < 0.001$). Between treadmill modes across all speeds, EE was statistically different ($p = 0.025$). There was a significant interaction effect for mode and speed for HR ($p < 0.001$) and RPP ($p = 0.003$). At all speeds except 1.5 mph, HR was higher on the LTM versus the AGTM ($p < 0.05$). **Conclusion:** Exercising on an ATM or an AGTM elicits similar physiologic responses to exercise on an LTM in adults with PD.

Table 1: Heart rate response and rate pressure product at rest and at all speeds on each treadmill

Variable	Treadmill Mode	Rest	Treadmill Speed (mph)				
			1.0	1.5	2.0	2.5	3.0
HR (bpm)	LTM	73±11 ^a	84±17 ^{ab}	86±18 ^{bc}	92±16 ^d	99±16 ^e	107±18 ^f
	ATM	72±11 ^a	77±14 ^a	80±17 ^{ab}	83±17 ^{ab}	90±13 ^b	97±10 ^b
	AGTM	73±11 ^a	80±15 ^{ab}	83±16 ^{bc}	85±14 ^{cd}	88±13 ^{bcde}	93±15 ^{cde}
RPP	LTM	91±26 ^{ab}	106±32 ^a	112±38 ^{ab}	123±37 ^b	135±36 ^c	149±42 ^d
	ATM	89±14 ^{ab}	97±21 ^a	107±36 ^{bc}	106±27 ^a	118±28 ^{bc}	130±29 ^c
	AGTM	91±19 ^a	102±22 ^{ab}	108±25 ^{bc}	111±24 ^c	116±25 ^{bc}	126±28 ^d

Values are mean ± s.d. Means with the same superscript are statistically similar ($p > 0.05$). ATM = aquatic treadmill; AGTM = anti-gravity treadmill; LTM = land treadmill; HR = heart rate; RPP = rate pressure product.

2261 Board #274 June 1 3:30 PM - 5:00 PM

Changes in Balance, Gait and Motor Control Following Treadmill Exercise in Adults with Parkinson's Disease

Marco Avalos, Brandon R. Rigby, Ronald Davis, Kevin Becker, David Nichols, FACSM, Nicholas Levine, Leah Goudy, Patricia Moo, Cecil Frederick, Desiree Patterson, Mitchell Robuck, Gena Guerin, Kristen Codish, Karrie Beck, Georgette Reyes, Doris Patino, Brenda De La Cruz. *Texas Woman's University, Denton, TX.*
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(No relationships reported)

Locomotion on an aquatic treadmill or anti-gravity treadmill may be a safe and effective alternative to exercise on a traditional land treadmill in those with Parkinson's disease as the removal of body weight in these environments may allow the participant to exercise with less concern of falling at higher speeds before reaching volitional fatigue. **Purpose:** To determine the training effects of three different treadmill modalities on dynamic balance, gait, and fine motor control in older adults diagnosed with Parkinson's disease. **Methods:** Ten adults diagnosed with Parkinson's disease (70 ± 5 years of age) completed 8 exercise sessions (4 weeks, 2x/week) each separately on a land treadmill, aquatic treadmill, and anti-gravity treadmill at 50% body weight. Two weeks separated each intervention and the order was randomized. A 4-week control period occurred at the start of the study in which no treadmill exercise was performed. Each exercise session included a 2-minute warm-up and 30 minutes at a moderate intensity. Before and after each intervention, balance, gait and fine motor control were measured. Dynamic balance and gait were assessed using a Timed-Up-and-Go test

and Performance Oriented Mobility Assessment (POMA). Fine motor control was assessed with the Purdue Pegboard Test. **Results:** The gait assessment of the POMA was significant across all time points ($p = 0.028$). All other variables were statistically similar ($p > 0.05$) across all time points. **Conclusion:** Exercising on a traditional land treadmill, aquatic treadmill, or anti-gravity treadmill for 60 min/week for 4 weeks at a moderate intensity did not alter balance, gait or fine motor control in adults with Parkinson's disease.

Variable	Pre-Control	Post-Control	Post-LTM	Post-ATM	Post-AGTM
TUG (s)	8.4±1.4	9.3±3.3	8.5±2.6	7.9±2.1	8.8±3.6
POMA Balance	13.5±3.0	14.3±1.2	13.5±2.3	14.3±2.0	14.0±1.6
POMA Gait*	10.3±1.6	9.2±3.1	11.7±1.5	10.8±2.3	10.8±0.9
FMC (left hand)	8.7±3.2	9.1±2.8	9.0±3.4	8.8±2.8	9.0±3.2
FMC (right hand)	8.4±3.3	8.6±3.0	9.2±2.7	10.1±2.8	9.8±2.6
FMC (both hands)	6.1±2.4	6.6±2.7	7.3±2.9	6.8±2.2	6.2±1.9

Values are mean ± s.d. * = main effect for time point ($p = 0.028$); ATM = aquatic treadmill; AGTM = anti-gravity treadmill; LTM = land treadmill; TUG = timed-up-and-go; POMA = performance oriented mobility assessment; FMC = fine motor control.

D-73 Free Communication/Poster - Oxygen Uptake Kinetics

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2262 Board #275 June 1 3:30 PM - 5:00 PM Oxygen Uptake during Three Varying Duration High-Intensity Functional Training Sessions

Jesse A. Stein, Joshua R. Smith, Carl J. Ade, Ryan M. Broxterman, Brian Sanborn, Thomas J. Barstow, FACSM, Katie M. Heinrich. *Kansas State University, Manhattan, KS.*
(No relationships reported)

PURPOSE: To determine oxygen uptake during three varying duration high-intensity functional training (HIFT) sessions. **METHODS:** Six healthy men with >1 year of HIFT experience were recruited (age:29±5 yrs). Participants completed an incremental exercise test on a treadmill to determine maximal oxygen consumption ($\dot{V}O_{2max}$), gas exchange threshold (GET), and respiratory compensation point (RCP). Participants completed three HIFT sessions. Session 1 (S1) consisted of 3 rounds of power cleans and ring dips. Session 2 (S2) consisted of 3 rounds of a 400-meter run, 21 kettlebell swings and 12 pull-ups. Session 3 (S3) consisted of as many rounds as possible of 5 pull-ups, 10 push-ups and 15 squats in 20 minutes. Participants were encouraged to complete S1 and S2 as fast as possible, while performing as many repetitions as possible in S3. Pulmonary gas exchange ($\dot{V}O_2$, $\dot{V}CO_2$, VE) were measured during each session. **RESULTS:** The mean $\dot{V}O_{2max}$ was 55.9±5.6 mL/kg/min with GET and RCP representing 61% and 79% of $\dot{V}O_{2max}$ respectively. The average time to complete S1 was 513±59s and elicited a mean % $\dot{V}O_{2max}$ of 70±7% that was not different from GET or RCP ($p > 0.05$). S2 required on average 783±79s to complete, with a mean % $\dot{V}O_{2max}$ of 82±7% of $\dot{V}O_{2max}$ that was significantly higher than GET ($p < 0.05$), but not different compared to RCP ($p > 0.05$). Mean % $\dot{V}O_{2max}$ across S3 was 66±6%, however the average % $\dot{V}O_{2max}$ was significantly higher than GET ($p < 0.05$) at minutes 2-8, but not different at any other interval and was not different compared to RCP ($p > 0.05$). Furthermore, $\dot{V}O_2$ demonstrated significant oscillations during all sessions ($p < 0.05$). **CONCLUSIONS:** Participants with HIFT experience who completed sessions as quickly as possible or performed as many rounds as possible elicited an oxygen consumption from 66-82% of $\dot{V}O_{2max}$. Moreover, the oscillating $\dot{V}O_2$ during HIFT suggests that metabolic demands, which ranged from 46-92% of $\dot{V}O_{2max}$ within-subjects, do not achieve a steady-state. Previous work suggests that the oscillating $\dot{V}O_2$ response could be a potent stimulus for improving health and fitness characteristics.

2263 Board #276 June 1 3:30 PM - 5:00 PM Characterization of Ventilatory Off-Kinetics Following Arm and Leg Cycling in Incomplete Spinal Cord Injured Men

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Introduction: The minute ventilation (\dot{V}_E) off-kinetics phase has been associated with greater muscle oxygen deficiency and slower muscle oxygen adjustments to exercise. Neural mechanisms are implicated in \dot{V}_E off-kinetics as recovery from exercise may be mediated by breathing frequency. Motor incomplete spinal cord injury (miSCI) is associated with significant cardiopulmonary impairment that may alter the off-kinetic response during arm and leg exercise. **Purpose:** The purpose of this study was to characterize the \dot{V}_E off-kinetics following both arm and leg exercises in adults with cervical miSCI compared to a group of age matched peers (CON). **Participants:** miSCI: Age: 31 (18.1) years, Height 185.7 (6.0) cm, Weight 75.9 (14.4) kg. CON: Age: 32 (4.6) years, Height: 178(3.6)cm, Weight 92.9(16.3) kg **Methods:** Both groups completed arm and leg cycle tests on separate days at an intensity that elicited a \dot{V}_E equal to 30% of measured maximum voluntary ventilation ($MVV \times L \cdot min^{-1}$). \dot{V}_E off-kinetics was analyzed over the 5 minutes following the 30% MVV bout using a mono-exponential model. Amplitude (Amp), in liters (L), was defined as the change from exercise to steady state of asymptote approaching baseline and tau(τ)(seconds) as the time taken to reach 63% of the of the end-recovery amplitude. **Results:** miSCI group: τ (s) and Amp(L) for arm and leg cycling were as follows: 67.9(9.8) and -20.5 (11.53), and 101.6 (19.5) and -23.4(14.5). The average arm τ was 33.7(29.27) faster than leg cycling with a 2.8(9.41) liter decrease in amplitude. CON group: τ (s) and Amp(L) for arm and leg cycling were as follows: 56.7(5.9) and -43.4(4.4) and 90.13 (17.83) and -49.2(4.9), respectively. On average, arm τ was 33.39(16.5) seconds faster than leg cycling while the Amp was 5.8(3.29) liters lower. On average, τ was 11.19 and 11.50 s slower for arm and leg cycling, respectively when compared to CON. Amplitude was also lower with 22.8 and 25.8 liter difference in arm and leg cycling, respectively. **Conclusion:** The miSCI group reported a longer τ following both arm and leg exercise than the CON group suggesting a prolonged recovery phase. A prolonged \dot{V}_E off-kinetic phase may, in part, contribute to reduced functional performance in adults with chronic miSCI. Character count w/o spaces: 1907/2000

2264 Board #277 June 1 3:30 PM - 5:00 PM Prior Supramaximal Cycling Transiently Increases Submaximal Cycling Energetics in Cyclists and Non-cyclists

Eric Homestead, William C. Byrnes, FACSM. *University of Colorado Boulder, Boulder, CO.* (Sponsor: William C. Byrnes, FACSM)
(No relationships reported)

PURPOSE: We sought to examine the effects of supramaximal cycling on the energetics of submaximal cycling at and below the lactate threshold (LT) in cyclists and non-cyclists. **METHODS:** On 3 separate days, endurance-trained cyclists (CYCL, n=10) and recreationally active non-cyclists (N-CYCL, n=9) performed 3 sub-LT cycling bouts at 60%, 80%, and 100% LT before (PRE) and after (POST 1, POST 2, and POST 3) supramaximal cycling bouts (3x2 min) at 110% of power at $\dot{V}O_{2peak}$ (SUPRA). POST 1, POST 2 and POST 3 occurred 2, 22, and 52 min after SUPRA. Metabolic variables, core temperature (T_c), and blood lactate concentration ([Lactate]) were measured. $\dot{V}O_2$ -power and EE-power linear relationships were developed for each subject from the 3 intensities and compared between conditions (PRE, POST 1, POST 2 and POST 3). **RESULTS:** $\dot{V}O_{2peak}$ and power at LT were significantly higher by 51% and 131% in CYCL compared to N-CYCL ($p < 0.01$). CYCL and N-CYCL responded the same across conditions so the estimated marginal means are reported which combines groups. $\dot{V}O_2$ was significantly greater during POST 1 compared to PRE, POST 2, and POST 3 regardless of intensity (2.0±0.5 vs. 1.8±0.5, 1.8±0.5, and 1.8±0.5 L·min⁻¹, $p < 0.05$). $\dot{V}O_2$ -power slopes were different between conditions ($p < 0.05$), but not when EE-power slopes were analyzed. The $\dot{V}O_2$ -power intercept during POST 1 was significantly greater compared to PRE, POST 2, and POST 3 (0.68±0.25 vs. 0.58±0.20, 0.55±0.19 and 0.53±0.20 L·min⁻¹, $p < 0.05$). The same results were found for EE-power intercepts. \dot{V}_E , HR, and T_c were significantly higher during POST 1 compared to PRE ($p < 0.05$). Only HR and T_c were higher during POST 2 and POST 3 compared to PRE ($p < 0.05$). [Lactate] increased from PRE to POST 1 and then progressively decreased over time ($p < 0.05$). **CONCLUSION:** Prior supramaximal cycling increases the energetic cost of submaximal cycling (at and below LT) in endurance-trained cyclists and recreationally active non-cyclists. For both groups, energy cost returns to baseline values within 20 minutes. No change in the EE-power slope and a greater EE-power intercept during sub-LT cycling immediately following supramaximal cycling suggests that muscle efficiency was unaltered and that the greater energetic cost is associated with metabolic demands that do not increase with increasing workrate.

2265 Board #278 June 1 3:30 PM - 5:00 PM
Do Training Masks Enhance Oxygen Utilization Capacity?
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(No relationships reported)

PURPOSE: High-altitude or oxygen-limited training has received a lot of attention as a way to increase oxygen utilization capacity. Due to the impracticality involved in traveling to high altitudes, endurance athletes and coaches have employed methods of simulating high-altitude (low-oxygen) conditions as an effective alternative. Some low-oxygen devices may not be available to all due to prohibitive cost or inconvenience. A recent simple alternative is altitude-simulating masks. However, the effectiveness of these masks is in question. This research looks at the effect of masked training on VO₂max and hematocrit levels.

METHODS: 14 subjects participated in a 6-week interval-training experiment. Subjects VO₂max, hematocrit, and lactate levels were measured. Half of the subjects were given a training mask and asked to complete 3 workouts per week in the range of 60%-80% of VO₂max. The control group was given the same task of working out 3 times a week without a mask. Hematocrit and VO₂max were measured after the 6 weeks of training and analyzed for significant differences.

RESULTS: There was no difference between the pre and post-training VO₂max values in the masked and no-mask groups. There was no difference in the percent change in VO₂max between the two groups. The no-mask group experienced a +8.974% change in hematocrit while the masked group had a decrease in hematocrit of 1.194% after training. There was a significant difference in how the two groups hematocrit levels responded to training. **CONCLUSIONS:** We found no support for the use of training masks helping athletes use oxygen better than using no mask at all. Perhaps training masks may help athletes use oxygen more effectively if they used them for longer than 6 weeks. A training protocol of longer duration would likely yield more conclusive results.

2266 Board #279 June 1 3:30 PM - 5:00 PM
High Intensity Interval Training (HIT) Increases Muscle Deoxygenation During Ramp Incremental Exercise.
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Endurance exercise training increases whole-body maximum O₂ uptake (V_{o₂peak}) by increasing both convective and diffusive O₂ conductances within the active muscles. High intensity interval training (HIT) very effectively increases V_{o₂peak} but it is unknown whether HIT enhances muscle O₂ diffusive properties.

PURPOSE: We investigated the effect of HIT on deoxygenated hemoglobin and myoglobin (Hb+Mb) concentration (HHb, reflecting fractional O₂ extraction) and total Hb+Mb concentration (tHb, reflecting diffusive O₂ potential) in quadriceps during ramp-incremental cycling (RI) using quantitative time-resolved near-infrared spectroscopy (TRS-NIRS).

METHODS: Fifteen men volunteered for exercise training (TR, n = 8) or non-training control (CN, n = 7). TR performed HIT (4 repeats of 30 s all-out sprint cycling and 4 min recovery) 3 times/week, for 5 weeks. All subjects performed RI to exhaustion pre- and post-intervention. V_{o₂} was measured breath-by-breath. Absolute HHb and tHb were measured in the *vastus lateralis* (VL) and *rectus femoris* (RF) by TRS-NIRS. HHb and tHb profiles were modeled by a double linear response ($y_1 = m_1 * x + b_1$, $y_2 = m_2 * x + b_2$, $y = if [x < IP, y_1, y_2]$), where m_x is the slope of heme chromophore accumulation above and below an inflection point, (IP).

RESULTS: V_{o₂peak} increased in TR (48.9±4.6 vs. 52.7±5.3 ml·kg⁻¹·min⁻¹, p < 0.05) but not in CN (46.1±8.9 vs. 45.2±10.1 ml·kg⁻¹·min⁻¹). The amplitude of HHb from rest to intolerance increased only in TR, in both the VL and RF muscles (29.5±13.5 vs. 34.8±13.7 μM, mean of both sites, p < 0.05). In contrast, post-training tHb amplitude was unchanged in both groups and both muscles. Moreover the slopes (m₁, m₂) of HHb and tHb were unchanged between pre- and post-intervention in either group or muscle.

CONCLUSIONS: Five weeks of HIT increased V_{o₂peak} and regional (VL and RF) muscle deoxygenation without altering HHb slope or peak tHb - reflecting a gain of O₂ flux to active muscle with an unchanged O₂ delivery to utilization matching during submaximal exercise and an unchanged diffusive O₂ potential. This supports the notion that greater muscle O₂ consumption following HIT in young adults occurs by the improvement of O₂ extraction capacity without an obligatory [Hb]-induced enhancement of diffusive O₂ conductance. Supported by JSPS-15K16476, 24247046, 26560362.

2267 Board #280 June 1 3:30 PM - 5:00 PM
Relationship Between SMO₂ Measured By NIRS And VO₂ During Severe Intensity Intervals Of Running
 Lee Shearer, Kaitlin Bruneau, Sun Lee, Kristine Knowles, Randolph E. Hutchison. *Furman University, Greenville, SC.*
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(No relationships reported)

Near infrared spectroscopy (NIRS) has been shown to be a non-invasive wearable alternative to measured blood oxygenation levels. **PURPOSE:** The purpose was to determine whether a significant relationship exists between SMO₂% and VO₂ during the last two stages of treadmill interval testing past LT₁. **METHODS:** Five volunteer members of a collegiate cross country team, (2 male, 3 female, 18.6±1.5 years, 169.4±10.9 cm, 61.3±7.8 kg) completed a maximal effort stepwise test to volitional exhaustion. Each subject was fitted with a calf sleeve containing the BSX NIRS Insight device, a ventilatory mask connected to the COSMED system, and a heart rate monitor. After a 5 minute recovery pace warm up, the subject ran four minute intervals, each increasing 0.4 mph in pace, with a one minute standing recovery period between each four minute stage. After blood lactate levels increased 1.5 millimoles from baseline levels, the final stage consisted of one-minute periods with the incline increased by 1 percent each minute, until volitional exhaustion ending the test. **RESULTS:** A Pearson correlation coefficient was calculated for the relationship between each participant's SMO₂% and VO₂ during the final ramp stage, the 4 minute stage preceding the ramp stage, and for those two stages combined. A strong negative correlation was found for each participant's total rest data, ranging from r = -0.660 to -0.925, and an average +/- standard deviation of -0.852±0.110. All correlations were significant at p<.01, indicating a significant linear relationship between the two variables. **CONCLUSIONS:** The study suggests that the BSX Insight device is a valid option for non-invasively measuring SMO₂% during ventilatory maximal interval training. Given that the study concentrated on elite runners, further testing would need to be done to generalize the results to a larger population.

Pearson Correlation SMO ₂ vs. VO ₂		
Subject	Pearson Correlation	P value
1	-0.890	p<.01
2	-0.867	p<.01
3	-0.919	p<.01
4	-0.925	p<.01
5	-0.660	p<.01
Mean	-0.852 ± 0.110	* all values significant

2268 Board #281 June 1 3:30 PM - 5:00 PM
Relationship Between SMO₂ Measured By NIRS And VO₂ During Recovery Periods Of Running
 Kaitlin Bruneau, Lee Shearer, Sun Lee, Kristine Knowles, Randolph E. Hutchison. *Furman University, Greenville, SC.*
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(No relationships reported)

Near infrared spectroscopy (NIRS) has been shown to be a non-invasive wearable alternative to measure blood oxygenation levels. **PURPOSE:** The purpose was to determine whether a significant relationship exists between SMO₂% and VO₂ during recovery periods of treadmill interval testing. **METHODS:** Six volunteer members of a collegiate cross country team, (3 male, 3 female, 18.8±1.5 years, 171.6±11.1 cm, 63.0±8.1 kg) completed a maximal effort stepwise test to volitional exhaustion. Each subject was fitted with a calf sleeve containing the BSX NIRS Insight device, a ventilatory mask connected to the COSMED system, and a heart rate monitor. After a 5 minute recovery pace warm up, the subject ran four minute intervals, each increasing 0.4 mph in pace, with a one minute standing recovery period between each four minute stage. After blood lactate levels increased 1.5 millimoles from baseline levels, the final stage consisted of one minute periods with the incline increased by 1 percent each minute, until volitional exhaustion ending the test. **RESULTS:** A Pearson correlation coefficient was calculated for the relationship between each participant's SMO₂% and VO₂ during each one minute recovery period and for all the rest periods combined. A strong negative correlation was found for each participant's total rest data, ranging from r = -0.518 to -0.949, and an average +/- standard deviation of -0.772 +/- 0.158. All correlations were significant at p<.01, indicating a significant linear relationship between the two variables. **CONCLUSIONS:** The study suggests that the BSX Insight device is a valid option for non-invasively measuring SMO₂% during ventilatory recovery. Given that the study concentrated on elite runners, further testing would need to be done to generalize the results to a larger population.

Pearson Correlation SMO ₂ vs. VO ₂		
Subject	Pearson Correlation	P value
1	-0.763	P<0.01
2	-0.711	P<0.01
3	-0.928	P<0.01
4	-0.949	P<0.01
5	-0.518	P<0.01
6	-0.764	P<0.01
Mean(SD)	-0.772 ± 0.158	* all results significant

2269 Board #282 June 1 3:30 PM - 5:00 PM
The Effect Of Stride Frequency On Running Economy In Collegiate And Recreational Runners

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 (No relationships reported)

Running economy (RE) is often a good predictor of running performance among athletes with a similar VO₂ max. Additionally, economy differences have been seen when comparing elite distance runners to recreational runners. **PURPOSE:** To explore the effect that varied stride frequencies (SF) have on RE in both collegiate and recreationally trained runners. **METHODS:** Four collegiately trained male distance runners and four college-aged recreational runners ran on a treadmill at speeds of 3.9 m/s and 2.7 m/s, respectively, which corresponded with 60 to 65% of their VO₂ max. Subjects completed 5 bouts of running for 5 minutes at their preferred stride frequency (PSF), ±5%, and ±10% of their PSF, in a random order. The first three minutes of each trial were used to match the prescribed stride frequency and to reach a steady state, the last 2 minutes were used for data analysis. Subjects were given three minutes between trials to recover from the prior prescribed SF session. PSF was determined prior to data collection and prescribed stride frequencies were defined with a metronome. Subjects were given a familiarization phase prior to data collection to aid in matching the prescribed SF and video was used to verify that prescribed SF was achieved. **RESULTS:** Mean VO₂ differences in collegiately trained runners were significant (p < 0.05) in all but one of the trials (-5% of SF) where p = 0.07. There was a U-shaped relationship that was observed between SF and running economy in collegiate runners, where any variation above or below PSF resulted in a decrease in RE. In all cases, however, the collegiately trained runners' PSF corresponded to what was most economical. Recreational runners saw mean VO₂ differences that were only significant (p < 0.03) when running at a SF that was below their PSF, where some subjects experienced a small but not statistically significant (p = 0.06) improvement in RE as SF increased. **CONCLUSION:** Experienced runners tend to have a PSF that corresponds with what is most economical, whereas lesser trained, recreational runners could potentially see improvements in RE from an increase in SF.

2270 Board #283 June 1 3:30 PM - 5:00 PM
Comparison Of Energy Expenditure Between Continuous Walking And Very Short-Bouts Of Intermittent Walking

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 (No relationships reported)

Since the 1995 physical activity guidelines, a number of studies investigated as to whether a single bout of continuous exercise and several intermittent (i.e. accumulated) bouts of exercise produced the same physiological responses and health benefits. Various studies focused on walking and compared the physiological responses between a single bout of continuous walking and during multiple 10-min bouts of intermittent walking. However, no study investigated the energy expenditure (EE) accumulated during very short bouts of intermittent walking (e.g., 30 s), which would better match with the daily life walking pattern. **PURPOSE:** to compare EE accumulated during a continuous walking exercise (CW) and during an intermittent walking exercise (IW) including very short bouts of walking. **METHODS:** Ten healthy young adults (F/M: 5/5; 22±1 years; 67.9±8.2 kg; 176±8 cm) performed, in a counter-balanced randomized order, two treadmill walking trials of 20 min each: i) Trial A: one 10-min bout of CW followed by a 10-min recovery bout in standing position; ii) Trial B: twenty 30-s walking bouts (20 x 30 s = 10 min) interspersed with twenty 30-s recovery bouts in standing position. For both walking trials, subjects walked at the same absolute intensity on a motorized treadmill: speed of 5.5 km/h and 0% grade. EE (kcal) was calculated from gas exchange measured using a portable metabolic system (K4b²). **RESULTS:** the EE accumulated during the 10-min single bout of CW (54.72±8.87

kcal) was significantly higher than the EE accumulated during the twenty 30-s recovery bouts of the IW (43.37±10 kcal; P<0.05). The EE accumulated during the 10-min recovery bout following CW (21.13±6.58 kcal) was significantly lower than the EE accumulated during the 20 recovery bouts of IW (38.50±9.42 kcal; P<0.05). No difference was found between the whole continuous and intermittent walking trials regarding total EE (78.97±14.58 kcal vs. 82.15±19.08 kcal respectively, P=0.185). **CONCLUSION:** A low absolute intensity intermittent exercise of walking, including bouts of very short-duration, enables young adults to reach a similar total EE as during a continuous walking exercise. While additional studies are needed, this study opens interesting applications not only in healthy subjects but also in very deconditioned or functionally-impaired subjects.

2271 Board #284 June 1 3:30 PM - 5:00 PM
Submaximal Predictions for Maximum Heart Rate and Maximal Oxygen Uptake from a Dynamical System Model

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Cardiopulmonary exercise testing (CPET) is the gold standard method for assessing maximum heart rate (HR_{max}) and maximal oxygen uptake (VO_{2max}). However, performing a CPET is not always practical or feasible. Alternative methods that utilize submaximal protocols and non-exercise regression models have been developed to estimate HR_{max} and VO_{2max}. However, these methods fail to account for inter-individual variability and are associated with a large degree of uncertainty and error. **PURPOSE:** The aim of this study was to develop a novel method for estimating HR_{max} and VO_{2max} that applies a dynamical system model to data collected from a submaximal exercise protocol. The dynamical system model accounts for the nonlinear dynamics and inter-individual aspects of the heart rate and oxygen uptake responses. **METHODS:** Twelve regularly exercising healthy adult males performed a CPET on a cycle ergometer to determine their true HR_{max} and VO_{2max}. Participants then performed a submaximal bout of exercise, and the dynamical system model was applied to the time series data in conjunction with a heuristic parameter estimation algorithm to estimate the participants' HR_{max} and VO_{2max}. **RESULTS:** The submaximal dynamical system model predictions were compared to the true maximal values for HR_{max} (R² = 0.96, SEE = 2.4 bpm) and VO_{2max} (R² = 0.93, SEE = 2.1 mL/kg/min). **CONCLUSIONS:** A dynamical system model that accounts for nonlinear dynamics and inter-individual physiological aspects can provide accurate submaximal predictions for HR_{max} and VO_{2max}. Supported by the ARO through an NDSEG Fellowship.

2272 Board #285 June 1 3:30 PM - 5:00 PM
Single Sprint Interval Training Session Induces Faster VO₂ Kinetics that is Sustained for 72 Hours

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The VO₂ kinetics response describes the rate of adjustment of the oxidative phosphorylation, providing an overall estimate of the efficiency of the cardiovascular system. Recent lines of evidence have demonstrated that, at least in young individuals, VO₂ kinetics can become faster even after only a single session of endurance training, likely due to improvement in the provision of oxygen (O₂) to the active tissues. Additionally, sprint interval training (SIT) has been shown to induce positive adaptations in oxidative metabolism. However, the effects of an acute bout of exercise, and more specifically SIT, in the VO₂ kinetics response of older individuals are unknown. **PURPOSE:** to investigate whether a very short session (3 bouts) of Sprint Interval Training (SIT) induces speeding of the VO₂ kinetics in older participants. **METHODS:** Before, as well as 24, 48, and 72 hours post SIT exercise intervention, the time-constant of the VO₂ kinetics response (τVO₂) was measured in eight older adults (67.3 ± 3.7 years; 21.5 ± 2.4 BMI) through three step transitions in work rate (WR) from 20 W to a moderate-intensity WR that elicited a VO₂ corresponding to 90% of the gas exchange threshold. The SIT session consisted of 3 consecutive "all-out" sprints (Wingate protocol) against a resistance corresponding to 5% of the body weight, interspersed by 4.5 min recovery. **RESULTS:** The average mean power throughout the three Wingate sprints was 366 ± 74 W, while the average peak power was 602 ± 106 W, and the average total work was 22.0 ± 4.4 kJ·min⁻¹. τVO₂ at the baseline was 41.8 ± 5.9 s. Significantly (p < 0.05) smaller values in τVO₂ kinetics were found 24 h (35.0±4.9 s; -16.2%), 48 h (35.5±3.4 s; -15.1%), and 72 h (37.2±7.2

s; -10.9%) post SIT intervention. **CONCLUSIONS:** This study demonstrated that a “low-volume” SIT session has the potency to speed the rate of adjustment of the oxidative phosphorylation in older adults. Despite the low dose of exercise, the speeding of the VO₂ kinetics occurred within 24 h and was sustained for 72 h, reinforcing the idea that SIT offers beneficial effects to the oxidative system, and that older individuals are capable of favorably adapting to this type of interventions.

was observed among duration of EPOC (steady-state = 11±2.75 min, maximal effort = 12.6±2.76 min, p=0.129). The time of completion for the maximal climb was 22% faster than the steady-state climb (7:47.3min±0.002).

CONCLUSIONS: A 23% increase in oxygen post-exercise was observed in the rapid trial despite being completed 22% faster (7:47min±0.002). Our results extend the noted increase in EPOC with rising intensity to climbing activities.

2273 Board #286 June 1 3:30 PM - 5:00 PM
VO₂, RER, And Heart Rate During Recovery Following A Whole-body High-Intensity And Moderate-Intensity Workout
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Whole-body high-intensity interval training (WB HIIT), including CrossFit®, has gained wide popularity, partly because HIIT benefits can be achieved in less time than moderate-intensity exercise. Most HIIT research, however, has used bicycle ergometer or treadmill-based exercises that emphasize only the lower body. **PURPOSE:** To compare heart rate (HR), respiratory exchange ratio (RER), and VO₂ following a 10-minute functional, WB HIIT CrossFit® workout and a 20-minute steady-state, moderate-intensity workout. **METHODS:** Fourteen CrossFit® athletes (11 F/3 M) aged 36.6±9.2y performed a 20-minute rowing ergometer exercise at 70% +5 bpm of age-predicted max and a 10-minute WB HIIT workout consisting of as many continuous reps as possible of 10 barbell thrusters (men 75lbs/women 55 lbs) and 10 burpees over the barbell, on separate days. VO₂ and RER were measured using indirect calorimetry immediately following each exercise and throughout recovery until VO₂ and RER returned to pre-workout levels. Heart rate was continuously monitored. Differences in time to return to baseline for VO₂ and RER between the two modalities were determined using dependent t-tests (p<0.05). **RESULTS:** Participants achieved 96.4±4.4% of age-predicted max HR during the WB HIIT workout, classifying it as a max-effort exercise. Time to return to resting RER values between the two workouts was significantly different (19.1±3.8 ml/kg/min after rowing vs. 32.5±5.4 min after WB HIIT, p<0.001). Peak VO₂ levels immediately after exercise also differed (19.5±4.8 ml/kg/min after rowing vs. 32.9±6.0 ml/kg/min after WB HIIT, p<0.001), as did the time for VO₂ recovery (8.2±1.6 min after rowing vs. 22.3±7.7 min after WB HIIT, p<0.001). **CONCLUSION:** RER and VO₂ remained elevated over 11 and 14 min longer, respectively, following WB HIIT, despite half the workout time. This is likely due to a longer time to restore ATP-PC stores, recycle lactate, and reduce body temperature. Heart rate remained elevated following the observed recovery period after WB HIIT suggesting a higher EPOC and caloric expenditure compared to moderate-intensity exercise. Our equipment prevented the measurement of VO₂ during the workout, so future research should use equipment that would allow for testing VO₂ during WB HIIT exercise so that EPOC can be accurately calculated.

2275 Board #288 June 1 3:30 PM - 5:00 PM
Transitioning To Minimalist Footwear To Improve Running Economy: A Randomized Controlled Trial.
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While recent research debates the potential benefits and risks of barefoot and simulated barefoot running, the long-term effects on biomechanical and physiological parameters remain unclear. **PURPOSE:** To investigate the effects of transitioning from traditional cushioned (CF) to minimalist footwear (MF) on running economy (RE) in recreational runners. **METHODS:** We used a prospective randomized controlled design. Thirty-two habitual shod recreational male runners (mean ± SD age 38.3 ± 8.5 years, length 178 ± 5.1 cm, weight 78.2 ± 11.2 kg, BMI 24.34 ± 2.9 kg/m² and weekly mileage of 53.1 ± 29.8 km) were allocated randomly in either an eight weeks training intervention in minimalist (=intervention) or cushioned running shoes (=control). The intervention consisted of a gradually increase of the new footwear (CF or MF) by 5% of weekly mileage per week. Before and after the intervention a VO₂max test and seven days apart a submaximal RE test at 70%, 80% and 90% of vVO₂max in both shoe conditions were conducted. Steady state oxygen consumption during the last of five minutes was captured and used to calculate the relative oxygen consumption per distance and bodyweight. A paired sample t test was used to determine differences between pre and post interventional RE values. **RESULTS:** The oxygen consumption of the intervention group showed a reduction in all tested conditions. The intervention group showed a statistically significant reduction from 222.4 to 217.5 mL·kg⁻¹·km⁻¹ (p=0.0479) for running in MF at 90% of vVO₂max. Interestingly, the VO₂ values were also reduced for the intervention group (training in MF) when running with CF at 80% (from 228.4 to 221.8 mL·kg⁻¹·km⁻¹, p=0.0186) and 90% (from 222.9 to 217.9 mL·kg⁻¹·km⁻¹, p=0.02) of vVO₂max. For all other stages and the control group (training in CF) no significant differences were observed. Five participants in the control and two participants in the intervention group did not finish the study (respectively one injury per group). **CONCLUSION:** In this study, transitioning to MF improved the RE for running in MF and in CF. Within the debate of pros and cons of (simulated) barefoot running, this adds evidence for improvements when transitioning gradually in small steps over 8 weeks to MF. Future research should investigate dose-response relationships and effects on running performance.

2274 Board #287 June 1 3:30 PM - 5:00 PM
Excess Post-Exercise Oxygen Consumption Following Bouts of Moderate and Vigorous Climbing
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PURPOSE: It has been observed that sustained, steady-state, rock climbing elicits a mean oxygen consumption (VO₂) of 20-25ml·kg⁻¹·min⁻¹ and VO₂ remains elevated into the post-climb recovery period for as much as 10-min (1). To our knowledge, the extent of metabolic recovery time has not been examined following vigorous climbing activity. The purpose of this investigation was to compare excess post-exercise oxygen consumption (EPOC) following bouts of rock climbing at moderate intensity and vigorous intensity. **METHODS:** Ten experienced climbers (male=7, female=3, age: 24.5±5, height: 177.4±8.4cm, mass: 70±11.25kg) performed 15min of seated rest to obtain baseline VO₂ measures, followed by an indoor rock-wall climb at a self-regulated moderate pace for 10min while connected to the Cosmed k4b2 portable metabolic analyzer. Recovery VO₂ was recorded for 15min immediately following the climb. A climb of maximal effort was then conducted across the same distance covered in the steady-state climb and VO₂ was recorded for 15min immediately following the maximal climb. All testing was performed in the morning between 0600-1000h. EPOC duration and the magnitude were calculated for both climbs. A within-subjects dependent paired-samples t-test was used for data analysis (p≤0.05). **RESULTS:** Significance was observed for EPOC magnitude (steady-state = 65.93±25.32 mL O₂, maximal effort = 85.88±23.24 mL O₂, p=0.23). No significance

2276 Board #289 June 1 3:30 PM - 5:00 PM
Strong Association Between Cardiorespiratory Fitness and Lipoprotein Subclass Pattern in Prepubertal Healthy Children
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Both serum lipoprotein subclass pattern and cardiorespiratory fitness (CRF) are strong predictors of cardiovascular (CV) health in adults. By means of chemical measurements techniques and multicomponent data analysis more detailed descriptions of lipoprotein distributions can now be acquired. These sophisticated methods allow for a better understanding of how CRF impacts CV health through its association to lipoprotein pattern. **Purpose:** Determine the association between lipoprotein subclass pattern and CRF in prepubertal children by using a combination of sophisticated chemical measurements techniques and multicomponent data analysis. **Methods:** Serum concentrations of lipoprotein subclasses were quantified in 94 (64% boys) ethnic rural Norwegian 10-year-old children. Twenty-four lipoprotein features were used as input to multivariate regression analysis to investigate the underlying pattern describing CRF. CRF was measured in two ways: 1) directly by a peak oxygen consumption (VO_{2peak}) test using a continuous running to exhaustion treadmill protocol, 2) indirectly by the 10-minute Andersen intermittent field test. Predictive cross-validated multivariate regression models, including BMI and sex, were obtained for both CRF measures. **Results:** CRF correlated positively to average particle size for high-density lipoprotein (HDL) and its subclasses of large HDL particles and

negatively to triglycerides (TGs) and average size and concentration of very low-density lipoprotein (VLDL) particles and their subclasses of large particles. BMI was negatively correlated to both measures of CRF, but exhibited a stronger association with VO_{2peak} than to the Andersen test. **Conclusions:** Our data showed a strong association between CRF (both the VO_{2peak} -test and the Andersen-test) and lipoprotein pattern in prepubertal healthy children, and this adds to the understanding of CRFs as a good measure of children's CV health. Furthermore, the Andersen test showed even stronger association to children's lipoprotein pattern compared to the VO_{2peak} -test. This is encouraging as the Andersen-test is a practicable field test that involves only minimal equipment and has a low cost.

2277 Board #290 June 1 3:30 PM - 5:00 PM
The Effect of Continuous versus Intermittent Exercise on VO_2 Slow Component and Muscle Activation

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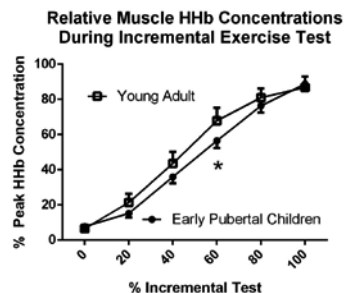
During heavy exercise intensity exercise (above lactate threshold (LT)), a higher O_2 cost than predicted by VO_2 -work rate relationship for exercise below LT occurs which has been termed, the oxygen uptake (VO_2) slow component (VO_{2SC}). Interestingly, a decrease in the overall VO_2 response during heavy intensity intermittent versus continuous heavy intensity exercise has been previously reported. However, intermittent exercise results in less total work being performed and perhaps muscle activation, which may affect the amplitude of the VO_{2SC} . **Purpose:** To examine the magnitude of the VO_{2SC} and muscle activation in response to heavy intensity continuous (CON) and intermittent (INT) exercise when the same total work was performed. **Methods:** Four healthy males (27 ± 3 yrs, (±SD)) performed 2 bouts of CON and INT on separate days, each bout lasting 6 min at an intensity of 50% of the difference between peak VO_2 and LT ($\Delta 50\%$). In the INT condition, 3 s recovery periods (20 W) were inserted every 10 s for the last 3 min of exercise. The work rate (WR) for the INT protocol corresponded to an intensity (greater than $\Delta 50\%$) which resulted in the same total work (i.e. area under the work curve) performed in CON. Pulmonary VO_2 was recorded breath-by-breath, while muscle activation (vastus medialis (VM), vastus lateralis (VL)) was assessed by surface electromyography (EMG). **Results:** The phase II τVO_2 (CON: 24.6 ± 10.8 s; INT: 25.0 ± 4.5 s) and VO_{2SC} , as measured by $\Delta VO_{2(6-3)}$ (CON: 534 ± 159 mL/min; INT: 402 ± 117 mL/min) were similar ($p > 0.05$) between CON and INT. The change in EMG, as measured by $\Delta EMG_{(6-3)}$ for VM (CON: 1.95 ± 3.51 mV; INT: -4.16 ± 13.95 mV) and VL (CON: 4.45 ± 3.31 mV; INT: -2.05 ± 13.78 mV) was similar ($p > 0.05$) between CON and INT. However, since end exercise VO_2 was similar (CON: 3258 ± 648 mL/min; INT: 3239 ± 682 mL/min, $p > 0.05$) and absolute exercise WR was lower ($p < 0.05$) for CON (203 ± 56 W) than INT (262 ± 80 W), the VO_2 /WR relationship was higher ($p < 0.05$) for CON (16.0 ± 2.0 mL/min/W) compared to INT (12.8 ± 1.3 mL/min/W). **Conclusion:** While considerably different absolute WRs were necessary to achieve the same total work performed, the similar VO_{2SC} and muscle activation, but lower VO_2 /WR relationship for INT versus CON suggests that brief periods of recovery significantly alter the O_2 cost of heavy intensity exercise.

2278 Board #291 June 1 3:30 PM - 5:00 PM
Muscle Deoxygenation during Incremental Exercise is Delayed in Children Compared to Young Adults

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The mechanisms regulating O_2 delivery and utilization during endurance exercise differ with maturation and are incompletely understood. This is important to understand the development of cardiovascular and neuromuscular diseases that originate early in life. Time-resolved near-infrared spectroscopy (TRS-NIRS) provides a quantitative non-invasive measurement of deoxy-hemoglobin + myoglobin concentration ([HHb]) at the muscle, an indicator of muscle deoxygenation during exercise. **PURPOSE:** To compare [HHb] dynamics during incremental ramp exercise in healthy early pubertal children and young adults. **METHODS:** 23 early pubertal children (16 F; 7-11 years) and 15 young adults (7 F; 21-35 years) underwent an incremental ramp exercise test on a cycle ergometer. Pulmonary gas exchange was measured breath-by-breath (V_{max} , Carefusion). *Vastus lateralis* [HHb] was quantified by TRS-NIRS (TRS-21, Hamamatsu Photonics). **RESULTS:** Peak VO_2 was not different between children and adults normalized to body mass (46.7 ± 8.1 vs. 48.9 ± 7.7 mL/min/kg). Absolute [HHb] was not different

between children and adults during unloaded pedaling (23.5 ± 5.5 vs 26.8 ± 10.0 uM, $p = 0.20$) but adults had a higher peak exercise [HHb] (32.0 ± 8.2 vs 44.4 ± 22.6 uM, $p = 0.01$). Two way RM-ANOVA of relative HHb dynamics revealed an effect of age ($F(1,36) = 6.895$, $p = 0.013$) and interaction with % peak power ($p = 0.001$, Figure). Post-hoc, relative HHb was lower at 60% peak power in children vs adults (57 ± 10% vs 68 ± 13%, $p = 0.0006$), while VO_2 did not differ (33.5 ± 4.9% vs 30.6 ± 6.2%, $p = 0.12$). **CONCLUSION:** Muscle deoxygenation is both attenuated and delayed during incremental exercise in children compared to adults, despite similar relative VO_2 . This is consistent with a closer matching of muscle microvascular O_2 delivery to utilization over a greater range of aerobic power in children. The mechanisms contributing to this improved regulation of muscle blood flow during exercise in children warrant further study.



2279 Board #292 June 1 3:30 PM - 5:00 PM
Effects of Bodyweight Exercise on Excess Post-exercise Oxygen Consumption and Metabolic Expenditure

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Introduction: Body weight exercises (BWE; push-ups, squats, lunges) are popular modes of exercise, yet little is known regarding their effects on caloric expenditure. Classic hypertrophy training results in up to four-hour excess post-exercise oxygen consumption (EPOC) and elevated 24-hour resting metabolic rate (RMR). The purpose of this study was to determine if BWE 1) alters the length and amount of EPOC and 2) increases 24-hour RMR. **Methods:** Four healthy adult volunteers (3 males, 1 female; age: 22 ± 2y, height: 168 ± 11 cm, mass: 74.7 ± 18.6 kg, body fat: 27.8 ± 4.7%) consumed standard diets and underwent two RMR measures [pre- (morning) and post- (following morning) BWE]. Three hours following pre-RMR, participants completed a BWE bout [4 sets of push-ups (~9 reps), squats (~14 reps), and lunges (~14 reps)], followed by a 4 hour EPOC test. To standardize the work done participants performed 1-repetition maximum tests for bench-press and leg-press (to determine number of repetitions for BWE). **Results:** It was found that a bout of BWE elevated relative VO_2 (rVO_2 ; mL/kg/min) and energy expenditure post-exercise. When comparing pre-RMR to EPOC there was a significant difference at minute 15 in both rVO_2 ($p < 0.02$) and caloric expenditure ($p < 0.05$). Yet, there was no significant difference in both rVO_2 and caloric expenditure when pre-RMR and post-RMR were compared. **Conclusions:** As expected, we found that EPOC occurs after BWE, but is only elevated up to 30 minutes after exercise. This shows that BWE is an efficient and practical way to elevate metabolic rate, leading to increased caloric expenditure while potentially saving time and money. More participants are needed to fully understand the physiological implications of BWE related to caloric expenditure in healthy adults.

2280 Board #293 June 1 3:30 PM - 5:00 PM
Effects Of Prolonged, Fatiguing Exercise On Critical Power: Reliability And Physiological Characterisation

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The critical power (CP) is an important parameter of aerobic fitness and a strong predictor of endurance performance. Establishing how prolonged, fatiguing exercise may influence the CP is important for accurate performance prediction. **PURPOSE:** To assess the reliability of the CP in a fatigued state established using a 3-min all-out

cycling test (3MT), and to assess the effects of fatigue on CP. **METHODS:** Subjects in Study 1 (n=6, 31 ± 6 yr, 76.8 ± 6.7 kg) and Study 2 (n=9, 29 ± 11 yr, 75.9 ± 7.1 kg) completed a ramp incremental test, a control 3MT test (C-3MT) and a 3MT immediately following 2 h of heavy-intensity constant work-rate (CWR) cycling (F-3MT). In Study 1 subjects performed the F-3MT condition twice. In Study 2 subjects completed 2 h of heavy exercise immediately followed by CWR exercise to exhaustion at 15 W above and below CP measured in F-3MT. Oxygen uptake (VO₂) and blood [lactate] were measured during all tests. **RESULTS:** In Study 1, CP estimates from repeated F-3MTs were not different (test 1: 273 ± 52 W vs test 2: 276 ± 58 W; *P* > 0.05), with an intraclass correlation coefficient of *r*=0.99 (*P*<0.05) and typical error of 5 W (2%). In Study 2, CP was lower in the F-3MT (282 ± 52 W) compared to C-3MT (306 ± 56 W; *P*<0.05). Four of nine subjects completed 30 min of exercise below F-3MT CP with sub-maximal steady state VO₂ and blood [lactate] profiles, whereas five subjects exhibited steady state VO₂ but non-steady state blood [lactate] and reached exhaustion in ~9-18 min. Subjects reached exhaustion in ~4-22 min when exercising above F-3MT CP. The VO₂peak and end-exercise blood [lactate] were not different between exercise bouts performed above (4.05 ± 0.41 L·min⁻¹) and below F-3MT CP (3.93 ± 0.50 L·min⁻¹) but the VO₂peak values were lower than the VO₂max in the ramp incremental test (4.33 ± 0.52 L·min⁻¹) (both *P*<0.05). **CONCLUSION:** The CP estimated in a 3-min all-out test evidenced high reliability in a fatigued state. We found that exercise in close proximity below the CP in the fatigued state was not sustainable beyond ~18 min and did not exhibit steady state blood [lactate] profiles. The VO₂ responses during exercise above and below CP were characterised by inability to attain the same VO₂max as in the rested state. These findings suggest that the well-characterised physiological definition of the CP is altered under conditions of extreme fatigue.

2281 Board #294 June 1 3:30 PM - 5:00 PM
Priming Exercise Speeds VO₂ Kinetics and Increases Critical Power During Supine but not Upright Cycling
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Critical power (CP) is a fundamental parameter in defining high-intensity exercise tolerance, however its physiological determinants are unclear. CP has been shown to correlate with the phase II time constant (τ) of oxygen uptake (VO₂) kinetics, however causative evidence confirming this effect is lacking. A prior bout of high-intensity "priming" exercise speeds τ in the supine, but not upright, position; therefore, if τ is causally related to CP priming exercise would be expected to increase CP in the supine but not upright position. **PURPOSE:** To determine the impact of priming exercise on τ and CP in the supine and upright body positions. **METHODS:** 16 healthy men were assigned to either upright or supine groups, and completed an incremental ramp test to determine VO₂ max and the gas exchange threshold. This was followed by 8 visits whereby CP, pulmonary VO₂ and muscle deoxyhaemoglobin ([HHb]); via near infrared spectroscopy) kinetics were determined via constant load exercise tests to exhaustion in two conditions: 1) without priming exercise (CON) and 2) following a bout of priming exercise at ~30%Δ. **RESULTS:** During supine exercise, priming exercise shortened τ (CON: 53 ± 17 vs. PRI: 31 ± 9 s; *P* < 0.001) and increased CP (CON: 177 ± 31 vs. PRI: 185 ± 30 W; *P* = 0.006) compared to control. However, priming exercise had no effect on τ (CON 35 ± 8 vs. PRI 37 ± 11 s; *P* = 0.82) or CP (CON: 235 ± 42 vs. PRI 232 ± 34 W; *P* = 0.57) during upright exercise. Priming exercise also resulted in a slowing of [HHb] kinetics during supine (CON: 8 ± 4 vs. PRI: 11 ± 4 s; *P* = 0.003) but not upright (CON: 10 ± 5 s vs. PRI: 14 ± 10; *P* = 0.10) position. **CONCLUSIONS:** The present study provides the first experimental evidence that VO₂ kinetics are an important determinant of CP. Specifically, priming exercise resulted in a concomitant speeding of VO₂ kinetics and increased CP in the supine position that was absent in the upright position. This was associated with a slowing of [HHb] kinetics in the supine position, suggesting that this effect might be mediated by increased O₂ availability.

2282 Board #295 June 1 3:30 PM - 5:00 PM
Fatigability And Vo₂ On-kinetics In Adults With Incomplete Spinal Cord Injury
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 (No relationships reported)

It has been reported that, in people with spinal cord injury (SCI), prolonged VO₂ on-kinetics may contribute to fatigability and exercise intolerance. **Purpose:** Examine the relationship between fatigability and VO₂ on-kinetics in incomplete SCI (iSCI) during self-selected treadmill walking. **Methods:** Eight participants (age: 38.4 ± 17.8 years; gender: 7 male, 1 female; BMI: 25 ± 4.5 kg/m²) classified with iSCI C & D according to the American Spinal Injury Association Impairment Scale (AIS) and eight able-bodied participants (age: 34.6 ± 11.3 years; sex: 7 male, 1 female; BMI: 26 ± 4.2 kg/

m²) were enrolled in the study. Fatigability was calculated as the ratio of perceived fatigability and performance fatigability. Perceived fatigability was measured using a perceived fatigability scale while performance fatigability was determined during constant work-rate treadmill test to exhaustion or 30-minutes, whichever came first, at preferred walking speed. VO₂ on-kinetics was determined using a mono-exponential model in which a time constant (τ) and amplitude (AMP) was calculated during phase 2 of the biphasic kinetic response. Differences in fatigability and VO₂ on-kinetics between the groups were analyzed using Student's *t*-test. Pearson product correlation was used to determine the relationship between fatigability and VO₂ on-kinetics. Statistical significance was set at *p*<0.05 for two-tailed hypotheses. Values are expressed as means ± SD. **Results:** The iSCI group demonstrated greater fatigability compared to the able-bodied group (6.62 ± 4.86 vs 1.87 ± 0.98; *p*=0.017). Performance fatigability was also higher in the iSCI group compared to the able-bodied group (1153 ± 529 vs 1800 seconds; *p*=0.011). iSCI group had a significantly greater τ (41.2 ± 7.7 vs 23.3 ± 6.5; *p*<0.0001) with no difference in AMP between groups (613 ± 128 vs 745 ± 174 ml/min; *p*=0.106). Fatigability was significantly correlated with τ (*r*=0.56; *p*=.024). **Conclusion:** Individuals with iSCI in this study demonstrated higher levels of fatigability as determined by both perceived and performance fatigability, and prolonged VO₂ on-kinetics compared to able-bodied individuals. Furthermore, the observed relationship between fatigability and VO₂ on-kinetics suggest τ may be a biomarker of fatigability during treadmill walking in adults with iSCI.

2283 Board #296 June 1 3:30 PM - 5:00 PM
Attenuation of the Oxygen Uptake Slow Component During Intermittent Compared to Continuous Heavy Intensity Exercise

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 (No relationships reported)

During constant load exercise at intensities above the lactate threshold, an additional increase in oxygen uptake (VO₂) of delayed onset, termed the VO₂ slow component (VO₂SC), becomes readily apparent. Results of a previous study have shown a considerable decrease in the overall VO₂ response to high intensity exercise when the exercise bout is interrupted by intermittent periods of recovery. However, the extent that the addition of the brief recovery periods, which began at the onset of exercise, affected the magnitude of the VO₂SC remains unclear. **Purpose:** The purpose of this study was to examine the magnitude of the VO₂SC in response to heavy intensity continuous (CON) and intermittent (10 s work: 3 s recovery (INT)) exercise when the on-transition (i.e. phase II response) was altered by intermittent recovery periods. **Methods:** Five healthy males (27.0 ± 2.8 yrs, (±SD)) performed heavy intensity exercise, each bout lasting 6 minutes with 6 minutes of recovery, at an intensity of 50% of the difference between peak VO₂ and lactate threshold (Δ50%). To control for phase II kinetics, exercise was performed for 6 min for CON and the first 3 minutes for INT. In the INT condition, 3 s recovery intervals (20 W) were inserted every 10 s for the last 3 min of exercise. Pulmonary VO₂ and minute ventilation (V_E) were recorded breath-by-breath using a metabolic measurement system, while heart rate (HR) was recorded using a 3 lead electrocardiogram (ECG). Phase II VO₂ responses (time constant, τ VO₂) were analyzed using either a 2 or 3 component exponential model after interpolating to 1 s and ensemble averaging each trial. **Results:** The τ VO₂ was similar (CON: 30.3 ± 11.1 s; INT: 37.4 ± 14.9 s, *p*>0.05) as expected. The amplitude of VO₂SC, as measured by Δ VO₂₍₆₋₃₎ was decreased in the INT compared to the CON condition (-153 ± 216 mL/min vs. 522 ± 140 mL/min, *p*<0.05). Δ V_{E(6-3)} and Δ HR₍₆₋₃₎ were decreased in INT (-4.8 ± 11.8 L/min; -3 ± 7 bpm) compared to CON (18.4 ± 8.3 L/min; 15 ± 6 bpm), respectively (*p*<0.05). **Conclusion:** While phase II kinetics were similar between protocols, INT heavy intensity exercise led to a significant attenuation of the VO₂SC compared to CON exercise performed at the same WR. This may be due, at least in part, to a reduction in myocardial and respiratory work, as evidenced by the reduction in end exercise HR and V_E in the INT condition.

D-74 Free Communication/Poster - Physical Activity Assessment in Adults

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

**2284 Board #297 June 1 2:00 PM - 3:30 PM
Prediction of Oxygen Uptake from Pedometer Output across Different Activities**

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Pedometers may be used to estimate participation in physical activity (PA) of moderate-to-vigorous intensity. Step rate thresholds for moderate-to-vigorous PA varying by height have been developed in research employing primarily locomotion activities. Whether pedometer output can accurately predict the energy cost across different locomotion, occupational, and household activities, and during sedentary behavior has not been thoroughly studied. **PURPOSE:** We examined if step rate and height predict the rate of oxygen uptake (VO_2) across different types of activities and sedentary behavior. Following development of a prediction model, we also evaluated its accuracy. **METHODS:** Participants were 36 healthy young adults (21 ± 4 yrs; 16 women). They completed 8 activities each lasting 6 min: (a) sitting; (b) level walk at 2.5 mph; (c) walk at 3.5 mph and 5% grade; (d) jog at 5 mph; (e) moving a box between 2 carts 7m apart; (f) washing dishes; (g) ascending and descending a 20-step staircase; and (h) vacuuming. We measured VO_2 with a portable open-circuit spirometer and step rate with a pedometer (NL-1000, New Lifestyles) worn on the non-dominant hip. We used multi-level regression to predict VO_2 , accounting for nesting of observations within participants. Possible predictors included step rate, step rate square, and height. Using VO_2 predicted from the model, we determined the absolute percent error across all activities combined and at each activity separately. Within-subject ANOVA was used to test differences in percent error across activities. **RESULTS:** Significant predictors of VO_2 were step rate and its square ($p \leq 0.001$; $R^2 = 0.72$), but not height. The prediction equation was $VO_2 = 7.6300 + 0.0872 \times \text{step rate} + 0.0004 \times \text{step rate}^2$. Absolute error across all activities combined was $29.4 \pm 27.3\%$. Absolute error differed between activities ($p < 0.001$): (a) sitting, $66 \pm 30\%$; (b) walk at 2.5 mph, $62 \pm 25\%$; (c) walk at 3.5 mph, $11 \pm 13\%$; (d) jog, $16 \pm 17\%$; (e) moving box, $15 \pm 14\%$; (f) washing dishes, $15 \pm 15\%$; (g) stairs, $22 \pm 8\%$; and (h) vacuuming, $29 \pm 13\%$. **CONCLUSION:** Pedometer-determined step rate and its square are significant predictors of VO_2 across different activities and sedentary behaviors in healthy young adults. Height does not contribute to VO_2 prediction. Accuracy of prediction across activities is low to moderate.

**2285 Board #298 June 1 2:00 PM - 3:30 PM
Zero Cadence as a Proxy Indicator of Sitting Behaviors in Objective Monitoring**

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Consistent evidence has been presented regarding the potentially deleterious health consequences of prolonged sitting time independent of physical activity level. Zero cadence (0 steps/min) determined using accelerometers may be a suitable proxy measure of sitting behaviors since theoretically no steps should be registered in this position. **PURPOSE:** The purpose of the current study was to determine the capability of accelerometer-determined zero cadence to predict seated activities of daily living. **METHODS:** A total of 80 young adults (mean age 29.8 ± 6.7 years), 10 men and 10 women representing each 5-year age-group category between 21-40 years (21-25, 26-30, 31-35, 36-40) performed lab-based simulated daily living activities (i.e., seated rest, watching a movie, computer work, folding laundry while standing, vacuuming, stair stepping and a self-paced over-ground walk) while concurrently wearing multiple ($n=7$) research-grade (e.g., ActiGraph, ActivPAL, ActiCal and StepWatch) and consumer-grade (e.g., Fitbit One and Vivofit2) accelerometers on manufacturer-indicated locations (i.e., hip, wrist, thigh or ankle). Receiver Operating Characteristic (ROC) analyses were conducted to examine the accuracy of zero cadence for classifying sitting behaviors (e.g., seated rest, watching a movie and computer work) among the performed activities. Sensitivity, specificity, accuracy and area under the ROC curve (AUC) values were compared for each device. **RESULTS:** All devices demonstrated the capability of using zero cadence to determine sitting activities with high combined sensitivity and specificity (e.g., ranges between 75-98%). AUC values

of all devices were above 0.8 ($p < .001$) indicating good or excellent discrimination ability of zero cadence. Vivofit2 and wrist-worn ActiGraph provided the highest (93%) and lowest (75%) accuracy, respectively. **CONCLUSION:** In agreement with zero cadence, both research- and consumer-grade activity monitors provided valid capacity for discriminating seated activities from common daily living activities. Based on this preliminary analysis it appears that accumulated time spent at zero cadence obtained by activity monitors can be used as a proxy indicator of time spent sitting. Supported by NIH/NIA Grant 5R01AG049024-03 – CADENCE-Adults study

**2286 Board #299 June 1 2:00 PM - 3:30 PM
Effect of Wear Location on ActiGraph Activity Counts**

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PURPOSE: Y-axis and vector magnitude (VM) counts of the ActiGraph accelerometer plateau at running speeds >10 km/hr, when worn on the hip. However, it is not known if counts plateau at other wear locations. This study examined if activity counts plateau with increasing running speed at alternative wear locations (wrist and ankle). **METHODS:** Participants ($N=20$) completed ten treadmill walking and running speeds (3-20 km/hr) for 30-s each with 30-s rest between speeds. Speeds 3-7 km/hr were walking and speeds 8-20 km/hr were running. An ActiGraph GT3X+ was worn on the right hip, both wrists, and both ankles. Acceleration data for y-axis and VM were converted to 5-s epochs. Mean counts (5 to 25-s) were used for analysis of each speed condition. Repeated measures ANOVAs were used to examine effect of speed on y-axis and VM activity counts for each wear location. Pair-wise comparisons with Bonferroni adjustments were performed to determine where differences occurred. A plateau was defined as no significant increase in counts with an increase in speed when running. Correlation analysis was used to assess the association between counts and speed. **RESULTS:** Hip y-axis and VM counts increased significantly up to 10 km/hr and significantly decreased at speeds above 16 km/hr. For the wrists and ankles, significant increases in counts were seen for y-axis across all running speeds and VM across all speeds. The table shows counts/5-s for y-axis and VM at each location and speed. Asterisks indicate no significant increase in counts from the previous speed ($P > 0.05$).

	Speed (km/hr)										R ²	
	3	5	7	8	10	12	14	16	18	20		
Hip												
Y-axis	94	268	417	662	728	735*	707*	664*	604*	544*	0.43	
VM	185	328	484	698	769	783*	761*	731*	690*	658*	0.53	
Wrist												
Left y-axis	196	315	414*	1166	1388	1631	1888	2110	2439	2740	0.97	
Right y-axis	199	293	395*	1253	1535	1791	2045	2260	2618	2906	0.96	
Left VM	279	445	692	1604	1813	2068	2317	2524	2867	3197	0.95	
Right VM	288	433	720	1702	1982	2262	2505	2711	3087	3383	0.95	
Ankle												
Left y-axis	393	559	603	392*	618	861	1062	1259	1432	1673	0.92	
Right y-axis	469	637	699	472*	687	943	1162	1132	1411	1640	0.92	
Left VM	550	1037	1627	1959	2444	2911	3308	3673	4007	4242	0.98	
Right VM	672	1143	1714	2050	2555	3069	3510	3906	4071	4419	0.98	

CONCLUSION: When the ActiGraph is worn on the wrist or ankle the y-axis and VM counts do not plateau as is seen with the hip location. The wrist and ankle wear locations result in a stronger linear relationship between speed and counts than the hip does.

**2287 Board #300 June 1 2:00 PM - 3:30 PM
Device Settings Impact on StepWatch Accuracy during Running**

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The StepWatch 3 ankle-mounted pedometer has been used to capture free-living ambulatory activity in published research, however, this device does not accurately count running steps. It is unclear from published literature if device setting impacts the accuracy of counting running steps. **PURPOSE:** To examine the step count accuracy of the StepWatch 3 at various running speeds by altering device settings. **METHODS:** Thirty participants aged 21.32 ± 3.72 participated in the study. Participants completed

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4-minute trials of treadmill ambulation at 6 different speeds ranging from 2.24 to 3.35 m·s⁻¹ while wearing one device on the lateral aspect of each ankle, directly above each malleolus for a total of 2 devices overall. Each device was programmed using either the “default” setting or “Quick Step” setting. A counterbalanced design was used to minimize order effect. Direct observation was used as the criterion of step count (total steps/trial). One-way repeated measures ANOVAs were used to determine differences between step count estimates from devices/settings at the ankle compared to criterion. ANCOVAs were used to determine the impact of stride length and cadence on device determined step counts. Mean absolute percent error (MAPE) was also determined for all running speeds. **RESULTS:** StepWatch determined steps were significantly different from criterion for all speeds regardless of device setting ($p < .05$), with the exception of device “Quick Step” setting at 2.24 m·s⁻¹ ($p = .18$) and MAPE was $< 3\%$ (1.9). MAPE values for the default setting were $\geq 24.4\%$ for all treadmill speeds. The remaining MAPE values for the “Quick Step” setting were $\geq 4.9\%$ for treadmill speeds beginning at 2.46 m·s⁻¹. When stride length was considered, StepWatch determined steps were not statistically different from criterion for all speeds regardless of device setting. **CONCLUSION:** StepWatch default and “Quick Step” settings do not accurately report steps at ambulatory speeds ≥ 2.24 m·s⁻¹, with the exception of device “Quick Step” setting at 2.24 m·s⁻¹. After accounting for stride length, device output accurately reported steps regardless of device setting and treadmill ambulation speed. Further research is needed to explore the advanced setting features of the StepWatch with a goal of improving accuracy.

2288 Board #301 June 1 2:00 PM - 3:30 PM
The Relationship Between Steps/min And Intensity On A Treadmill In 21-40 Year Old Adults

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The time-stamped sampling nature of accelerometry-based wearable technologies allows minute-by-minute study of step accumulation, and specifically cadence (steps/min). **PURPOSE:** Considering cadence has been strongly correlated with absolute intensity defined using metabolic equivalents or METs (e.g., 3 METs=moderate intensity and 6 METs=vigorous intensity), the purpose of this study was to identify objectively observed, manually counted cadence criterion cut points that can inform heuristic (i.e., reasonably acceptable or guiding) values associated with 3 and 6 METs. **METHODS:** Ten men and 10 women representing each 5-year age-group category between 21-40 years (21-25, 26-30, 31-35, 36-40) for a total of 80 adults (mean age 29.75±6.7 years; BMI 24.76±3.4 kg/m²) participated in a lab-based study of videotaped cadence and oxygen consumption (indirect calorimetry). Data were collected during a series of 5-min treadmill bouts (starting at 0.5 and increasing up to 6 mph in 0.5 mph increments) as tolerated, until running occurred, or until reaching 75% of maximum heart rate or a rating of perceived exertion (RPE) > 13 . MET level was calculated by dividing steady state VO₂ by resting (seated) energy expenditure (both expressed in ml/kg/min). **RESULTS:** Two distinct areas of linearity emerged from the cadence versus METs data and a bilinear or ‘hockey stick’ model was subsequently applied to ascertain 3 and 6 MET cut points. Cadence accounted for 78% of the variance (least-squares bilinear regression model) in intensity with the bilinear break point apparent at 103 steps/min. The cadence cut point (95% Prediction Intervals; broader than more conventional Confidence Intervals) for 3 METs was 104.2 (34.8-113.7) steps/min and for 6 METs was 131.4 (120.5-140.9) steps/min. **CONCLUSIONS:** Heuristic values are practical, guiding, rounded quantities which may be imprecise but serve effectively to convey generalized and reasonably accurate information. We confirmed previous speculation that, despite individual variability, 100 steps/min can serve as a reasonable heuristic value indicative of moderate intensity in this age group. Further, 130 steps/min appears to be a similarly useful indicator of vigorous intensity ambulatory movement. NIH/NIA Grant 5R01AG049024-03 - CADENCE-Adults study.

2289 Board #302 June 1 2:00 PM - 3:30 PM
Validation Of Accelerometer-based Energy Expenditure Prediction Models In Structured And Semi-structured Settings

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Accelerometer-based physical activity monitors (AMs) and their associated prediction models are often validated in structured settings, but it is unclear if including AM data from less structured settings improves AM accuracy for free-living energy expenditure (EE) prediction.

PURPOSE: This study compared the accuracy of machine learning models developed to predict EE from AM data collected in structured and semi-structured settings. **METHODS:** Twenty-four adults (age 45.8±19.4 y, 50% female) completed two sessions, performing 11-21 activities over 80-90 min protocols while wearing four AMs (right hip, ankle, and both wrists) and a portable metabolic system (EE criterion). Session 1 (V1, structured setting) involved performing 3 sedentary, 4 household, and 4 ambulatory activities for 5 min each, with activities selected by the research staff. Session 2 (V2, semi-structured setting) involved performing ≥ 4 sedentary, ≥ 4 household, and ≥ 4 ambulatory activities, with activity type, order, and duration chosen by participants. Artificial neural network EE prediction models were developed for each AM via a leave-one-out approach using three training methods, incorporating data from either one training setting (V1 or V2) or both settings (V1/V2). Model accuracy (r² and root mean square error [RMSE]) for EE prediction was evaluated in the semi-structured setting. Repeated measures ANOVA was used to assess differences in prediction accuracy among training methods.

RESULTS: The V1, V2, and V1/V2 training methods had r² ranging from 0.58-0.68, 0.55-0.70, and 0.60-0.72, respectively. The r² value for the V1 training method was significantly higher than the V2 method for the left wrist AM, and the r² values for the V1/V2 method were significantly higher than the other training methods for the hip and left wrist AMs ($p < 0.05$). No differences were found among training methods for RMSE (1.17-1.28, 1.10-1.34, and 1.04-1.23 METs for V1, V2, and V1/V2 methods, respectively).

CONCLUSIONS: Developing prediction models using data from both structured and semi-structured data settings in a small improvement in EE prediction accuracy for particular monitor placements compared to using data from a single setting and should be considered when developing EE prediction models for AMs.

Supported by Ball State University ASPIRE grant.

2290 Board #303 June 1 2:00 PM - 3:30 PM
Physical Activity Assessment in African Americans: Modified International Physical Activity Questionnaire vs. Objective Measurement

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Physical activity (PA) assessment is critical for understanding PA levels. Self-report tools are useful but can be inaccurate. **PURPOSE:** To determine: 1) reliability/validity of the 7-item Modified International Physical Activity Questionnaire (MIPAQ) compared to objective measurement in African Americans and, 2) the effect of a 10-minute bout of moderate-intensity PA prior to survey administration on response accuracy.

METHODS: Participants (N=91; 55 male, 33 female; aged 46.5 ± 12.6 years) were randomized to: 1) complete the MIPAQ only or 2) complete the MIPAQ after a 10-minute PA bout. Following the survey, participants wore a pedometer and accelerometer for seven days. Upon return, a random sample of participants completed the MIPAQ a second time for test-retest reliability, computed by Chronbach's alphas. Spearman's rank-order correlations compared objective and self-report PA measures. **RESULTS:** Walking PA ($r = .3$, $p < .01$) and Total PA ($r = .28$, $p < .01$) were correlated with the accelerometer PA. Among those who performed a pre-MIPAQ PA bout, Walking PA and Total PA were significantly correlated with the accelerometer ($r = .43$ and $.31$, respectively) and pedometer ($r = .33$ and $.37$, respectively). Associations remained significant in overweight participants. Chronbach's alphas ranged from $.88$ -. $.94$, indicating high survey reliability. **CONCLUSIONS:** The MIPAQ is a valid and reliable measure of PA in African Americans. Adding a brief period of activity prior to survey completion may increase reporting accuracy. Research supported by Award Number R01HL094580.

2291 Board #304 June 1 2:00 PM - 3:30 PM
Comparison of Objective and Subjective Sedentary Behavior
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Physical activity decreases the risk of chronic disease, while sedentary behavior increases this risk. Questionnaires are an easy, inexpensive way to quantify sedentary behavior. However, there tends to be error with self-report. **PURPOSE:** To compare time in sedentary behaviors assessed via activity monitor (objective) with sedentary time assessed by self-report (subjective). **METHODS:** Office staff and administrators with a sedentary job description at a University were recruited. The activPAL3 activity monitor was placed on the participants' ($n=44$) thigh and worn continuously for seven days. Participants completed the Occupational Sitting Questionnaire (OSPAQ) and Paffenbarger Physical Activity Questionnaire (PPAQ) for the timeframe that the activPAL3 was worn. Data were expressed in total time (hrs/day) spent sedentary over a typical work week. A Pearson Product Correlation was utilized to examine the relationship between the subjective sedentary time at work (OSPAQ) and over a 24hr period (PPAQ) and objective (activPAL3) sedentary time. The agreement between the objective and subjective assessments was evaluated using a Bland-Altman analysis. Differences between objective and subjective scores for each individual were calculated and the mean error was determined. **RESULTS:** Participants were predominantly Caucasian (95%), middle-aged ($48 \text{ y} + 10$), and had an average BMI ($30.5 + 8.2$). A positive, weak correlation between sedentary time assessed subjectively from the OSPAQ ($r = .100$; $p = .518$) and PPAQ ($r = .317$; $p = .036$), and objectively by the activPAL3 activity monitor was found. The mean error of the sedentary time estimated during the workday was approximately one hour ($1.07 + 1.02$) and approximately four hours ($3.52 + 2.31$) for the entire day, with most participants underestimating sedentary time. The Bland Altman analysis found no systematic bias in the OSPAQ ($p = .743$), while a trend of proportional underestimation bias in the PPAQ ($p = .001$) was found relative to the activPAL3 measures. **CONCLUSION:** Self-reported sedentary time subjectively assessed by the PPAQ and OSPAQ was weakly correlated to sedentary time objectively assessed by the activPAL3 activity monitor over a 24 hour period and while at work. The lack of a relation demonstrated substantial error in self-reported assessment.

2292 Board #305 June 1 2:00 PM - 3:30 PM
Indoor and Outdoor Distance Estimation for Accelerometer-Derived Proximity Data: A Simulation and Machine Learning Study
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Advancements in physical activity measurement now afford researchers the capacity to measure proximity between accelerometers using Bluetooth low energy hardware. However, further research is needed to interpret the available proximity data to estimate distances from devices, which provide radio propagation measurements between accelerometers. **Purpose:** To estimate metered distances in indoor and outdoor environments from accelerometer-derived proximity data, and 2) compare the predictive accuracy of machine learning models in estimating distance. **Methods:** The study was two-phased: 1) calibration and 2) simulation. During calibration, received signal strength indicator (RSSI) data were collected from stationary accelerometers within indoor and outdoor environments at metered intervals (1m to 10m) in a major urban center. Observations of distances between devices (i.e., "ground truth") were recorded by the researchers, and approximately $N = 2,000$ observations were recorded in each respective environment. Calibration results were used to simulate free-living proximity data as a Markov chain for indoor (1m to 20m) and outdoor (1m to 50m) ranges. Using $N = 10,000$ simulated indoor and outdoor proximity data cases, respectively, distance was estimated under measurement conditions wherein 1) calibration data are available and 2) calibration data are unavailable and are therefore estimated from RSSI. Three competing machine learning models were used to predict distances for both conditions, and cross-validated Root Mean Squared Error was calculated and reported in meters (ranges). **Results:** The regression tree model (RT) had the lowest error for indoor 1.65m and outdoor 1.35m calibration data. Using measured calibration data, RT had the lowest error for simulated indoor (2.9m to 3.8m) and outdoor data (7.5m to 11.8m). With estimated calibration data, RT showed errors of 4.0m and 11.1m for simulated indoor and outdoor data, respectively. **Conclusions:** A regression tree model estimated distances from simulated indoor and outdoor accelerometer-derived proximity data with the lowest error; however, error in the outdoor range was large. Researchers collecting proximity data via accelerometry can estimate metered distances from radio signals propagated between accelerometers.

ACSM May 30 – June 3, 2017

2293 Board #306 June 1 2:00 PM - 3:30 PM
Within-person Reliability Of Step-rate Cut-offs For Physical Activity Intensity
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The intensity of physical activity (PA) can be monitored with pedometers. Step-rate cut-offs for PA intensity are developed from the relationship between oxygen uptake (VO_2) and step-rate. This is based on the assumption that the relationship between VO_2 and step-rate across different activities is stable within people, but this has not been evaluated. **PURPOSE:** To examine if the relationship between VO_2 and step-rate, and the cut-offs for moderate- and vigorous-intensity PA based on step-rate are reliable within people. **METHODS:** Thirty six healthy persons (21 ± 4 yrs; 16 women and 20 men) completed two sessions with identical procedures within 7 days. VO_2 was measured with open-circuit spirometry and step rate with a pedometer (NL-1000, New Lifestyles) placed on the non-dominant hip during sitting and seven activities: walking at 2 intensities, jogging, ascending and descending a staircase, washing dishes, vacuuming, and moving a box. Using individual linear regressions of VO_2 against step rate for each participant, we determined 5 variables: the slope, intercept, and R^2 of the relationship between VO_2 and step-rate, and the cut-offs for moderate- and vigorous-intensity activity defined as step-rate at 3 and 6 Metabolic Equivalent units, respectively. We evaluated differences in these variables between sessions with paired t-tests, Intra-class Correlation Coefficients (ICCs; 2-way random model with absolute agreement), and Bland-Altman plots. **RESULTS:** There were no significant mean differences between sessions in any of the dependent variables ($p > 0.05$). All ICCs were significant ($p \leq 0.023$). ICC was strong for the slope (0.80), but moderate-to-low for the intercept, R^2 , and the moderate- and vigorous-intensity cut-offs (0.76, 0.58, 0.57, and 0.50, respectively). Bland-Altman plots showed nearly-zero mean error. The plots also showed that the variation in the difference between sessions was relatively small for the moderate-intensity cut-off (95% CI: -24 to 24 steps \cdot min $^{-1}$), but wider for the vigorous-intensity cut-off (95% CI: -48 to 49 steps \cdot min $^{-1}$). **CONCLUSION:** The relationship between VO_2 and step-rate, and the cut-offs for moderate- and vigorous-intensity PA are moderately reliable within people. Calibration procedures should advance for better prediction of PA intensity from pedometer data.

2294 Board #307 June 1 2:00 PM - 3:30 PM
Correlations between Objective and Subjective Instruments on the Measurement of Energy Expenditure in Older Adults
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PURPOSE: Many objective and subjective instruments have been developed to estimate energy expenditure (EE). However, the validity and correlations on these measurements are lacking especially in the older adult population. American Association of Retired Persons (AARP) questionnaire and Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire are common self-reported questionnaires. The purpose of the study was to examine which self-reported physical activity instruments correlated with objective data from ActiGraph accelerometers and fitness tests. We also compared outcomes from the above instruments with total EE (TEE) measured by the gold standard of doubly labeled water (DLW).

METHODS: Data sets were obtained from the Interactive Diet and Activity Tracking in AARP (IDATA) study through the National Cancer Institute. A total of 681 participants aged between 50-74 years were included in the analysis. The outcomes of our interest from each instrument were as follows: total number of steps and EE from ActiGraph, VO_2 max from fitness test, activity EE (AEE) from CHAMPS and AARP, and TEE from DLW. Pearson's correlations were conducted to examine the relationships between objective and subjective measures.

RESULTS: The results showed that AEE from AARP was moderately significantly associated with VO_2 max ($r = .348$) and EE from ActiGraph ($r = .365$). A weak but significantly positive relationship was also observed between AEE from AARP and steps from ActiGraph ($r = .136$). However, AEE from CHAMPS was only related to steps from ActiGraph ($r = .172$). No significant correlations were found between AEE from CHAMPS and the other objective measures. Each instrument was also compared to DLW. The strongest positive relationships with TEE from DLW were seen in EE from ActiGraph ($r = .484$) and VO_2 max ($r = .474$). However, there was no significant association between AEE from CHAMPS and TEE from DLW, $p > .05$.

CONCLUSIONS: AEE from AARP appears to be the subjective instrument most positively associated with the objective instruments in older adults. Of all subjective

Denver, Colorado

and objective instruments, objective measures may estimate TEE more accurately than the subjective instruments. AEE from CHAMPS performed the worst estimate on TEE and was least likely to be related to the objective instruments.

2295 Board #308 June 1 2:00 PM - 3:30 PM

Improved Count Based Metrics For Estimation Of Energy Expenditure With Waist Worn Actigraph

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(No relationships reported)

Traditional methods for analyzing accelerometer activity counts rely on the assumption that there is a linear relationship between counts and increasing energy expenditure. However, this relationship varies depending on the type of activity being performed and intermittent activities can have a 2-3 fold higher energy cost than walking and running at the same count level. **PURPOSE:** This study explored the effects of using the 75th percentile of counts to characterize the relationship between counts and energy expenditure (EE) in an effort to make walking/running counts more comparable to counts from intermittent activities. **METHODS:** Twenty-nine participants completed ten lifestyle activities ranging from sedentary behaviors to vigorous intensities for seven minutes each. Participants wore an ActiGraph GT9X on the right hip. A Cosmed K4b² was used as the criterion measure of EE. Acceleration data was converted to 5-s epochs. Oxygen consumption data from the Cosmed was averaged over 30-s and converted to metabolic equivalents (METs) for each activity (1 MET = 3.5 ml/kg/min). Mean counts and 75th percentile of the 5-s counts for y-axis and vector magnitude (VM) were calculated using the middle 4-min from each activity bout. The relationship between activity counts and METs was summarized using R² values. **RESULTS:** Across all activities, the y-axis mean counts and METs had a R² of 0.789, which was improved to a R² = 0.835 when using the 75th percentile of the y-axis counts. For the VM mean and 75th percentile count metrics, the R² was 0.871 and 0.875, respectively. **CONCLUSIONS:** The relationship between EE and y-axis counts can be improved using the 75th percentile of the counts. However, both VM count metrics had a stronger relationship to EE than their y-axis counterparts. This new count metric may provide an alternative for those utilizing data collected with older single axis accelerometers.

2296 Board #309 June 1 2:00 PM - 3:30 PM

The Relationship Between Walking Cadence and Percentage of Maximum Heart Rate

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(No relationships reported)

Previous studies report that walking cadence (steps/min) is strongly correlated with intensity measured using indirect calorimetry. **PURPOSE:** The aims of this study were: 1) to investigate the relationship between cadence and percentage of maximum heart rate (%HRmax), an often used proxy-measure of intensity; and 2) to specifically identify cadence cut points associated with ACSM defined %HRmax thresholds for moderate and vigorous intensity. **METHODS:** Ten men and 10 women representing each 5-year age-group category between 21-40 years (total n=80; mean [±SD] age 29.8±6.7 years; BMI 24.8±3.4 kg/m²) were recruited. Participants completed a treadmill walking test comprised of 5-min bouts at incrementally faster speeds from 0.5 to 6 mph, with a 2-min rest between bouts. The test was terminated at the completion of the 5-min bout during which the participant began to run, achieved >75% HRmax, or reported a Borg rating of perceived exertion >13. Cadence was visually observed (steps per bout / 5 min) and heart rate (HR) was measured using a chest-worn monitor during all bouts (average of final 2-min). HRmax was estimated using the standard equation: 220 - age. Based on the data, a bilinear regression model with random effects to account for repeated measures was applied. Cadence cut points associated with moderate (64% of estimated HRmax) and vigorous (77% of estimated HRmax) intensity were calculated using the regression model. **RESULTS:** Over half of the variance in %HRmax was explained by cadence (i.e., R²=0.54, least-squares bilinear regression model) with the bilinear break point at 103 steps/min. Cadence cut points (95% prediction intervals) for 64% and 77% of estimated HRmax were 128.6 (106.9-149.04) and 146.3 (124.6-164) steps/min, respectively. **CONCLUSION:** Cadence explained over half of the variance in %HRmax, with ~130 steps/min and ~145 steps/min representing reasonable heuristic (i.e., guiding) values for moderate and vigorous intensity, respectively. Further analysis is warranted investigating the cadences associated with moderate and vigorous intensity defined by percentage of HR reserve. This may account for some of the inter-individual variability in resting HR and HR response, thereby strengthening the relationship observed. Supported by NIH/NIA Grant 5R01AG049024-03 - CADENCE-Adults study

2297 Board #310 June 1 2:00 PM - 3:30 PM

Identifying Physical Activity Type using Wrist Models Constructed for High-frequency Accelerometer Data

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Accelerometer-based measurements have played an important role in assessing physical activity (PA). Hip-worn accelerometer data is the most validated based on current literature, but wrist-worn accelerometer has greater user acceptability. There is an emerging focus to understand the data from wrist-worn accelerometers to assess PA but data is still lacking.

PURPOSE: To investigate the capability of the wrist-worn accelerometer to identify sedentary behavior, levels of activity intensities, and locomotion.

METHODS: This study evaluated 25 adults (n = 14 females, mean age = 33.8 years, mean BMI = 26.4 kg/m²) who performed 34 simulated tasks of sedentary (e.g., computer work) and locomotion (e.g., self-paced walk). Data were collected using a 100 Hz tri-axial wrist-worn accelerometer. Energy expenditure was measured in parallel using a portable calorimetry system. Constructed features included time and frequency domain variables, such as vector magnitude (VM) and its angle with the vertical axis, dominant frequency (DF), fractions of power by DF and human movement frequencies (i.e., 0.6 - 2.5Hz). Regression and classification methods were used to estimate metabolic equivalent score (METs) and detect sedentary behaviors, locomotion tasks, and intensities of activity.

RESULTS: The time and frequency features were capable of estimating METs (rMSE = 1.2 METs), activity intensity (accuracy > 80%), sedentary behavior (accuracy > 94%), and locomotion (accuracy > 92%). All features were found significantly different (p < 0.05) between groups of tasks. However, sedentary and locomotion tasks could be distinguished using as few as two features. With little variation in VM (< 0.06 m/s²) and the angle between VM and the vertical axis (< 7 degrees), sedentary tasks were distinguished versus other tasks (accuracy = 92%). Locomotion tasks could also be detected (accuracy = 90%) by examining DF (< 1.6 Hz) and its fraction of power (< 0.05).

CONCLUSION: Time and frequency domain features defined for wrist accelerometer data can detect sedentary activity with 94% accuracy. Further, locomotion within activity can be identified with 92% accuracy. Future work will require evaluations during free-living conditions to confirm the accuracy.

Supported by NIH/NIA (R01AG042525) and UF Claude D. Pepper Center (1P30AG028740).

2298 Board #311 June 1 2:00 PM - 3:30 PM

Development and Validation of Universal Step Detection Threshold for Raw Accelerometer Data

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(No relationships reported)

PURPOSE: To develop a universal and computationally inexpensive algorithm for accurately detecting steps from GENEActiv raw acceleration data relative to the criterion measure of directly observed steps and improve on the accuracy of ActiGraph's proprietary step-counting algorithm. **METHODS:** A total of 80 young adults (mean age = 29.8±6.7 years, BMI = 24.76±3.4 kg/m²) performed 5-min bouts of 7-lab based simulated activities of daily living and treadmill walking (beginning at 0.5 and increasing up to 6 mph in 0.5 mph increments). GENEActiv and ActiGraph GT9X accelerometers were worn concurrently on the right anterior-axillary line. For ActiGraph, step counts detected in 1-s epochs using the manufacturer's default and proprietary algorithm were summed over the duration of each 5-min bout of activity. Raw accelerometer data from the GENEActiv's Y-axis (which captures vertical motion) was filtered using a band-pass filter (cut-off frequency of 0.25 and 2.5 Hz) and de-trended to the mean. All peaks greater than zero gravity were detected for each activity in a subsample (n=40, gender and age balanced) and used to 'train' the threshold. The threshold was developed by identifying the median of the peaks detected in the training dataset; which was then tested on the remaining sample (n=40). Mann-Whitney U nonparametric tests were used to compare mean step counts obtained from the ActiGraph, GENEActiv, and observed criterion in each activity. **RESULTS:** The threshold obtained from the training dataset (i.e., 0.0318 g) corresponded with 0.5 mph treadmill walking in 80% of the testing dataset. ActiGraph and GENEActiv step counts at treadmill speeds ≥ 2.5 mph did not differ, nor were they different than the criterion measure. The application of the thresholding technique to GENEActiv testing dataset resulted in significant improvements in step detection in both simulated activities of daily living and walking at slow speeds (0.5 ~ 2 mph)

(all $p < .05$) compared to the ActiGraph's proprietary algorithm. **CONCLUSIONS:** An approximate threshold based on the median amplitude of the acceleration peaks detected across a range of activities could serve as a universal data treatment technique to detect steps from raw accelerometer data with improved accuracy relative to the ActiGraph's proprietary algorithm.

2299 Board #312 June 1 2:00 PM - 3:30 PM
Self-Reported Fitness and Objectively Measured Physical Activity among Older Adults

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PURPOSE: To study the relationship between self-reported fitness and objectively measured physical activity and sedentary behavior among elderly. **METHODS:** The study is based on the older Finnish Twin Cohort. All same-sex twin pairs born 1940-1944 with both co-twins alive were invited to participate in the study. They first participated in a telephone interview followed by an objective activity monitoring (a hip-worn triaxial accelerometer, Hookie AM20) and activity related questionnaire. By end of 2015, altogether 406 individuals (mean age 74 years, 209 male and 197 female) had used accelerometer for at least four days and had answered a following question on perceived fitness: "Is your current physical fitness in your opinion; 1) Very good 2) Fairly good 3) Satisfactory 4) Fairly poor 5) Very poor. Groups four and five were combined for the analyses. In this study twins were studied as individuals. Analysis was done using linear regression and Sidak post-hoc test was used to analyses differences between fitness groups.

RESULTS: According to preliminary data, self-reported fitness explained moderately different objectively measured activities as R-squared for daily steps was 29% ($p < 0.001$), for overall daily MET 29% ($p < 0.001$) and sitting down 32% ($p < 0.001$). Better self-reported fitness was associated with more steps taken an average each day (8 545 steps (most fit) vs. 3 168 steps (poor fitness), $p < 0.05$), more light (1.5-3 MET: 3.3 h/day vs. 2.1 hours/day, $p < 0.05$), moderate (3-6 MET, 0.93 h/day vs 0.28 h/day, $p < 0.05$) and vigorous (> 6 MET, 3.6 min/day vs. 0.005 min/day, $p < 0.05$) activity compared to subjects who reported poor fitness when the model was adjusted with accelerometer wear time, age, BMI and movement restricting injury. Better self-reported fitness was also associated with less sitting (7.3 h/day (most fit) vs. 8.1 h/day (poor fitness) $p < 0.05$). **CONCLUSION:** These preliminary results show that self-reported fitness is associated with objectively measured daily activity profile among elderly. Most differences were seen in variables describing activity, but also some differences were seen even in sitting down. Among elderly subjects who perceive themselves as having poor fitness, it would be important to find factors associated with low mobility and try to find ways to improve them.

2300 Board #313 June 1 2:00 PM - 3:30 PM
Validation of a Biometric Smart Shirt for Assessment of Physical Activity

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Smart shirts are embedded with sensors to collect physiologic data (e.g., heart rate and breathing rate/volume) and an accelerometer to assess kilocalories (kcal) and steps. However, little is known about measurement accuracy of smart shirts. **PURPOSE:** The purpose of this study was to validate a smart shirt for assessment of physiologic and physical activity variables.

METHODS: Participants ($n=32$) aged 18-51 years wore a smart shirt and performed 15 total activities, 12 in the laboratory and 3 on a 200-m indoor track. Lab activities were performed for 5 min each and included lying, sitting, standing, walking at various speeds (2.0, 3.0, 3.5-4.0 miles*hr⁻¹) and inclines (0%, 5%, 10%), jogging, and cycling. Track activities included self-paced walking (200 m, 2 speeds) and jogging (400 m). Steps, kcal, heart rate, and breathing rate and volume from the smart shirt were compared to criterion measures (metabolic analyzer for kcal and breathing rate/volume, pedometer for steps, and pulse oximeter for heart rate). Percent (%) errors were calculated between smart shirt estimates and criterion-measured variables. A threshold of 10% was used for low ($\leq 10\%$) vs. high ($> 10\%$) predictive error. Paired samples T-tests were conducted to determine significant differences between smart shirt estimates and criterion measurements with $p < 0.05$ used to denote statistical significance.

RESULTS: Estimates made by the smart shirt had high % error (shown as mean [standard error]) for kcal (29.8% [3.1]), breathing rate (19.4% [4.3]), and breathing volume (33.6% [3.8]). The smart shirt had low % error for steps (9.4% [0.7]) and heart rate (2.7% [0.3]). For all activities, kcal and breathing rate and volume performed poorly ($> 10\%$ error), whereas heart rate had $< 10\%$ error for all activities. Step

predictions were significantly underestimated for slow walking speeds (16.7-36.1%, $p < 0.05$), and kcal were significantly overestimated during all activities (5.6-94.7%, $p < 0.05$).

CONCLUSIONS: The smart shirt performed well estimating and heart rate, but performed poorly estimating kcal, breathing rate and breathing volume. Future research should further examine accuracy of this smart shirt during sport-specific activities as well as in free-living protocols.

This study was supported by the Alma College CORE Research Grant.

2301 Board #314 June 1 2:00 PM - 3:30 PM
The Reasoned Action Approach Better Predicts Self-report Measures of Active Play than Accelerometer Measures

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 (No relationships reported)

The Reasoned Action Approach (RAA) has been successfully used to identify factors that predict a child's intention to be physically active, however, the predictive ability of intention to physical activity (PA) behavior has been weak. **PURPOSE:** To determine if subjective (i.e. self-report) vs objective (accelerometry) measures impact the predictive ability of intention to engage in physical activity behavior in children ages 9-12 years. **METHODS:** 210 5th and 6th grade students completed a 17-item RAA survey assessing after-school active play. Extensive pilot work was conducted to ensure the instrument was developmentally appropriate for the target population. The survey was administered on Monday inquiring about after-school active play that same week. On Friday, self-reported (SR) behavior was assessed by two questions during a face-to-face, semi-structured interview. Accelerometry (AC) was used as an objective measure of after-school active. Students wore an AC on the hip during waking hours, for the school week. Minutes spent in moderate-vigorous PA during the hours of 3:00-8:00 PM were determined using ActiLife software and the Evenson (2008) cutpoints. The strength of relationship between Intention and SR, and between Intention and AC, was measured via Pearson correlations. Multivariate linear regression was used to determine the predictive ability of Intention for the number of days the behavior was performed as determined by SR and AC. **RESULTS:** 100 participants met the AC wear inclusion criteria (female=60%; fifth grade = 48%, age = 11.25 +0.58y, height = 149.5 +8.14 cm, weight = 45.3 + 13.44 kg). Intention was significantly correlated to both SR ($r=0.679$; $p < 0.01$) and AC ($r=0.268$; $p < 0.01$). SR was better predicted by intention than AC ($F=83.84$; $p < 0.01$ vs. $F=7.57$, $p < 0.01$), explaining 46.1% and 7.2% of the variance, respectively. **CONCLUSION:** SR should be used to measure PA when using the RAA, due to the higher predictive ability, compared to AC. The stronger relationship between intention and SR is likely due to the higher correspondence between the measures. The developmental appropriateness of the measures may have also contributed to the higher predictive ability seen in this study, compared to other studies.

2302 Board #315 June 1 2:00 PM - 3:30 PM
Performance Of Actigraph's Wear-time Sensors For Wear/non-wear Time Classification

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 (No relationships reported)

PURPOSE: To evaluate the performance of the wear-time sensor in ActiGraph's wGT3X+BT and GT9X monitors under controlled laboratory and uncontrolled free-living settings.

METHODS: The lab protocol tested the accuracy of a wrist worn GT9X in capturing wear-on and off 'instances' (round minute) against direct observation as criterion. Participants ($N = 26$; mean \pm SD: age= 23.2 \pm 3.8 years, BMI= 23.2 \pm 3.7 kg/m²) wore and removed an Actigraph GT9X on 4-5 occasions during a 3-hour physical activity protocol. In the free-living setting we tested the accuracy of the wrist-worn wGT3X+BT and GT9X in classifying wear (i.e. sensitivity) and non-wear time (i.e. specificity) over a 2-day period. The criterion for the free-living condition was determined using an independent temperature sensor and self-report. Sensor-based free-living measures of wear-time were also compared to the commonly used Troiano 2007 and Choi 2011 wear/non-wear algorithms, which are based solely on motion signals.

RESULTS: In the lab protocol the GT9X wear sensor detected 83.95% of wear-on and wear-off 'instances,' and had significant delays (4.7 \pm 11.6 min) in detecting the minute when the monitor was taken off. Sensitivity and specificity of the GT9X in the laboratory protocol was 93% and 49%, respectively. In the free-living protocol, the sensitivity and specificity of the wGT3X+BT and GT9X was 82% and 95%, and 72 and 90%, respectively. The wear sensors from both devices had inferior sensitivity but superior specificity to Troiano 2007 and Choi 2011 wear/non-wear algorithms.

CONCLUSIONS: Actigraph wear-time sensors yielded inferior wear detection performance and superior non-wear detection performance over Troiano 2007 and Choi 2011 algorithms. Motion-based algorithms may have inferior non-wear detection capabilities because of a reliance on pre-determined durations of inactivity (i.e. 20-60 min) to classify non-wear. This strategy may not distinguish between the lack of motion that occurs during both monitor wear and non-wear. Conversely, Actigraph wear sensors are capable of making this distinction. The inferior wear detection performance of the ActiGraph wear-sensor may stem from the sensor's exclusive reliance in detecting skin conductance. For example, a loose strap may inaccurately yield a higher rate of non-wear.

2303 Board #316 June 1 2:00 PM - 3:30 PM
A Decision-tree Model For Classifying Physical Activity Types Using A Three-axis Accelerometer In Japanese Adults

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Accelerometry is a valid method for assessing physical activity in free-living conditions. Although there are numerous studies on estimating physical activity-induced energy expenditure (PAEE), classification of physical activity types using an accelerometer is not well established.

PURPOSE: To develop a physical activity classification model using a three-axis accelerometer in Japanese subjects

METHODS: Eleven healthy adults (age, 33.3±10.4 years) stayed in a human calorimeter for 23 hours and performed activities (sitting, standing, walking, lying down) while wearing a three-axis accelerometer (Actigraph-wGT3X-BT). Raw three-axis acceleration values were obtained at 30 Hz. Raw acceleration values were processed into five feature quantities: filtered acceleration values (FAC), raw acceleration values (RAC), absolute value of filtered accelerations (ABS), standard deviation of FAC (SD), and peak-to-peak of FAC (PP). A classification model was proposed using a decision tree and an 11-fold cross-validation method with time resolutions of 1, 5, or 10 seconds.

RESULTS: The classification model achieved the following accuracy levels for each time segment for all activities: 75.1% with 1-second segments, 76.1% with 5-second segments, and 77.7% with 10-second segments. Selected feature quantities in these models were RAC, ABS, and PP in 1-second segments; FAC, RAC, ABS, SD, and PP in 5-second segments, and FAC, RAC, and PP in 10-second segments. The classification model with a 10-second time resolution had better accuracy than with 5- or 1-second time resolution. The model's accuracy for each type of physical activity with 10-second segments was 80.6% for sitting, 59.6% for standing, 99.7% for walking, and 84.1% for lying down.

CONCLUSIONS: These results suggest that the decision tree is a valid method for physical activity classification in Japanese subjects. The addition of other features and classification methods, e.g., random forest, needs to be discussed in future studies.

2304 Board #317 June 1 2:00 PM - 3:30 PM
Moving Toward 24-hour Assessment: Validation Of PA Accelerometers For The Assessment Of Activity And Sleep

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Twenty-four hour accelerometer assessments create the opportunity for concurrent measurement of daily behaviors previously examined in isolation, including physical activity (PA), sleep, and sedentary behavior (SB), as well increasing device wear compliance and simplifying data capture. Evidence demonstrates that understanding how these behaviors make up the 24 hour day will help understand their compositional impact and interrelationships on health. This shift in research focus calls for the integration of methods to assess PA, SB and sleep to allow for the evaluation of overall 24-hour daily activity using a single device. Devices currently being used to assess daytime PA have not been substantially validated to evaluate sleep. **Purpose:** The objective of this study was to: 1) validate commonly used PA accelerometers using a gold standard polysomnography (PSG) test in a sample of older adults and; 2) to examine common sleep actigraphy data processing methods. **Methods:**

Twenty-two subjects (50 to 75 years) were recruited for participation. Of them, 17 participants completed an in-home overnight PSG while concurrently wearing three PA accelerometers. Total Sleep Time (TST) and Sleep Efficiency (SE) were compared for each device against PSG. **Results:** Across devices mean TST ranged from 361.6 - 403.2 minutes. Mean SE estimates ranged from 86.9% (PSG) to 96.9% (hip-worn accelerometer). We found significant differences between TST measured with hip-worn accelerometers compared to PSG (p=0.03, paired t test). We did not find significant differences between TST estimated by PSG and wrist-worn accelerometers (ranged from 0.49- 0.94). For SE, we did not find significant differences between PSG and wrist-worn accelerometers, but found a significant difference between PSG and hip-worn sleep estimated SE (p<0.001). **Conclusions:** When compared to gold standard PSG, PA wrist-worn devices worn on either wrist may be used to evaluate TST and SE. Further studies to investigate new algorithms to predict in bed and out of bed time and improve the assessment of sleep by PA devices seem warranted to advance the evaluation of sleep in addition to other 24-hour daily activity behaviors in both the clinical and population settings.

2305 Board #318 June 1 2:00 PM - 3:30 PM
Recognising Bone Loading Exercises In Older Adults Using Machine Learning

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 (No relationships reported)

Machine learning has been used to accurately recognise physical activity patterns; however, classifiers for recognising targeted bone loading exercises have not been developed. **PURPOSE:** The purpose of this study was to determine the accuracy of machine learning models for classifying the intensity of exercises necessary for bone adaption in older adults. **METHODS:** Triaxial accelerometer data was collected from forty-four older participants (60-70 yrs) wearing a GCDC X16-1C accelerometer on their hip during three aerobic classes consisting of impact aerobic exercises performed at high and low intensities. Multi-class support vector machine (M-SVM) classifiers were trained in parallel for activity type detections where one classifier trained with low intensity activity samples and the other with high intensity samples. In a multi-view scoring manner, the classification confidence of these two learners was utilised for predicting the activity intensity. The leave-one-out cross-validation technique was used for assessment purpose. **RESULTS:** Overall recognition accuracy of the M-SVM classifier for detecting exercise intensity was 73%. For each aerobic class, the M-SVM classifier accurately recognised exercise intensity by 82%, 73% and 65%. **CONCLUSIONS:** Machine learning techniques such as M-SVM accurately recognised the intensity of bone promoting exercises from triaxial accelerometer data in community-dwelling older adults. First results of the developed classifier demonstrate significant potential of machine learning models for the evaluation of exercise adherence and performance in older adults.

2306 Board #319 June 1 2:00 PM - 3:30 PM
Validation Of A Physical Activity Monitor As A Measure Of Energy Expenditure During A Circuit-style Workout With Females Who Are Overweight Or Obese

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While the SenseWear Armband has been validated for a variety of physical activities, it has not been validated with circuit-style exercise for individuals who overweight or obese. **PURPOSE:** The purpose of this study was to validate the SenseWear Armband for measuring energy expenditure in overweight or obese females during circuit-style training. **METHODS:** Overweight and obese females, N = 40, 20-59 years of age, completed a pre-recorded circuit-style exercise session consisting of eight exercises. An SenseWear Armband and portable metabolic analyzer were worn by each participant throughout the exercise session to measure energy expenditure. **RESULTS:** While the total overall energy expenditure between devices was not significantly different (p = .882), both energy expenditure excluding rest periods (p < .001) and rest periods between exercises (p = .007) were significantly different when the SenseWear Armband was compared to the portable metabolic analyzer. The SenseWear Armband overestimated exercise energy expenditure, but underestimated rest period energy expenditure compared to the portable metabolic analyzer. **CONCLUSION:** The results suggest females who are overweight or obese could use a SenseWear Armband to aid in tracking caloric expenditure with circuit-style training. However, care must be used if looking at individual exercise components.

2307 Board #320 June 1 2:00 PM - 3:30 PM
Accuracy Of Behavioral Assessment With A Wearable Camera in Semi-structured And Free Living Conditions In Older Adults.

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PURPOSE: To examine the congruency of wearable cameras (WC) and direct observation (DO) to identify posture, activity category, and type during semi-structured (Semi) and free-living (Free) conditions in older adults.

METHODS: 824 observations were analyzed (n=8; 5 female; 69±5.1 y; 169.1±5.2 cm; 69.5±12.5 kg) over a 20-minute Semi bout of activity (sit, stand, walk) while video recorded. Videos were analyzed by DO. An independent sample of 1499 observations were analyzed (n=5; 3 female, 71±5.1 y; 162.1±5.1 cm; 64.5±10.6 kg) during a three-hour bout of community-dwelling Free activity while a researcher performed DO. Both groups wore a WC placed at the sternum. WC images and DO were annotated independently for posture (sedentary, standing, movement), activity category (sedentary, walking, household, exercise/sport), and type (laundry, dishes, cooking, general cleaning). Cross tabs and Kappa statistics were run to assess accuracy between the WC images and the DO results across both conditions for observations. Time spent in each attribute was tested with the Wilcoxon signed-rank test.

RESULTS: Posture had a 96.4% (Kappa=0.93; SE=0.10; p<0.0001) and 93.1% (Kappa=0.89; SE=0.07; p<0.0001) agreement between the WC and DO during the Semi and Free conditions, respectively. For activity category, there was 76.7% (Kappa=0.45; SE=0.10; p<0.0001) and 94.6% (Kappa=0.92; SE=0.08; p<0.0001) agreement between the WC and DO during the Semi and Free conditions, respectively. For activity type, obtained from Free only, there was 100% (Kappa=1.0; SE=0.20; p<0.0001) agreement across measures. WC total time spent in seconds was not significantly different to that obtained from the DO for posture during Semi (186±47 vs. 199±50, z=0.9342) or Free conditions (1341±414 vs. 1400±418, z=0.3170). For activity category, time spent across each measurement type did not significantly differ for Semi (WC = 162±38 vs. DO = 171±44, z=0.7348) or Free conditions (WC = 1082±322 vs. DO = 1256±342, z=0.4806). For activity type, time estimates for Free only were not statistically different 827±333 for WC and 145±70 for DO, z=0.7459.

CONCLUSIONS: Results from this study suggest that there is high congruency between wearable cameras and direct observation for behavioral observations and time spent in posture, activity category and type.

2308 Board #321 June 1 2:00 PM - 3:30 PM
Metabolic Cost Of Resistance Exercise

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PURPOSE: Determine if the Total O₂ cost (TO₂) of RE differs during & following RE as a function of RE type & relative intensity (RI) & Determine if TO₂ during & following RE, differs across 3 RI, when the volume of Work is held constant.

METHODS: 8 Ss, 6 female, volunteered. Ss underwent testing for VO₂Max, body composition, and 1-RM for Chest Press (CP) & Leg Press (LP). RI were 33, 50, & 75% 1-RM, with 22, 15, & 10 reps performed, respectively to control for volume of work during RE. RE consisted of: 5min Rest, followed by RE, & 10min Post RE Rest; RE & Post RE Rest were repeated for RE type (LP & CP) & RI. RE & RI were counterbalanced. Metabolic measures & HR were recorded using a Cosmed K4b². Body composition was measured with BodPod.

RESULTS: Age=21.5±0.5, Height=166.5±6.2, Mass=65.4±11.7, BMI=23.5±3.7, BodyFat%=20.7±7.5, FatMass=13.8±7.5, LeanMass=51.5±7.7, VO₂max=46.4±8.4, RERmax=1.13±0.03, & HRmax=200±6.2. TO₂ cost was measured as the O₂ used during exercise & through 10min Post RE Rest using Integral estimation of breath-by-breath intervals. TO₂ cost during RE & 10 min Post RE Rest was significantly greater for LP when compared to CP at each corresponding RI: LP75-CP75 p=0.005, CI95% (6.72, 13.58); LP50-CP50 p=0.003, CI95% (4.12, 13.98); LP33-CP33 p=0.005, CI95% (1.81, 7.33). TO₂ cost was significantly (p<0.02) greater for LP75 & LP50 when compared to LP33. TO₂ cost for CP was not significantly different at any RI. LP & CP RE times differed significantly for RI: LP75-50 p=0.000, LP75-33 p=0.001, LP50-33 p=0.016, CP75-50 p=0.007, CP75-33 p=0.000, CP50-33 p=0.002. TO₂ cost for LP75 & CP75 returned to Pre RE Rest at min 3.

CONCLUSIONS: Results suggest TO₂ cost is related to RE type, muscle mass activated, O₂ deficit incurred during RE, & O₂ debt repaid during recovery. Further, the O₂ cost during recovery from LP75 & LP50 is greater when compared to LP33 even though Work was held constant. This suggests factors other than the O₂ deficit contribute to the O₂ debt.

2309 Board #322 June 1 2:00 PM - 3:30 PM
A Comparison Between Actual Energy Expenditure Measurements And A System Dynamics Model Output

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 (No relationships reported)

Portable metabolic units afford a practical utility for field measurements of energy expenditure (EE). This methodology has proven useful to assess EE related to terrain, intensity, and duration during a single event. Similarly, system dynamics (SD) modeling has been used to describe the relationship between exercise and obesity as it relates to EE. However, there is paucity of literature that report SD to predict EE in real time.

PURPOSE: To compare actual EE from a portable metabolic unit to predicted EE from a System Dynamics model.

METHODS: Seven subjects (4 males, 3 females; 24.4 +/- 1.71) walked selected routes of varied terrain paced by a metronome at 2.7 mph. EE was measured using a Cosmed K4b2 portable metabolic unit with each subject completing four trials per route. An integrated GPS receiver recorded latitude and longitude coordinates of each route. The modeling software STELLA was used to design the SD model which incorporates subjects' weight, walking pace, route elevation profile and distance. Pandolf's et al (1977) prediction equation for EE was run in the model to compare with the real-time K4b2 data.

RESULTS: In simulation modeling parameters (stocks and flows) are adjusted to increase accuracy. Model parameters were adjusted to provide agreement for EE to within +/- 1% of the actual total EE as measured by the Cosmed K4b2 unit. A paired t-test comparing the actual versus the SD model predictions of total EE were not significantly different (p = .034).

CONCLUSION: It appears that SD modeling can be an effective tool to predict EE of individuals walking on varied terrain. Once user parameters have been entered, simulation modeling can provide feedback on EE with suitable accuracy of a selected route. Compared to a single event measurement, SD allow users to compare EE of multiple defined routes simultaneously. Feedback has been identified as a critical component of adherence and motivation for physical activity. In this case of SD modeling, accurate feedback and route selection may encourage users to engage in regular physical activity.

Funded by James Madison University Office of Public Safety

2310 Board #323 June 1 2:00 PM - 3:30 PM
Accuracy Of Wrist-worn Activity Monitors During Walking And Swimming

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 (No relationships reported)

Wrist-worn activity monitor market has been growing at a rapid pace with many manufacturers. **PURPOSE:** To assess the accuracy of wrist-worn activity monitors during walking and swimming. **METHODS:** Twenty-seven participants (age=48.4±12.5 yrs, ht=171.1±9.0 cm, wt=71.6±15.0 kg) were fitted with five wrist activity monitors (XT and VS on the left wrist, PL, MF, and LT on the right wrist). After walking for 200m at a self-selected pace and swimming freestyle for 200m at a self-selected pace, monitor counts and actual step counts from a hand tally (AC) were recorded. Repeated measures ANOVA was used to determine significant differences between the counts. Pedometer error was calculated as [(monitor counts-actual counts)/actual counts]*100. **RESULTS:** All monitors registered counts significantly lower (p<.05) than AC during the walk (26.8±40.5, 29.1±47.8, 20.8±33.8, 37.0±65.0, and 28.5±34.6 counts for XT, VS, MF, LT, and PL, respectively). Percent error was lowest in MF while walking, followed by XT, PL, VS, and LT (7.2±12.6, 8.9±12.8, 9.0±12.1, 9.7±15.5, 11.9±20.8 percent, respectively). LT and PL counts were significantly higher (p<.05) than AC during the swim (378±93.4 and 198.2±143.5 counts, respectively) while XT, VS, and MF were not significantly different than AC (21.8±139.4, 15.4±112.3, and 44.7±120.1 counts, respectively), p>.05. During the swim, VS exhibited the lowest percent error, followed by XT, MF, PL, and LT (10.4±108.0, 24.6±130.4, 45.4±111.2, 177.9±119.7, 365.8±86.2 percent, respectively).

CONCLUSIONS: While four out of five activity monitors registered less than 10% error during the walk, the differences in counts compared to AC was significant. It is noted in some participants the step counts were extreme compared to the AC, thus the unusually high standard deviations. This was especially evident in the swim. The ability of a monitor to register a count is determined by the manufacturer and while different monitors have different construction, those who wear them do not always move in the same way, particularly in walking and swimming gait. These variables should be considered when using wrist-worn monitors to track different modalities of activity.

D-75 Free Communication/Poster - Posture and Balance

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2311 Board #324 June 1 3:30 PM - 5:00 PM
Effect Of Pace On Stabilization After Rising From A Chair In Young And Older Adults
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(No relationships reported)

Falls are a significant concern for an aging population, with 14% of falls thought to occur during the transition from sitting to standing. **PURPOSE:** To determine the effect of chair rising speed on stabilization time in young and older adults. **METHODS:** Twenty healthy older (71.8±4.2 yrs; mean±SD) and 20 young adults (22.5±2.7 yrs) were first assessed for functionality using the Short Physical Performance Battery (SPPB). Then, each performed 4 single repetitions each of comfortable pace (CSTS) and maximal fast pace sit-to-stand (FSTS) in a randomized block design while on a force platform. The stabilization phase was defined as the period from when the vertical ground reaction force returned to bodyweight after knee extension until center of pressure (COP) variability was within 2 standard deviations of their quiet stance. The anterior-posterior (A-P) and medial-lateral (M-L) directions were assessed independently. **RESULTS:** The older adults had higher scores on the SPPB (11.3±0.8 vs 12.0±0.2; p=0.002). The stabilization phase was significantly longer in the A-P direction during FSTS (3.13±1.01 vs 2.70±0.88 s; p=0.039), with no differences between groups or within the M-L direction. However, the older adults did have significantly greater movement of the COP during the first 2s of stabilization, regardless of pace (A-P Path Length: 5.17±1.47 vs 3.96±1.17, p=0.002; M-L Path Length: 3.35±0.94 vs 2.57±0.64 % standing height, p=0.001). Furthermore, this A-P Path Length was significantly correlated between the CSTS and FSTS amongst the older adults, but not for the young (r=0.598, p<0.01 vs r=0.438, p>0.05). **CONCLUSION:** Although a healthy and high functioning group of older adults were examined, differences between groups existed during the STS, most notably at the beginning of the stabilization phase. It also appears that performance during CSTS and FSTS are more closely coupled in the older adults than the younger adults. This coupling suggests that older adults might dynamically control slow and fast STS similarly with a singular strategy while younger adults may have multiple strategies. This reduced flexibility of response may be adding to the increased risk of falls in older adults during the STS task.

2312 Board #325 June 1 3:30 PM - 5:00 PM
The Effect of Prolonged Standing on Ground Reaction Force Control
Kylie M. Soliday¹, Wayne J. Board¹, Erika Nelson-Wong², Raoul F. Reiser, II, FACSM¹. ¹*Colorado State University, Fort Collins, CO.* ²*Regis University, Denver, CO.* (Sponsor: Raoul F. Reiser II, FACSM)
(No relationships reported)

Prolonged standing (PS) substantially increases the risk of experiencing low back pain. However, the specific factors involved, and sex related differences are not fully understood. One factor may be bilateral asymmetries in posture. **PURPOSE:** The goal of this study was to examine the effect of prolonged standing on weight-bearing and ground reaction force control within healthy young adults during quiet stance. **METHODS:** Twenty-four subjects (12 male, 12 female) voluntarily participated in the study (age = 22.3 ± 2.4 years, height = 1.70 ± 0.09 m, mass = 69.89 ± 11.31 kg, BMI = 24.1 ± 2.5 kg/m² [mean ± SD]). Subjects performed two 60 sec quiet standing trials separated by one 30 min free standing trial while ground reaction forces under each foot were measured. Forces were normalized to percent body weight (%BW). Sway, maximum velocity (maxV), and path length (PL) were calculated from the center of pressure (CoP) for both the dominant (D) and non-dominant (ND) foot, as well as net combined values. All CoPs were calculated in both the anterior-posterior (AP) and medial-lateral (ML) directions, and were normalized to standing height (%height). Weight-bearing (WBAs) and CoP asymmetries (CoPAs) were calculated by subtracting the ND limb from their D limb. **RESULTS:** There were no differences in WBA or CoPA between the pre- and post-PS trials, nor between the men and the women (p>0.05). In both of the quiet stance trials, there were no significant differences between the D and ND limbs for WBAs, but the ND limb generally had a greater contribution to CoP movements than the D limb. There was an increase in four of the net CoP variables after PS exposure (p≤0.003). Significant negative correlations were found between WBAs and some CoPAs during the pre-PS trial (p≤0.018, r≤-0.660) and the level of these significant correlations changed during the post-PS trial (p≤0.024,

r≤-0.628). Men and women exhibited different significant correlations for both trials. **CONCLUSION:** While these results suggest that 30 min of PS does not have an effect on WBA or CoPA during quiet stance, there appears to be an effect on net CoP movements, as well as sex related differences in the correlations between WBAs and CoPAs. These findings suggest that fatigue is potentially occurring.

2313 Board #326 June 1 3:30 PM - 5:00 PM
Optoelectronic Plethysmography Characterises Thoracic Excursion In The Evaluation Of Dysfunctional Breathing (DB)
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(No relationships reported)

PURPOSE: Ventilatory pattern and thoracic excursion, can vary during exercise and impact on ventilatory performance. A deviation away from an optimal trunk lumbopelvic recruitment pattern may affect lung volumes, work of breathing and may be relevant in the development of exertional dyspnoea. The aim of the study was to investigate the effect of different postural positions on the ventilatory excursion using optoelectronic plethysmography (OEP) and a spirometer. **METHODS:** Fifteen healthy male athletes (Mean ± SD age: 30.3±6.5 yrs.) completed the study. Ninety reflective markers were placed on the chest, abdomen and back (Figure 1). Participants underwent simultaneous OEP and spirometry data collection in two conditions, in a randomised order: (C1) with normal shoulder position or (C2) with hunched shoulders. Forced vital capacity (FVC) was assessed by the spirometer and data was gathered on the chest wall volume (CW) and the compartmental volumes of the rib cage (RC) and the abdomen (AB) by OEP. **RESULTS:** The correlation between the two instruments in measuring FVC was good in both normal (R²=0.89) and hunched (R²=0.84) positions. FVC was significantly lower in hunched position during both spirometry (5.22±0.69 L vs. 5.35±0.69 L; p=0.03) and OEP measurements (5.22±0.62 L vs. 5.42±0.69 L; p=0.01). When volume contributions in the two conditions were compared the RC/AB ratio was significantly lower in hunched position (1.84±0.74 vs. 2.12±0.79; p=0.01). **CONCLUSIONS:** These findings suggest that respiratory excursion and lung volume compartmentalisation are affected by the position of the shoulders. Specifically, a hunched shoulder position leads to increased abdominal motion to vital capacity and decreased lung volumes. OEP may be a useful tool to detect altered parameters associated with development of exertional dyspnoea.



THURSDAY, JUNE 1, 2017

2314 Board #327 June 1 3:30 PM - 5:00 PM
Effect of Respiratory Activity on Traditional Center of Pressure Related Measures during Standing in Parkinson's Patients
 Jamal Roper¹, Matthew Gloss¹, Paul Wright¹, Christina Odeh¹, David Benner¹, Shuqi Zhang¹, Li Li, FACSM². ¹Northern Illinois University, Dekalb, IL. ²Georgia Southern University, Dekalb, IL.
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 (No relationships reported)

Parkinson patients are at a high risk of falling due to the neurological disorder. Standing balance is an important indicator of postural control capacity among people with falling risks. During standing, respiratory activity, as the internal perturbation, may alter the motion of center of gravity. Therefore, in Parkinson patients, different respiratory activities could influence balance outcomes related to Center of Pressure (COP). **PURPOSE:** this study was to examine the effects of different breathing patterns on balance performance in patients with Parkinson. **METHODS:** ten Parkinson patient (PG) and ten age-matched health individuals (CG) were recruited. Each participant randomly performed 3 trials of balance test under three respiratory conditions (neutral, thoracic, and abdominal breathing patterns) with eyes closed. 95% sway area ($A_{95\%}$ in cm^2), average velocity (V_{Average} in cm/s) and standard deviation at ML (SD_{ML}) and AP (SD_{AP}) directions were recorded for each trial. Two-way MANOVA was performed to examine the effects of group and respiratory activity on the association among COP-related measures listed above. Post Hoc Tukey's test was applied when necessary. **RESULTS:** Significant differences were observed between groups on all measures ($P < .05$). Compared to control group, Parkinson group exhibited greater $A_{95\%}$ (PG: $10.36 \pm 9.89 \text{ cm}^2$, CG: $7.52 \pm 7.07 \text{ cm}^2$), higher V_{Average} (PG: $3.18 \pm 1.24 \text{ cm/s}$, CG: $2.56 \pm .92 \text{ cm/s}$), more SD_{ML} (PG: $.58 \pm .30$, CG: $.54 \pm .28$) and SD_{AP} (PG: $.84 \pm .31$, CG: $.68 \pm .24$). No other significant difference was observed. **CONCLUSIONS:** Parkinson's group showed a worse balance performance as expected. However, the effect of respiration on traditional COP related measures was not observed. This may be because that traditional measures could not detect the alteration of COP induced by the internal perturbation of respiratory activity. Instead of using traditional measures, future studies should adopt the nonlinear dynamic analysis to assess the complexity of COP motion potentially altered by respiratory activity.

2315 Board #328 June 1 3:30 PM - 5:00 PM
Wii-Based and Supervised Exercise Training Decrease Falls Risk in Older Adults with Type 2 Diabetes
 Rachel Simmons, Sheri R. Colberg, FACSM, Steven Morrison. Old Dominion University, Norfolk, VA. (Sponsor: Sheri Colberg-Ochs, FACSM)
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 (No relationships reported)

Loss of balance resulting in falls is a serious health issue for older persons with type 2 diabetes (T2D). One intervention shown to produce benefits for these individuals is various types of exercise training. However, motivation is commonly cited as a barrier to consistent physical activity participation in unsupervised conditions. Interactive video games, such as the Nintendo Wii system, have been viewed as an innovative tool for engaging individuals in activity at home. **PURPOSE:** To assess the differences between supervised and unsupervised (using the Nintendo Wii) exercise training aimed at improving balance, reaction time, lower limb strength, and falls risk in older adults with T2D. **METHODS:** 47 older adults with T2D participated in 12 weeks of training: 32 (mean age 67.7 ± 5 yr) completed supervised training (ST) while 15 (mean age 66.3 ± 5 yr) completed unsupervised Wii training. ST sessions (40 min each, 3 times a week) consisted of lower limb stretches followed by leg, abdominal, and lower back exercises. The Wii training group completed three 40-min sessions on the Wii balance board per week. The Wii-based exercises were self-selected to emphasize balance and postural control. Prior to and following training, assessments of lower limb strength (i.e., isometric knee extension and flexion), falls risk (using the Physiological Profile Assessment), balance, postural coordination, vision, proprioception and reaction time were performed. **RESULTS:** Following training, participants in both the ST and Wii groups showed a significant decline in overall falls risk (ST, 0.59 ± 0.12 to 0.22 ± 0.14 ; Wii, 0.33 ± 0.13 to 0.17 ± 0.11 ; $p < 0.05$). Falls risk reductions were driven by significant improvements in knee extension (ST, 31.5 kg to 36.4 kg; Wii, 31.1 to 34.3 kg), knee flexion (ST, 16.9 to 19.3 kg; Wii, 17.0 to 18.3 kg), faster reaction times (ST, 278 to 247 ms; Wii, 244 to 225 ms) and improved postural coordination (ST, 13.4 to 9.1 errors; Wii, 9.7 to 6.5 errors). **CONCLUSION:** Both ST and unsupervised Wii exercise training interventions led to a reduction in falls risk in older adults with T2D, accompanied by increases in leg strength, faster reaction times, and improved balance coordination. Thus, both supervised and unsupervised exercise may lead to improvements in falls risk in older adults with T2D.

2316 Board #329 June 1 3:30 PM - 5:00 PM
Effects of Backpack Load and Load Height on Lower and Upper Body Reaching Ability
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 (No relationships reported)

PURPOSE: Reaching performance with lower and upper body has not been examined during load carriage with a backpack, particularly with the load in the backpack distributed high or low in the backpack.

METHODS: Lower extremity reaching during backpack carriage was tested using the Y-Balance Test (measuring leg reach in posterolateral, posteromedial and anterior directions), and upper extremity reaching was tested using the Functional Reach Test (FRT). Subjects were healthy males ($n=4$) and females ($n=3$), ages 18-49, who wore a backpack (REI) and performed in bare feet using the dominant leg and arm. Subjects were tested with no backpack, and then (in random order on different days) with the backpack empty (0), or load (weight) equivalent to 10, 30, and 50% of bodyweight in the bottom of the backpack. Trials were repeated with the load high in the backpack using a specially designed box. Three trials were completed for each reach. Results were analyzed with paired t-tests and Bonferroni corrections.

RESULTS: In Table 1, data presented as normalized for limb length reach, mean \pm SD; BW = bodyweight; ld high = load (weight) in backpack at ~ level C5 vertebrae instead of bottom; * = sig diff from ld high via t-test with Bonferroni; † = sig diff from No backpack via t-test with Bonferroni. Backpack load at 30% and 50% bodyweight resulted in reductions in lower body reach in all three directions for both load high or low in the backpack compared to no backpack. When compared to no backpack, load high in the backpack resulted in significant reductions in upper body reach (FRT) at 10, 30, 50% bodyweight and load low in the backpack resulted in no significant reductions in upper body reach.

CONCLUSIONS: Backpack load height effects upper body, but not lower body, reach.

	Anterior	Anterior (ld high)	Postero-Medial	Postero-Medial (ld high)	Postero-Lateral	Postero-Lateral (ld high)	FRT	FRT (ld high)
No backpack	67.5±6.5	NA	108.0±7.8	NA	104.2±7.9	NA	155.6±6.0	NA
Backpack 0% BW	65.6±5.1	NA	105.8±7.1	NA	102.3±8.6	NA	149.5±6.8	NA
Backpack 10% BW	64.1±4.8	64.0±6.7	100.9±7.4	101.5±9.7	97.8±8.7	99.3±10.5	151.9±8.8*	144.4±9.6†
Backpack 30% BW	62.6±5.0†	60.5±5.7†	93.1±7.5†	94.4±10.2†	88.1±9.2†	90.7±13.6†	154.0±7.6*	141.7±11.6†
Backpack 50% BW	60.3±5.9†	58.1±5.8†	85.3±8.0†	89.7±13.1†	80.8±8.9†	83.5±14.0†	150.6±6.5*	130.1±7.7†

2317 Board #330 June 1 3:30 PM - 5:00 PM
Sprint Interval Training: Dissociating Stamina and Stability in Older Adults
 Alissa A. Ackerman, Timothy W. Brodsky, Nathan C. Grimm, Jeremy Theisen, Simon P. Fredericks, Erika Rigel, Raoul F. Reiser, II, FACSM, Christopher Bell. Colorado State University, Fort Collins, CO. (Sponsor: Raoul F. Reiser II, FACSM)
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 (No relationships reported)

The risks and consequences of falling are appreciable in sedentary older adults. Regular exercise has been proposed as an intervention, however the perceived time commitment may prove problematic for exercise initiation and/or compliance. Sprint interval training (SIT) evokes rapid and appreciable physiological adaptation in a time efficient manner, but the utility of SIT for improving stability in older adults is unknown. **PURPOSE:** To determine the effect of SIT on fatigue resistance and stability in young and older adults. **METHODS:** Sedentary young (Y: $n=7$, age: 21 ± 1 years (mean \pm SE)) and older (O: $n=6$, age: 69 ± 2 years) men and women completed three weeks of SIT (9 sessions of 4-8 30s maximal efforts on a cycle ergometer). Maximal oxygen uptake ($VO_{2\text{max}}$) and time to exhaustion while cycling at 75% $VO_{2\text{max}}$ were determined prior to and following SIT. Stability (amount of sway of center of pressure with eyes closed) was determined prior to and following a single bout of sprinting, prior to and following SIT. **RESULTS:** $VO_{2\text{max}}$ (Y: 39.5 ± 2.7 vs. 41.3 ± 3.1 ; O: 22.8 ± 1.5 vs. $24.6 \pm 0.8 \text{ ml/kg/min}$), and time to exhaustion (Y: 25.8 ± 4.0 vs. 37.0 ± 3.1 ; O: 31.5 ± 3.9 vs. $54.0 \pm 8.8 \text{ min}$) were increased (all $P < 0.05$) in young and older adults. Stability (normalized to height) prior to a single bout of sprinting was unaffected by short term SIT in either young (214 ± 13 vs. $268 \pm 38 \text{ mm/m}$) or older (230 ± 10 vs. 186 ± 10) adults; similarly, SIT did not attenuate the decline in stability following a single bout of

sprinting (Y: 302±21 vs. 334±72; O: 235±14 vs. 246±22). CONCLUSION: Short term SIT dissociated stamina (VO_{2max} and fatigue resistance) from stability in young and older adults.

2318 Board #331 June 1 3:30 PM - 5:00 PM
The Relationship Between Hip Musculature Range of Motion and BESTest Scores
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 (No relationships reported)

Limited range of motion (ROM) is often considered detrimental to both athletic performance and everyday function similar to balance. **PURPOSE:** The purpose of this study was to determine a relationship between hip range of motion and BESTest scores. **METHODS:** 20 college age women (19.55 ± 3.45 years) with no prior lower extremity injuries or previous concussions volunteered for this study. Using standard goniometer measuring techniques, participants passive range of motion for flexion (FL), extension (EX), internal rotation (IR) and external rotation (ER) was established and compared to scores from the BESTest (Balance Evaluation Systems) to determine a correlation. Overall BESTest scores were compared to each aspect of hip musculature ROM. **RESULTS:** Although there was no significant correlation between any specific aspect of ROM and overall BESTest scores (P>0.05), both right and left internal rotation showed a statistically significant moderate correlation (R=0.52 (P<0.05) and, R=0.51 (P<0.05) respectively) to stability in gait. **DISCUSSION:** Despite no correlation between overall BESTest score and range of motion, internal rotation was shown to have a statistically significant moderate correlation to a single aspect of the BESTest, stability in gait. We determined that range of motion does not pose as a limiting factor to balance as measured by the BESTest.

2319 Board #332 June 1 3:30 PM - 5:00 PM
Examining Postural Control Without Feedback in Individuals with history of Ankle Sprain
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Lateral ankle sprains are common orthopedic injuries and often result in chronic ankle instability (CAI). Studies have shown that the CAI population typically has decreased ankle proprioception and possibly a greater reliance on visual feedback when compared to healthy controls. However, little is known about how the postural control characteristics change in those with and without CAI when external visual feedback is manipulated. **Purpose:** To compare postural control characteristics of persons with CAI, Copers and healthy adults when performing a single leg balance test with and without external feedback. **Method:** The definition for CAI used for this study includes persons who have experienced recurrent ankle sprains, in addition to self-reported “feelings of instability” and “giving way,” and a score on the Identification of Functional Ankle Instability (IdFAI) of 11 or greater. 18 participants with CAI, 15 Copers, and 18 healthy controls (mean age of all groups: 22 years) performed the Athlete Single Leg Test on the Biodex Balance System (BBS) at Level 4, which involved a high degree of platform instability. All participants completed 2 trials without and with feedback in that order. Center of pressure position was recorded and the two trial mean was used for further analysis. Overall stability index (OSI) defined as the mean distance of the center of pressure from the center of the platform was obtained from the system. Sway area was calculated using custom Matlab script. Separate 3 (Group) x 2 (Feedback) mixed ANOVAs were run using overall stability index (OSI), and sway area as dependent variables. **Results:** Significant feedback main effect showed participants had significantly lower (better) OSI value with feedback (1.4±0.1) compared to without feedback (2.6±0.2; P < 0.001) but sway area with feedback (8.61±2.33cm²) was similar to without feedback (10.94±2.43 cm²). There was no significant group main effect or interaction observed for either of the variables. **Conclusion:** Results suggest that external visual feedback may not play a significant role in helping persons with CAI improve their postural control.

2320 Board #333 June 1 3:30 PM - 5:00 PM
Evaluating Perturbations To Human Balance Following An Exercise Intervention In Previously Sedentary, Overweight Adults
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PURPOSE: Previous research suggests that an improvement in body composition could potentially lead to a substantial improvement in balance performance in previously obese and overweight individuals (Handrigan et al., 2010; Maffiuletti et al., 2005). However, few studies have evaluated the balance of a person before and after weight loss following an exercise intervention that did not include any directed balance exercises. The purpose of this study was to evaluate if an exercise intervention alone can lead to a substantial decrease in body weight and therefore improvement in standing balance. **METHODS:** Fifteen overweight, but otherwise healthy adults (9 females, 6 males) (age: 23.5 years; height: 1.70 m, starting body mass: 92.8 kg) participated in this study. Balance performance was assessed with a sensory organization test (SOT) and motor control test (MCT) prior to and after a 10-week exercise intervention. SOT equilibrium scores were analyzed using a repeated-measures ANOVA. **RESULTS:** Results from the SOT equilibrium (EQ) scores revealed significant differences in the eyes open, sway referenced visual surrounding and platform (EOSRVP) condition (p = 0.033). Post hoc pairwise comparisons for this variable revealed significantly higher SOT equilibrium scores in post-intervention evaluation versus pre-intervention. No other SOT EQ scores were found to be significant (p > 0.05). Also, no significant differences were seen in MCT postural latency scores (p > 0.05). **CONCLUSIONS:** The results of the current study suggest that an exercise intervention alone without a significant loss in weight and also without any form of specific balance training can lead to an improved balance performance, but that it may be limited to the conditions where the somatosensory system plays a larger role in balance maintenance.

2321 Board #334 June 1 3:30 PM - 5:00 PM
Effects of Long Term Marijuana Use On Postural Steadiness During Quiet Standing
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 (No relationships reported)

The legalization of marijuana in a number of states has resulted in increased accessibility to the drug. However, little is known about the influence of marijuana on everyday tasks, such as quiet standing. **PURPOSE:** To determine whether marijuana influences postural steadiness during quiet standing. **METHODS:** All participants were physically active, defined by at least 150 minutes of moderate-intensity exercise per week, and were either marijuana users (MU, n = 10, mass = 81.4 ± 20.0 kg; ht = 1.75 ± 0.08 m; age = 25 yrs ± 6 yrs) or non-marijuana users (NU, n = 15, mass = 73.5 ± 13.5 kg; ht = 1.80 ± 0.08 m; age = 25 yrs ± 6 yrs). MU were consuming marijuana products at least once a week for the past 6 months and NU had not used any form of marijuana in the past 12 months. Participants were asked to stand quietly with each foot on a separate force plate for 30 seconds under four conditions: rigid surface eyes open, rigid surface eyes closed, compliant surface eyes open, and compliant surface eyes closed. Center of pressure (COP) under each foot (100 Hz) was evaluated to determine 95% confidence, mean velocity and mean frequency of the mediolateral (ML) and anteroposterior (AP) components of the COP trajectories. 2-factor (group, condition) MANOVA was used to identify main effects (p < 0.05). **RESULTS:** There was no interaction between group and standing condition. However, a group effect was observed, (left leg: Λ* = .843, F=2.706, DF=6,87, p=.019; right leg: Λ* = .822, F=3.129, DF=6,87, p=.008). Mean velocity in the AP direction for the right leg was greater among NU (p = .044, 19% difference), respectively) and approached significance for the left leg (p = .054, 18% difference). Mean frequency in the AP (p = .006, 24% difference) and ML direction (p < .001, 27% difference) for the left leg was greater among NU. Similarly, mean frequency in the AP and ML direction for the right leg was also higher among NU (p = 0.068, 16% difference, p = 0.024, 20% difference, respectively). **CONCLUSION:** These data suggest a suppressed central nervous system drive to modulate posture in marijuana users. This is consistent with anecdotal evidence that marijuana has calming effects on the body.

THURSDAY, JUNE 1, 2017

2322 Board #335 June 1 3:30 PM - 5:00 PM
Effect of Abdominal Wall Muscle Fatiguing Exercise on Balance in Healthy College-Age Individuals

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 (No relationships reported)

Abdominal wall muscle function is thought to be an important factor affecting balance. **PURPOSE:** The purpose of this study was to determine if an acute fatiguing stimulus to the abdominal muscle groups affects balance in healthy college-age individuals. **METHODS:** A randomized pre-test post-test counterbalanced crossover design was utilized. Twenty healthy college-age students (age = 20.5±1.1 years; body mass = 71.3±14.5 kg; height = 168.8±10.4 cm; n = 10 males; n = 10 females) completed the trial and underwent two sets of seven different core muscle exercises to volitional fatigue after an aerobic full-body warm-up. The seven exercises were: Front plank, right side plank, left side plank, double leg raise, Russian twist, partial curl ups, and spine extension. Fatigue was determined as the point in which the participant could no longer maintain proper biomechanical form. Static single leg balance was assessed on each foot using a computerized balance assessment system (CBAS) and dynamic balance was assessed using the Star Excursion Balance Test (SEBT). Averages between the left and right side were calculated for both balance assessments and used during the statistical analysis. **RESULTS:** 2 X 2 repeated measures analysis of variance tests were calculated to assess for balance differences between the control group and the exercise group. Cohen's d effect sizes were calculated on pre and post measurements within each group. A statistically significant time-group interaction was noted on the CBAS mean scores (control pre vs post: 2.99±1.48 vs 2.53±0.81 degrees; exercise pre vs post: 2.91±1.13 vs 3.21±1.22 degrees; $p = 0.021$). However, the effect size of the exercise group pre vs post measure was small (Cohen's $d = 0.34$). No statistically significant differences occurred on the SEBT (control pre vs post: 670.5±85.6 vs 673.3±95.4 cm; exercise pre vs post: 664.9±78.6 vs 664.9±74.6 cm; $p = 0.687$). **CONCLUSIONS:** The abdominal wall muscle exercise protocol induced a statistically significant decrease in static balance but the size of the effect was small. Dynamic balance was not affected by the exercise protocol. Considering the small effect size and the statistical disagreement between the two assessments, it is possible that acute abdominal wall muscle fatigue may not functionally affect balance, but more research is needed.

2323 Board #336 June 1 3:30 PM - 5:00 PM
The Correlation of Forward Head Posture Measured via The Craniovertebral Angle to Neck and Low Back Pain

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Abstract

Physical health practitioners often recommend special attention and care for postural misalignment. The postural adaptation of forward head posture (FHP) has been assumed to compromise the structural integrity of the body causing or leading to pain. There has been limited studies examining the direct correlation between the degree of forward head posture and neck and low back pain. **PURPOSE:** To determine if there is a correlation between FHP angle and neck and low back pain. **METHODS:** Thirty nine male and thirty seven female subjects completed this study. Forward head posture was measured with via the craniovertebral angle (CVA) utilizing the Head Posture Spinal Curvature Instrument (HPSCI). The Northwick Neck Pain Questionnaire (NPQ) and the Oswestry Low Back Pain Questionnaire (ODQ) were used to assess pain in the neck and back, respectively. **RESULTS:** There was no correlation ($r = -0.09$) found between CVA measurement and total score of NPQ and no correlation ($r = -0.03$) was found between CVA and ODQ; however, a moderate correlation ($r = 0.54$) was found between the subjects' NPQ total score and the ODQ score. **CONCLUSION:** No correlation was found from increased forward head posture and neck and low back pain.

2324 Board #337 June 1 3:30 PM - 5:00 PM
Proprioception, Postural Sway and Mobility in Parkinson's Disease Patients And Healthy Individuals

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 (No relationships reported)

Previous studies have shown that ankle proprioceptive ability is significantly correlated with sports performance. It is unknown if ankle proprioceptive ability is related

to postural sway and mobility in healthy individuals (HI) and Parkinson's Disease patients (PD) and, if there is a relationship, how the groups may differ. **PURPOSE:** To examine ankle proprioception, postural sway and mobility performance in PD and HI. **METHODS:** PD (n=27) and HI (n=27) volunteers were matched for age (mean 62 years old), weight (mean 62 kg), and height (mean 161cm). Ankle proprioception was measured while standing, using the active movement extent discrimination apparatus (AMEDA). Bipedal postural sway was assessed via the Biodex Balance System, with eyes open and close in anterior-posterior and medio-lateral directions (EOAP, EOML, ECAP, and ECML, respectively). Mobility measures included the 30 seconds sit-to-stand (STS) and timed-up-and-go (TUG) tests. **RESULTS:** Compared to HI, PD showed significantly worse ankle proprioception, STS and TUG ($p = 0.03$, 95% CI = -1.03~-0.01, $p < 0.01$, 95% CI = -7.89~-3.52; $p < 0.01$, 95% CI = 1.90~4.19, respectively) but no differences were evident in any postural sway measures. Ankle proprioceptive discrimination scores were not significantly correlated with STS, TUG, or any postural sway measures in either PD or HI. However, both STS and TUG scores were significantly correlated with ECML in PD ($r = -0.548$, $p < 0.01$, and $r = 0.494$, $p < 0.01$, respectively), but not in HI. **CONCLUSIONS:** Our findings support the sensory-reweighting theory, suggesting that PD and elderly HI may use other sensory input, not ankle proprioception, to achieve optimal postural control. Given that PD's mobility is significantly correlated with ECML, specific exercise should be designed to address medio-lateral control in PD to promote mobility.

2325 Board #338 June 1 3:30 PM - 5:00 PM
Impact Of An Exercise Intervention On Human Balance Center Of Pressure Sway Parameters In Previously Sedentary, Overweight Adults

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PURPOSE: Previous research suggests that a loss in excess body weight could potentially lead to a substantial improvement in overall balance in previously obese and overweight individuals (Maffiuletti et al., 2005). However, very few studies have evaluated balance performance before and after weight loss due strictly to exercise. The purpose of this study was to evaluate if an exercise intervention aimed at weight loss could lead improvement in standing balance. **METHODS:** Fifteen overweight, but otherwise healthy adults (9 females, 6 males) (age: 23.5 years; height: 1.70 m, starting body mass: 92.8 kg) participated in this study. Balance performance was assessed with a sensory organization test (SOT) prior to and after a 10-week exercise intervention. Center of pressure (COP) sway velocities and root-mean-square (RMS) sway were analyzed using a repeated-measures ANOVA and potential relationships with changes in body mass was evaluated employing a Pearson correlation. **RESULTS:** Results from the SOT COP sway parameters revealed significant differences in the eyes closed (EC) for anterior-posterior sway velocity (AP VEL) ($p = 0.006$), and in the eyes open sway referenced (EOSRV) conditions for AP VEL ($p = 0.048$). Post hoc pairwise comparisons for both variables revealed significantly lower postural sway in post-intervention evaluation versus pre-intervention. In addition, there was shown to be a significant correlation between degree of weight change and the following variables: EOSRV medial-lateral (ML) VEL ($p = 0.002$), EOSRV ML RMS sway ($p = 0.011$), eyes open sway-referenced platform (EOSRP) ML RMS sway ($p = 0.029$), EOSRP AP RMS sway ($p = 0.049$), eyes closed sway-referenced platform (ECSR) ML VEL ($p = 0.003$), ECSR ML RMS sway ($p = 0.036$). **CONCLUSIONS:** The results of the current study suggest that improved balance performance can result from an exercise intervention without any directed balance exercises. This could especially be true in situations where the somatosensory system plays a greater role in maintaining balance.

2326 Board #339 June 1 3:30 PM - 5:00 PM
Recovery Of Center Of Pressure Variability Following Total Ankle Arthroplasty

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 (No relationships reported)

Postural stability is achieved through the integration of multiple systems including proprioceptive, vestibular and visual systems. Following a total ankle arthroplasty (TAA), balance is compromised due to the loss of joint sensory input. Variability is an inherent aspect of performance and a measure of neuromuscular adaptability. No previous research has investigated the recovery of variability following TAA.

PURPOSE: To quantify the recovery of center of pressure variability following TAA. **METHODS:** Forty-six individuals (63.3±9.6 years; 1.70±0.10 m; 83.7±17.1 kg) with severe ankle arthritis were recruited for this study. Each patient completed three trials of quiet standing for a period of 10 seconds with their feet placed together at three time points: before surgery (PRE-OP), and then one-year (POST-1yr) and two-years (POST-2yr) following TAA. Center of pressure (CoP) was recorded bilaterally using two embedded force platforms (1200 Hz, AMTI, Watertown, MA). Standard deviation (SD) of the CoP time-series was calculated for each limb (surgical and non-surgical) at each of the three time points. SPSS was used to conduct two 2 x 3 (side by time) repeated measures ANOVAs were used to determine the effect of surgical limb and time on CoP variability in the mediolateral and anteroposterior directions. Significance was set at $p < 0.05$. **RESULTS:** No significant time by limb interaction existed for either the anteroposterior or mediolateral CoP. No main effects for time ($p=0.35$) or limb ($p=0.44$) were observed in the anteroposterior CoP SD. No significant effect of limb was observed ($p=0.25$) for the mediolateral CoP, however, a main effect of time was present ($p=0.02$). Post-hoc tests revealed smaller SDs in PRE-OP compared to POST-1yr ($p=0.04$; PRE: 5.4±2.4; POST1yr: 6.4±5.8) while no differences were observed between PRE-OP and POST2yr ($p=0.11$; POST2yr: 6.8±7.0) or POST1yr and POST2yr ($p=0.43$). **CONCLUSIONS:** CoP variability magnitude was increased and maintained at two years post-TAA surgery. These data may suggest the presence of altered somatosensory input to the central nervous system increasing adaptability of postural control. Alternatively, increased variability may represent changes in postural control associated with reduced pain and inhibition associated with osteoarthritis.

2327 Board #340 June 1 3:30 PM - 5:00 PM
A 6-week Rehabilitation Training Improves Single-leg Static Postural Control In Patients With Chronic Ankle Instability
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Ankle sprains occur at a high rate and often develop into chronic ankle instability (CAI). Impaired postural control may be a contributing factor to CAI. Effective rehabilitation programs and preventative measures for CAI are needed.

PURPOSE: To examine the effect of a 6-week ankle and hip rehabilitation program on center of pressure (COP) total distance and 95% ellipse area during single-leg static balance among groups of strength, strength with balance, and control.

METHODS: 14 CAI subjects in a strength group (22±1 yrs, 173±9 cm, 73±12 kg, 82±8% FAAM ADL, 58±13% FAAM Sports, 3.0±0.8 MAII, 3.7±1.5 ankle sprains) completed a series of 5 ankle and hip strength exercises (isometric, concentric, and eccentric contraction with theraband). 15 CAI subjects in a strength and balance group (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) completed a series of 10 ankle and hip strength and balance exercises (theraband, wobble board, ankle disk, etc.). 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains). The rehabilitation intervention was administered 3 times/week for 6 weeks under supervision. Subjects performed 2 trials of single-leg stance on a force plate (1000 Hz) for 30 sec. 3 x 2 (group x time) mixed model ANCOVA analyses (covariate: pre-intervention value) with repeated measures were used to detect group x time differences in the COP total distance and 95% ellipse area.

RESULTS: Results are shown in Table 1.

Table 1.

	Strength (n=14)		Strength and balance (n=15)		Control (n=14)		F Value
	Pre	Post	Pre	Post	Pre	Post	
COP total distance (m)	18.9(4.2)	18.7(3.1)	18.8(3.7)	15.7(5.9)*	17.9(3.1)	17.5(3.8)	2.39 = 5.89 P < 0.05
COP 95% ellipse area (cm ²)	8.5(3.5)	8.0(3.0)	8.6(3.6)	5.9(1.9)§	8.0(3.6)	7.9(2.4)	2.39 = 5.88 P < 0.05

Values are mean (SD)
 *Changes in COP total distance (m) are significantly different than the strength and control groups (P < 0.05).
 §Changes in COP 95% ellipse area (cm²) are significantly different than the strength and control groups (P < 0.05).

CONCLUSION:

CAI patients in the strength and balance group improved postural control. Strength training alone did not have a significant impact on postural control. This may be due to the lack of proprioceptor activation during training. More data are needed to understand if this intervention may be used as a rehabilitation tool to reduce the risk of CAI.

2328 Board #341 June 1 3:30 PM - 5:00 PM
Maintenance of Postural Steadiness throughout Chemotherapy Treatment
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Chemotherapy negatively affects postural steadiness of cancer patients, contributing to an increased risk of falling. Physical activity improves postural steadiness, and has been shown to reduce toxic effects of chemotherapy such as peripheral neuropathy and vestibular dysfunction; two known causes of decreased postural steadiness.

PURPOSE: To determine whether postural steadiness improves in cancer patients undergoing chemotherapy following 12-weeks of exercise.

METHODS: Cancer survivors (n = 25; mass = 79.0 ± 22.6 kg; ht = 1.66 ± 0.08 m; age = 61.3 ± 10.0 yrs) receiving chemotherapy participated in this study. Postural stability was assessed prior to and following a 12-week individualized exercise intervention that included cardiovascular, muscular strength, flexibility, and balance training. In both pre- and post- measures, center of pressure (COP) data were collected (1000 Hz) for 10 seconds in four conditions: rigid surface eyes open (RSEO), rigid surface eyes closed (RSEC), compliant surface eyes open (CSEO), and compliant surface eyes closed (CSEC) using the Bertec BalanceScreener™ (Bertec Corporation, Columbus Ohio). Root-mean square (RMS), mean velocity (VEL), 95% confidence ellipse area (95CE), and mean frequency (FREQ) were investigated (Prieto et al., 1996). A MANOVA with repeated measures ($p < 0.05$) was used to identify main effects between pre- and post-training assessments.

RESULTS: From pre- to post- assessments mediolateral RMS decreased significantly for all conditions ($p < 0.04$ across all comparisons; RSEO by 35%, RSEC by 45%, CSEO by 43%, CSEC by 43%). A significant decrease was also observed in FREQ between pre- and post- assessments ($p < 0.044$ across all comparisons; RESEO by 29%, RSEC by 29%, CSEO by 31%, CSEC by 23%). No other variables changed significantly between pre and post assessments ($p > 0.05$).

CONCLUSIONS: Postural stability in the mediolateral direction was improved in cancer patients after 12-weeks of individualized exercise training. In addition, there was evidence of increased postural control based on an increased mean frequency of the COP trajectory after training. These results suggest that exercise training is beneficial to postural stability in cancer patients undergoing chemotherapy treatment.

2329 Board #342 June 1 3:30 PM - 5:00 PM
Preliminary Analysis: No Differences in Leg Strength Between Fallers and Non-Fallers
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 (No relationships reported)

Previous research suggests that increased leg strength in aging adults can decrease the risk of falling. Individuals with a history of falling are at increased risk for a recurrent fall. However, there is limited research in evaluating leg strength between Fallers and Non-Fallers.

PURPOSE: To evaluate isometric knee extension strength in aging adults that are classified as Fallers and Non-Fallers.

METHODS: Eighty-two aging adults (Fallers, n=39 age: 76±9.82 years, height: 1.61±0.09 m, mass: 79.63±7.74 kg, and Non-Fallers, n=43, age: 75±8.54 years, height: 1.61±0.07 m, mass: 78.99±20.38 kg) participated in this study. "Fallers" were defined as participants who had fallen within the year prior to the study, whereas "Non-Fallers" were participants that had not fallen within that time frame. A leg strength dynamometer (American Weight Scales, Inc.) was used to measure knee extension maximal voluntary isometric contractions (MVIC) for all participants. Participants were required to complete three valid trials of a unilateral knee extension MVIC for five seconds while sitting in a chair with the knee flexed at 90 degrees. Participants were given 20 seconds of rest between trials; the highest score was recorded. This protocol was performed for the right and left leg. Independent samples T-test were performed to compare leg strength values between Fallers and Non-Fallers ($p < 0.05$).

RESULTS: No significant differences ($p > 0.05$) were found between the two groups for right leg (Fallers=15.22±7.63 kg, Non-Fallers=13.72±5.87 kg) or left leg (Fallers=15.33±6.92 kg, Non-Fallers=14.93±6.91 kg) strength values.

CONCLUSION: No difference in isometric knee extension strength between Fallers and Non-Fallers was found. However, leg strength remains an important modifiable factor suggested in the falls prevention literature. Furthermore, research should evaluate if intervention programs have similar effects on leg strength on both Fallers and Non-Fallers. The effects of intervention programs should particularly target aging adults with a history of falls. These examinations may provide information to develop targeted intervention programs focusing on leg strength for Fallers. Research supported by grant from the Potomac Health Foundation.

THURSDAY, JUNE 1, 2017

2330 Board #343 June 1 3:30 PM - 5:00 PM
Postural And Cognitive Changes Observed During Re-Baseline Assessments

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Baseline assessments are vital in the evaluation of concussion and are recommended for any person competing in organized athletics. Following a head injury, the same assessments are administered and results are directly compared to baseline scores. Previous literature has suggested re-baseline assessments be administered to all athletes who have sustained a concussion, as the longitudinal effects of a single concussion are not well understood. However, the clinical utility of re-baseline concussion assessments has not been well investigated. Limited literature exists examining clinical change when evaluating postural control and cognition from baseline to re-baseline assessment following a concussion. **PURPOSE:** The purpose of this study was to examine the differences in clinical postural control and cognition with the Balance Error Scoring System (BESS) and the Standard Assessment for Concussion (SAC) in athletes who had previously sustained a concussion. **METHODS:** 34 NCAA athletes and cheerleaders (males = 13, females = 21) participated in this study. All athletes had previously been diagnosed with a concussion during the 2014-15¹ and 2015-16² athletic seasons. Pre-season concussion baselines (PRE) were administered before the first athletic season for each athlete and all athletes completed BESS and SAC evaluations. The same assessments were administered following full recovery from concussion (POST). A medical doctor confirmed the diagnosis and recovery of concussion. The SAC is a verbal assessment evaluating orientation, memory recall, and concentration. The BESS is a subjective evaluation used to identify balance impairments. One-way ANOVAs evaluated the scores on SAC and BESS between each time point. **RESULTS:** From PRE to POST no significant differences were observed with the BESS (PRE = 15.5 ± 7.34 errors, POST = 16.62 ± 8.04 errors; $p = .468$; $\Delta -2.12 \pm 8.69$) and SAC (PRE = 26.79 ± 1.59 units, POST = 27.24 ± 2.24 units; $p = .234$, $\Delta 0.44 \pm 2.12$). **CONCLUSIONS:** From PRE to POST assessment, scores on the SAC and BESS did not change significantly. This could suggest that re-baseline of the SAC and BESS has limited clinical utility. Future studies should include more sensitive assessments to adequately detect postural changes from baseline to re-baseline.

D-76 Free Communication/Poster - Protein Metabolism and Exercise

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

2331 Board #344 June 1 3:30 PM - 5:00 PM
Effect Of Different Protein Ratio Beverages On Blood Glucose Regulation

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 (No relationships reported)

When protein and essential amino acids are the most popular supplementation in sports nutrition. It has been recommended that protein plus carbohydrate in a certain ratio 1:3 or 1:4 improve the muscle glycogen synthesis and promote recovery. These benefits from protein and carbohydrate complex are compelling compared to supplement protein or carbohydrate alone. However different protein ratio on blood glucose regulation remains unclear.

PURPOSE: In this study we investigated a single supplement different protein beverage in different ratio on blood glucose regulation.
METHODS: We used cross-over study design. Twelve healthy college baseball players (21 ± 0 y). Thereafter the subjects were divided into four groups: protein0% (PRO0), protein12% (PRO12), protein36% (PRO36) and protein75% (PRO75). Fasting blood were collected. After drinking protein supplement, blood glucose and insulin were measured every 30 min for 2 h. The data were analyzed by one-way ANOVA with repeated measures.
RESULTS: PRO0 on glucose area under the curve (GAUC) was significantly higher than other groups (4241 ± 446 vs. 2538 ± 275, 1784 ± 234, 196 ± 287, $P < 0.05$) and PRO75 GAUC was significantly lower than other groups (196 ± 287 vs. 4241 ± 446, 2538 ± 275, 1783 ± 234, $P < 0.05$). After supplement 30 min PRO75 blood glucose was significantly lower than other groups (107 ± 2 vs. 166 ± 8, 139 ± 6, 146 ± 6 mg/dL, $P < 0.05$). After supplement 60 and 120 min PRO12 was significantly higher compared with PRO36 (123 ± 3 vs. 107 ± 4 mg/dL, $P < 0.05$ and 118 ± 3 vs. 108 ± 1 mg/dL, $P < 0.05$). PRO36 on insulin area under the curve (LAUC) was significantly higher compared with

PRO75 (2972 ± 336 vs. 1178 ± 158, $P < 0.05$). After supplement 30 min PRO36 produced higher insulin concentration compared with other groups (56 ± 7 vs. 31 ± 5, 35 ± 7, 14 ± 2 mU/L, $P < 0.05$).

CONCLUSION: High protein ratio did not have better glucose and insulin response. However PRO36 may increase insulin level faster than other groups, but did not secrete more insulin.

2332 Board #345 June 1 3:30 PM - 5:00 PM
Relationship Between Autophagy and Heat Shock Response in Peripheral Blood Mononuclear Cells Following Resistance Exercise

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Autophagy and protein degradation occur during the proximal hours (hr) post-exercise (PE) and are then followed by a gradual transition to protein synthesis. Previous works suggest that this biphasic relationship is mediated in-part by the heat shock response which may influence autophagy activity and may be influenced by the presence of amino acids. **Purpose:** To determine the effect of acute resistance exercise and branched-chain amino acid (BCAA) supplementation on autophagy and the heat shock response. **Methods:** Twenty males (22.3 ± 1.5 yr, 86.4 ± 15.6 kg; 175.4 ± 6.7 cm) were randomly assigned to complete 8 days of 0.22 g/kg/d BCAA or placebo (PL) supplementation. On day 5 participants performed a bout of eccentric resistance exercise. Peripheral blood mononuclear cells (PBMC) were isolated pre-exercise, immediately post-exercise (IPE), and 2, 4, 24, 48, and 72 hr. PBMC protein expression of autophagy markers (LC3I & II, & p62) and HSP70 were measured using Western blot. All autophagy and heat shock markers were assessed in relation to a standard baseline (1.0RQ). Red cell lysate was collected pre-exercise, IPE, and 1, 2, 4, and 24 hr to assess glutathione/total glutathione ratio (GSSG/tGSH). **Results:** No group differences ($p > 0.05$) were detected for protein expression of autophagy markers, HSP70, or GSSG/tGSH ratio at any time-point. When combining groups, LC3II decreased significantly ($p < 0.01$) at 2 (0.51 ± 0.38RQ) and 4 (0.41 ± 0.36RQ) hr PE. p62 decreased significantly ($p < 0.001$) at IP (0.56 ± 0.33RQ), 2 (0.24 ± 0.23RQ), and 4 (0.33 ± 0.31RQ) hr PE and significantly increased ($p < 0.01$) at 24 (1.43 ± 0.44RQ) hr PE. HSP70 increased significantly ($p < 0.001$) increased at 48 (1.59 ± 0.96RQ) and 72 (4.71 ± 3.84RQ) hr PE. GSSG/tGSH ratio significantly ($p < 0.05$) increased from baseline (0.11 ± 0.04RQ) at 1 (0.39 ± 0.05RQ), 2 (0.69 ± 0.22RQ), and 4 (0.39 ± 0.17RQ) hr post-exercise. **Conclusion:** These data support previous work that the heat shock response may exert regulatory control of autophagy in-part through HSP70. HSP70 may assist in transitioning the cell from an initial degradation phase immediately following exercise towards protein synthesis in the latter phases of the post-exercise period. The initial autophagy upregulation may be influenced by oxidative stress.

2333 Board #346 June 1 3:30 PM - 5:00 PM
Matrix Metalloproteinases and Tissue Inhibitors of Metalloproteinases Following High Fat Diet and Acute Exercise

Yunsuk Koh¹, Yonghyeon Jo¹, Eric K. O'Neal², Angela Hollingsworth², Lauren G. Killen², Ashton F. Waddell², Alexander J. Heatherly². ¹Baylor University, Waco, TX. ²University of North Alabama, Florence, AL.
 (No relationships reported)

Matrix metalloproteinases (MMPs) play a major role in apoptosis, angiogenesis, and inflammation by degrading extracellular matrix proteins. Specific endogenous proteases, tissue inhibitors of MMPs (TIMPs), are known to inhibit MMPs.

PURPOSE: The current study examined the effects of a high fat diet and an acute bout of exercise on MMPs and TIMPs in runners. **METHODS:** Eight middle-aged, aerobically trained male runners ($\text{VO}_{2\text{max}} = 48.5 \pm 4.5$ mL/kg/min, age = 39.5 ± 9.9 years) participated in the study. As a crossover design, participants maintained their habitual high carbohydrate diet (HC, 60-70% of carbohydrate) in the beginning of the study and shifted to a high fat (HFLC, ~70% of total calories from fat) diet with < 50 g of carbohydrate per day for 3 weeks during the second phase. At the end of each phase, participants performed a 50-min acute bout of treadmill exercise at varying race paces in an environmental chamber (29 °C with 60% relative humidity) followed by an outdoor 5-km time trial (average = 23 min). Overnight fasting serum samples were collected at pre- and 24-hr post-exercise during both HC and HFLC phases to analyze MMPs (MMP-1, -2, -9, and -10) and TIMPs (TIMP-1, -2, -3, and -4). Data were

analyzed using a 2 X 2 (phases: HC and HFLC X time: pre- and 24-h post-exercise) analysis of variance with the Sidak's multiple comparisons when necessary ($p < 0.05$). **RESULTS:** There was no significant difference in MMPs or TIMPs between HC and HFLC phases. Furthermore, an acute bout of exercise in the heat did not alter MMPs or TIMPs. There were, however, significant positive correlations between TIMP-2 and MMP-2 ($r(14) = 0.51, p = 0.01$) and TIMP-2 and MMP-9 ($r(14) = 0.49, p = 0.01$). Additionally, a significant negative correlation was found between TIMP-4 and MMP-4 ($r(14) = -0.57, p = 0.02$). **CONCLUSION:** A 3-week high fat diet and an acute intense exercise in the heat did not negatively affect serum MMPs and TIMPs in healthy, trained male runners. It seems that MMP-4 activity may be inhibited by TIMP-4, whereas both MMP-2 and -9, interestingly, may be upregulated by TIMP-2. Future studies examining the effects of a long-term high fat diet on metabolic pathways of circulating or tissue MMPs and TIMPs in active individuals along with a variety of populations are highly recommended.

2334 Board #347 June 1 3:30 PM - 5:00 PM

Whey Hydrolysate Supplementation Following Resistance Exercise Elicits Similar Anabolic Responses in Both Young and Older Adults

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(No relationships reported)

Skeletal muscle sensitivity to dietary protein and exercise typically declines during aging. However, previous data presented by our group indicates that whey protein hydrolysate (WH, di- and tri-peptide mixture) may be able to stimulate muscle anabolism at lower dosages than observed with intact whey protein in older adults. **PURPOSE:** To compare the effect of a minimal dose (10 g) of WH provided after resistance exercise (REX) on skeletal muscle anabolism in young and older adults. **METHODS:** Twenty healthy recreationally active adults (YOUNG: M=8, F=2; 25±4yr, 25±4 kg·m² | OLD: M=7, F=3; 65±4yr, 25±4 kg·m²) were studied pre- and post-ingestion (PI) of 10 g of WH 1 h after high-intensity REX (8x10@~70% 1RM, leg ext). We measured mixed-muscle protein fractional synthetic rate (FSR) and plasma BCAA concentrations by stable isotopic methods. Western-blotting was used to assess anabolic signaling and the presence of peptide transporters in muscle. Muscle biopsies from the vastus lateralis were collected at rest and during the early (0–2 h) and late (2–4 h) PI periods. Mixed muscle FSR and anabolic signaling was analyzed using a 2(group) x 3(time) mixed model ANOVA repeated across time. BCAA concentrations were modeled separately per time point using a 2 (group) x 2 (time) mixed-model ANOVA. Type I error for all analyses was set at $\alpha=0.05$.

Effects on Post Resistance Exercise Mixed-Muscle FSR (%/h)						
Groups	Basal	(0-2h) Post Ingestion	(2-4h) Post Ingestion	Entire Post Ingestion Period (0-4h)		
YOUNG (n=10)	0.058% ± 0.003	0.075% ± 0.003 †	0.100% ± 0.009 †	0.087% ± 0.005 †		
OLD (n=10)	0.067% ± 0.005	0.106% ± 0.012 †*	0.091% ± 0.014 †	0.086% ± 0.005 †		
Plasma BCAA Concentrations (Δ From Basal, umol·L)						
Time Post Ingestion	20min	40min	60min	80min	100min	180min
Leucine						
YOUNG	259 ± 29†	206 ± 24†	112 ± 20†	68 ± 9†	50 ± 7†	42 ± 7†
OLD	247 ± 28†	255 ± 22†*	149 ± 20†	146 ± 22†*	114 ± 25†*	57 ± 16†
Isoleucine						
YOUNG	103 ± 12†	87 ± 13†	39 ± 8†	20 ± 4†	13 ± 3†	10 ± 3
OLD	90 ± 9†	98 ± 6†	54 ± 6†	45 ± 5†*	31 ± 4†*	13 ± 4
Valine						
YOUNG	126 ± 17†	123 ± 13†	62 ± 11†	31 ± 8†	16 ± 7	6 ± 6
OLD	99 ± 10†	128 ± 8†	74 ± 7†	70 ± 13†*	44 ± 6†*	10 ± 8
Data are means ± SE. † different from basal value; * different from the YOUNG group ($p < 0.05$)						

RESULTS:

Compared with rest, increases in p-mTOR (Young: +2.0 fold, Old: +2.5 fold) and p-4E-BP1 (Young: +1.5 fold, Old: +1.4 fold) were observed in both groups at 4h PI ($p < 0.05$). Increases in p-S6K1 were observed in both groups at 2h PI but to a greater extent in the OLD group ($p < 0.05$). Peptide transporter-1 (PEPT1) expression was found in muscle samples from both groups. **CONCLUSION:** WH provided after REX enhances muscle anabolism in older adults at a dose previously shown to be ineffective with intact whey isolate. Future studies will be required to determine if WH may aid in the long-term preservation of muscle in this population.

2335 Board #348 June 1 3:30 PM - 5:00 PM

Recovery is Not Facilitated with Protein Supplementation Following Muscle-Damaging Concurrent Exercise

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(No relationships reported)

Concurrent exercise is an important training modality for many sports and the dynamic nature of concurrent training imposes significant physiological stress that can lead to exercise-induced muscle damage (EIMD). Additional protein is frequently consumed with the intention to improve exercise recovery following EIMD; however the evidence for this practice is equivocal at best because of limitations in the research, which are attributable, at least in part to poor dietary control. **PURPOSE:** To investigate the efficacy of protein as a recovery aid following damaging exercise in a concurrent training paradigm, when rigorous dietary control and supplementation are provided. **METHODS:** Twenty-four well-trained male cyclists were randomised to three groups receiving supplement servings of 20 g protein, or an iso-caloric carbohydrate or low-calorific placebo. Supplements were provided twice daily from the onset of the muscle-damaging exercise and for a total of four days. During this time a controlled diet was consumed by all participants (6 g·kg⁻¹·d⁻¹ carbohydrate, 1.2 g·kg⁻¹·d⁻¹ protein, remainder fat). The concurrent exercise consisted of a simulated high-intensity road cycling trial followed by 100 drop-jumps; dependent measures were taken before and at 0, 24, 48 and 72 h following the concurrent exercise bout. **RESULTS:** Significant time effects for decrements in maximal voluntary contraction (MVC) and countermovement jump (CMJ) performance, along with increased muscle soreness, serum creatine kinase (CK) and C-reactive protein (CRP) concentrations provided evidence that EIMD had been induced ($p < 0.001$). No group or interaction effects ($p > 0.05$) were observed for any of the dependent measures, with both MVC and CMJ performance reaching a nadir immediately post-exercise (MVC: 83 ± 8, 85 ± 11 and 89 ± 11% of baseline for PRO, PLA and CHO; CMJ: 93 ± 8, 91 ± 8 and 93 ± 6% of baseline for PRO, PLA and CHO) and both CK and CRP values peaked at 24 h post-exercise (CK: 282 ± 166, 341 ± 167 and 291 ± 177% of baseline for PRO, PLA and CHO; CRP: 206 ± 110, 260 ± 207 and 241 ± 178% of baseline for PRO, PLA and CHO). **CONCLUSION:** Protein supplementation did not attenuate any of the indices of EIMD imposed by concurrent exercise, when employing high degrees of rigour around the habitual diet and the provision of appropriate supplemental controls.

2336 Board #349 June 1 3:30 PM - 5:00 PM

The Effects of Whey vs. Soy Protein at Breakfast on Satiety Response, Energy Intake and Metabolism

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Elon University, Elon, NC.
(No relationships reported)

PURPOSE: To determine the effects of animal-based (whey) compared to plant-based (soy) protein on perceived satiety, hunger, fullness, desire to eat, prospective food consumption, thirst, energy metabolism and subsequent energy intake. **METHODS:** Seventeen healthy men and women (age: 27 ± 7, BF%: 21.5 ± 6.9) consumed three isocaloric breakfast smoothies with 40% of energy from either whey, soy, or control (no protein) in a double blind, randomized crossover design. Participants completed a visual analog scale (VAS) of appetite profile and thirst (before, 0, 60, 120, 180 minutes). Indirect calorimetry was used to determine the effect of a meal (TEM) (at 45-60, 105-120, 165-180 minutes). In addition, energy intake at lunch was recorded. **RESULTS:** There was a significant difference in hunger ($p = 0.03$), satiety ($p = 0.001$), fullness ($p = 0.001$), desire to eat ($p = 0.03$), and prospective food consumption ($p = 0.04$) between the three breakfast conditions. Measures of satiety and fullness were higher whereas hunger, desire to eat, and prospective food consumption were lower after consumption of whey protein compared to control. A significantly higher ($p < 0.05$) respiratory quotient (RQ) and lower oxygen consumption (VO₂) was observed for whey and soy compared to control condition. In addition, a significantly higher (p

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<0.05) energy intake at lunch was observed after control (770 ± 289 kcals) compared to whey condition (654 ± 252 kcals). However, there was no significant difference ($p > 0.05$) in energy intake between soy (696 ± 296 kcals) and whey or control conditions. **CONCLUSIONS:** Consuming whey or soy protein at breakfast led to similar perceptions of appetite profile as well as lower energy intake at lunch, which may aid in weight management efforts among individuals following a vegan or vegetarian diet.

D-77 Free Communication/Poster - Renal Physiology

Thursday, June 1, 2017, 1:00 PM - 6:00 PM
Room: Hall F

2337 Board #350 June 1 3:30 PM - 5:00 PM Hydration and Renal Responses During Pre-Season High School American Football

Cory L. Butts¹, Aaron R. Caldwell¹, Richard A. Perry, Jr.¹, Kathleen M. Heath¹, J.D. Adams¹, Matthew S. Ganio, FACSM¹, Lisa T. Jansen¹, Hyun-Gyu Suh¹, Lesley W. Vandermark¹, M. Kyle Smoot², Brendon P. McDermott¹. ¹University of Arkansas, Fayetteville, AR. ²University of Kentucky, Lexington, KY.
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Reported Relationships: C.L. Butts: Consulting Fee; Gatorade Sports Science Institute.

American football athletes often report to practices and games in a hypohydrated state, potentially increasing the risk for performance and thermoregulatory impairments. However, the renal responses to progressive dehydration with environmental and workload stressors, have not been elucidated in this population. **PURPOSE:** To observe the hydration status and renal function of high school American football players during preseason practices. **METHODS:** High school American football players ($n = 31$ males, age 16 ± 1 y, ht 1.79 ± 0.07 m, mass 88.4 ± 19.9 kg, body fat $19.9 \pm 9.4\%$) participated in this observational study. Body mass (BM), blood, and urine samples were obtained 2-3 days prior to the start of pre-season practices (Base) and at Days 4 (D4), 7 (D7), and 10 (D10). D4 and D7 samples were collected prior to practice while D10 samples were obtained post-practice. Serum osmolality (S_{osm}), urine specific gravity (U_{sg}), and urine color (U_{color}) were measured at each time point. Renal stress was assessed by measuring plasma neutrophil gelatinase-associated lipocalin (pNGAL) via enzyme linked immunosorbent assay. Wet bulb globe temperatures (WBGT) were also recorded for each practice. **RESULTS:** BM did not change significantly from Base (91.6 ± 22.9 kg) through D10 (90.2 ± 23.2 kg; $p = 0.26$). S_{osm} at Base (292 ± 4 mOsm/kg) was significantly lower than D10 (295 ± 4 mOsm/kg, $p = 0.05$). Further, $S_{osm} > 290$ mOsm/kg was present in 67-73% of players reporting to practices on D4 and D7, and 80% finishing practice on D10. U_{sg} at Base (1.023 ± 0.007) and D10 (1.027 ± 0.005) were greater than D4 (1.018 ± 0.009) and D7 (1.019 ± 0.009 , all $p < 0.05$). U_{color} on D4 (3 ± 1) was lower than Base (4 ± 1) and D10 (4 ± 1 , all $p < 0.05$). pNGAL was not different throughout preseason (Base, 50.7 ± 12.5 ng/mL, D10, 52.8 ± 14.7 ng/mL, $p = 0.19$). Further, there was no relationship between S_{osm} and pNGAL ($r = -0.03$, $p = 0.77$) or U_{sg} and pNGAL ($r = 0.05$, $p = 0.63$). Average WBGT ranged from 20.0°C to 31.1°C . **CONCLUSIONS:** At least two-thirds of players reported for or completed practice sub-optimally hydrated. However, renal stress assessed via pNGAL was not elevated throughout preseason. Thus, despite suboptimal hydration and environmental stress, these American football players experienced minimal renal injury as measured via pNGAL.

Supported by AMSSM-ACSM Grant

2338 Board #351 June 1 3:30 PM - 5:00 PM Low Estimated Glomerular Filtration Rate (eGFR) is Associated with Skeletal Muscle Function Deficit in Elderly Persons

Jae Seung Chang, Tae Ho Kim, In Deok Kong. *Yonsei Institute of Sports Science & Exercise Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea, Republic of.*

(No relationships reported)

Physical performance is closely associated with chronic diseases and dysfunction of numerous organ systems. Old persons with chronic renal failure have shown the apparent decline in physical performance, especially in the end-stage. However, it is unclear whether the subclinical kidney dysfunction is associated with skeletal muscle function deficit in the elderly population.

PURPOSE: To determine the association between renal function and skeletal muscle function deficit in old persons without nephropathy. **METHODS:** Eight hundred fifty-four Korean elderly (female, 75.3%) aged 65 to 89 years were included in this cross-sectional study. All participants were interviewed face-to-face and received

measure of anthropometry, body composition and serum biomarkers of metabolic diseases. eGFR was calculated using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation based on serum creatinine concentration. The following physical performance tests were performed: handgrip strength (absolute and relative values), timed up-and-go (TUG), chair stand, 2 min stationary walking, figure-eight walk and sit-and-reach. Skeletal muscle function deficit was defined as a combination of weakness and slowness based on the relative handgrip strength (men < 1.32 , women < 0.792) and converted TUG to walking speed (< 0.8 m/s), respectively. **RESULTS:** Of the subjects, the prevalence of $30 \leq \text{eGFR} < 45$ mL/min/1.73m² was 16.2%. The subjects with $30 \leq \text{eGFR} < 45$ mL/min/1.73m² showed significantly lower physical performance for muscular strength and functional mobility than those with $45 \leq \text{eGFR} < 60$ and $\text{eGFR} \geq 60$ mL/min/1.73m², respectively (all for $p < 0.05$). Multinomial (polychotomous) logistic regression analysis, with three categories of eGFR as the dependent variable, showed the significant association between eGFR and skeletal muscle function status even after adjustment for potential confounders (odds ratios [95% CI] were 4.8 [1.3-17.2] for a GFR of 45 to 59, 12.9 [3.1-52.9] for above 60 mL/min/1.73m², p for trend < 0.01). **CONCLUSION:** Taken together, skeletal muscle function status is associated with even moderately reduced eGFR in an older population. This finding suggests that maintenance of physical and functional fitness may be a contributory factor for preserving renal function in elderly persons.

2339 Board #352 June 1 3:30 PM - 5:00 PM Impact of Moderate Intensity Endurance Exercise on Kidney Injury

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(No relationships reported)

Purpose. Exercise-induced redistribution of blood results in a decreased renal perfusion and changes in glomerular permeability and filtration ratio. These alterations may lead to a deterioration of renal function or even acute, but transient, renal failure. Kidney Injury Molecule-1 (KIM1) and Neutrophil gelatinase-associated lipocalin (NGAL) are new urinary biomarkers to detect kidney injury in an early stage. Therefore, the purpose of this study was to examine the effects of an acute bout of endurance exercise on urinary KIM1 and NGAL levels.

Methods. A total of 60 subjects (56 ± 10 years) participated in an annual walking event and walked 30-50 km at a self-selected pace. Heart rate was recorded every 5 km. Baseline and post-exercise blood and urine samples were taken to assess fluid balance and kidney injury and body mass was measured to determine the relative body mass loss. Urinary KIM1 and NGAL levels were corrected for variations in urine volume and for urinary concentration changes using urinary cystatin C.

Results. Subjects completed the exercise bout at $71 \pm 9\%$ of their predicted maximal heart rate. At baseline, kidney function, measured as estimated glomerular filtration rate (eGFR) was 89.3 ± 11.6 mL/min, whereas 49% of the subjects had a slightly decreased kidney function ($\text{eGFR} < 90$ mL/min). Post-exercise body mass loss was $0.9 \pm 1.2\%$ and 20% of the subjects were dehydrated after exercise (relative body mass loss $> 2\%$). We observed a significant increase in post-exercise cystatin C-corrected urinary NGAL levels (3.0 ± 1.5 ng/10 μg cystatin C) compared to baseline (2.3 ± 1.3 ng/10 μg cystatin C, $p = 0.025$). Moreover, 65% of subjects demonstrated elevated NGAL levels after exercise. In contrary, corrected urinary KIM1 levels did not change after exercise (0.70 ± 0.45 versus 0.74 ± 0.49 ng/10 μg cystatin C, $p = 0.63$). At baseline, 2 subjects were detected with proteinuria, whereas 8 subjects had post-exercise proteinuria ($p = 0.048$).

Conclusion. The increased levels of cystatin C corrected NGAL and proteinuria after an acute bout of endurance exercise suggest that an acute bout of endurance exercise may cause transient kidney injury.

2340 Board #353 June 1 3:30 PM - 5:00 PM Changes in Glomerular Filtration Rate after Maximal and Submaximal Exercise in Olders

Marina M. Trejo¹, Francisco J. Diaz², Carlos Kornhauser², Maciste Macias², Antonio Rivera², Magdalena Nájera², Citlalli Arce¹, Arturo Figueroa-Galvez, FACSM¹. ¹Universidad Autonoma de Baja California, Baja California, Mexico. ²Universidad de Guanajuato, Guanajuato, Mexico. ³Florida State University, Florida, FL. (Sponsor: Figueroa Galvez Arturo, FACSM)

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(No relationships reported)

PURPOSE: Strenuous exercise may decrease Glomerular Filtration Rate (GFR) in older adults. However, kidney function in older adults has not been investigated utilizing the new creatinine-cystatin C equation for GFR during exercise. The

purpose of this study was to analyze the effect of maximal and submaximal bicycle exercise utilizing the equation for GFR of creatinine-cystatin C in older adults (≥ 65 years). **METHODS:** Twenty healthy subjects (13 men and 7 women; 70 ± 4 years) participated in the study. Subjects performed 3 bicycle exercise tests one week apart: one maximal (MAXCAP-B), and two 20-minute submaximal at 80% (SUBMAX-B80) and 60% (SUBMAX-B60) of heart rate reserve (HRR), respectively. Blood samples were obtained before and after the test in the seated position to measure the plasma concentration of creatinine and cystatin C. GFR was estimated according to the equation of Creatinine-Cystatin C Equation (CKD-EPI 2012). **RESULTS:** MAXCAP-B produced a significant reduction in GFR (87.3 ± 18.3 ml/min to 80.9 ± 18.8 ml/min, $P < 0.05$). SUBMAX-B80 (80.6 ± 14.03 ml/min to 82.7 ± 16.9 ml/min) and SUBMAX-B60 (84.7 ± 15.0 ml/min to 80.3 ± 12.7 ml/min) produced no significant reduction in GFR. **CONCLUSIONS:** Although maximal exercise produced a decrease in GFR, the changes were minimal. Intense and moderate exercise did not alter significantly GFR when the equation of creatinine-cystatin C was used. Kidney function after intense and moderate exercise in older adults was preserved, indicating safe incorporation of exercise at these intensities.

D-78 Clinical Poster Reception

Thursday, June 1, 2017, 5:45 PM - 6:45 PM
Room: Hotel-Mineral B

2341 Board #1 June 1 5:45 PM - 6:45 PM

Back Injury - Cheerleading

Michael Stilller, Michelle A. Miller. *The Ohio State University, Columbus, OH.*

(No relationships reported)

HISTORY: A 15-year-old high school cheerleader sustained a back injury while cheering on her school's football team. She was performing a "toe touch" jump and upon landing, she felt a "pop" and a sharp pain posteriorly between her shoulder blades. An hour later, she developed a "pins and needles" sensation from her belly button to her toes bilaterally. The next morning, the numbness had spread to just under the ribcage and she fell when trying to stand upright from bed. She presented to the emergency room later that morning.

PHYSICAL EXAMINATION: Examination revealed that she was afebrile with normal vital signs. There was no tenderness on palpation over the spinous processes or the paraspinal musculature. Her neurologic exam was significant for decreased sensation to light touch at the T8 dermatome and caudally with a proprioception deficit in the great toe bilaterally. Strength was 4/5 throughout the left lower limb. The patellar reflexes were 3/4 and the Achilles were 2/4 bilaterally. She demonstrated a wide-based gait with significant loss of balance.

DIFFERENTIAL DIAGNOSIS:

1. Spondylolysis/spondylolisthesis
2. Vertebral fracture
3. Intervertebral disc herniation
4. Transverse myelitis
5. Psychogenic

TESTS AND RESULTS:

ESR and CRP normal

T-spine MRI:

1. Mild age related change/disc degeneration at T7-8 and T8-9 with a small acute appearing central disc protrusion at T8-9 that abuts the adjacent spinal cord.
2. No findings to indicate transverse myelitis.

FINAL/WORKING DIAGNOSIS: T8-9 intervertebral disc herniation resulting in myelopathy.

TREATMENT AND OUTCOMES:

1. Neurosurgery consult with no surgical intervention taken. Patient admitted for continued monitoring, PT, and OT.
2. Notable lower limb strength improvement seen over the first three days, however, acute inpatient rehabilitation was needed to assure ability for safe ambulation with impaired lower limb sensation.
3. After 12 days of inpatient rehab, lower body sensation was still impaired, but patient demonstrated improved lower limb strength and was ambulating with proper technique multiple times around the unit without assistance.
4. Patient discharged with outpatient therapy and a follow-up with neurosurgery in one month with repeat spine MRI.
5. Patient instructed to not return to cheerleading until follow-up.

2342 Board #2 June 1 5:45 PM - 6:45 PM

Wrist Injury - Go karting

Jonathan T. Napolitano, Anastasia Fischer, FACSM. *Nationwide Children's Hospital, Columbus, OH.*

(No relationships reported)

HISTORY: A 15 year old right handed female basketball player presented to the sports medicine clinic of a pediatric hospital four months after a go-karting accident. The go-kart rolled and landed on her right wrist. With no significant pain or disability after the injury she did not seek immediate medical attention. Four months later she presented with increased pain and swelling in the wrist. She was immobilized with a cock-up splint and instructed to follow up after further imaging and occupational therapy. Her pain improved with bracing and she was lost to follow-up, attending only one occupational therapy visit. She presented again eight months later with improved pain and swelling but severe loss of range of motion. **PHYSICAL EXAMINATION:** Inspection of the right upper extremity revealed atrophy of right forearm, wrist, and hand, and a volar angular deformity of the wrist. No tenderness to palpation. Active and passive range of motion was severely limited in all directions. No soft tissue swelling or effusion. No temperature or skin texture changes. **DIFFERENTIAL DIAGNOSIS:** Post-traumatic arthritis, complex regional pain syndrome, juvenile idiopathic arthritis. **TEST AND RESULTS:** X-ray attached. MRI: Diffuse infiltrative process suggestive of ongoing inflammatory process. 3 Phase Bone Scan: Increased uptake along the right wrist and carpal joints. Sedimentation Rate: 45mm/h. Anti-CCP: 160 U. Rheumatoid Factor: 250 IU/mL. X-Rays of bilateral elbows reveal possible joint effusions. Ankle x-ray with irregular dorsal contour of the navicular. **FINAL WORKING DIAGNOSIS:** Rheumatoid factor positive, polyarticular, juvenile idiopathic arthritis. **TREATMENT AND OUTCOMES:** The patient was referred to rheumatology for further workup and close follow-up, started on methotrexate, etanercept, and prednisone, and subsequently referred to orthopedic surgery for evaluation for wrist fusion, and to physical and occupational therapy for joint range of motion and preservation.



2343 Board #3 June 1 5:45 PM - 6:45 PM

Hepatotoxicity Associated With Frozen Shoulder In A 47 Year Old Tennis Player; What's The Link?

Michael J. Murphy, Brian Keisler. *Palmetto Health Richland - University of South Carolina, Columbia, SC.*

(No relationships reported)

HISTORY: A 47 year-old female recreational tennis player with no past medical history presented with 4 months of increasing shoulder pain and stiffness. She was diagnosed with adhesive capsulitis and started on diclofenac sodium 75mg BID. Over the next month she started having abdominal pain and stopped taking diclofenac. Her pain continued to worsen and she developed intractable vomiting and jaundice and went to the hospital at that time.

PHYSICAL EXAMINATION: Alert and oriented. Scleral icterus and jaundice present. No spider telangiectasias or angiomas. No JVD. Lungs were clear. Heart regular rate and rhythm, no murmur, rub, or gallop. Abdomen soft with minimal RUQ tenderness and no ascites. Right shoulder with full ROM and normal strength. Left shoulder had severely restricted ROM in all directions with significant pain. Her neurologic exam was normal including no asterixis.

DIFFERENTIAL DIAGNOSIS: Primary Biliary Sclerosis, Viral Hepatitis, Wilson's Disease, Hemochromatosis, Medication Hepatotoxicity, Malignancy, Autoimmune Hepatitis, $\alpha 1$ -Antitrypsin Deficiency, Porphyria, Granulomatous Liver Disease, Idiopathic Portal Fibrosis

TEST AND RESULTS: Bilirubin 24.4 (Direct 20.3), AST 650, ALT 859. Lipase, iron studies, ceruloplasmin, IgG, IgA, IgM, ANA, viral hepatitis panel, PT, INR, CBC, chem-7, alkaline phosphatase, and total protein all within normal limits. PPD negative. RUQ US: cholelithiasis without evidence of cholecystitis. CT Abdomen/pelvis with contrast: hepatosplenomegaly without any masses or ascites.

FINAL WORKING DIAGNOSIS: Diclofenac induced hepatotoxicity

TREATMENT AND OUTCOMES: 1.Cessation of diclofenac. 2.In addition to inpatient GI consult and outpatient follow up, she also saw hepatology who agreed with diagnosis and treatment. 3.Initially followed LFT's daily, which was spaced to bi-weekly at discharge and continued to be spaced as she improved. Her transaminases decreased and normalized within a week. Her bilirubin increased to 30.6, and then gradually decreased until normalizing 8 months later. 4.Her adhesive capsulitis gradually improved, although she continued to have decreased ROM at last follow up which continued to restrict her ability to play tennis. 5.NSAIDs are now completely contraindicated for her. 6.She has annual follow up with GI for labs.

2344 Board #4 June 1 5:45 PM - 6:45 PM

**Proximal Muscle Weakness in 10-year-old Female
Gymnast**

Peter Waller, David Lessman, Philip Skiba. *Advocate Lutheran General Hospital, Park Ridge, IL.*

(No relationships reported)

History:

A 10-year-old gymnast initially presented with three weeks of right hamstring pain, and was started on a home exercise program. After 4 weeks without improvement, the patient was started on a program of formal physical therapy. After ten weeks of therapy, the patient began to develop core muscle weakness and right anterior hip pain, and reported an inability to walk more than a mile without limping. She went on to develop similar pain with stair climbing, as well as activities of daily living. Shortly thereafter, the patient began to complain of quadriceps weakness and thoracic back pain.

Physical Examination:

Afebrile. Muscle strength 4/5 with bilateral shoulder elevation and abduction. Strength 5/5 with elbow flexion and extension. Bilateral hip flexor strength 3/5. Sensation intact in upper and lower extremities bilaterally. Deep tendon reflexes 2+ bilaterally. Scaly erythematous rash on each side of nose. Erythema present across knuckles bilaterally.

Differential Diagnosis:

1. Juvenile Dermatomyositis
2. Polymyositis
3. Viral myositis
4. Lupus Erythematosus

Tests and Results:

Labs: CPK: 524 H, AST: 75 H, ALT: 32 H, ESR: 18 wnl, Aldolase 11 H, CRP <0.3 wnl, LDH Total 317 H

X-Ray: 3V of bilateral hips-No acute fractures, subluxation, or dislocations.

MRI Pelvis: Diffuse intramuscular edema, predominantly involving gluteal muscles.

Consistent with myositis.

Final Working Diagnosis: Juvenile Dermatomyositis

Treatment and Outcomes:

1. Patient admitted to outside hospital, and patient started on daily prednisone, weekly methotrexate, and hydroxychloroquine.
2. Patient started on IV methylprednisolone weekly, and monthly IVIG infusion by rheumatology
3. Evaluation at NIH Myositis Clinic. Recommended increasing IVIG dosing and pulse doses of IV steroid with every IVIG infusion.

2345 Board #5 June 1 5:45 PM - 6:45 PM

Cardiovascular Injury-Marathon Running

Stephen Schaaf, Beth Stepanczuk. *University of Pittsburgh Medical Center, Pittsburgh, PA.*

(No relationships reported)

HISTORY: A 48-year-old female competitive marathon runner with no significant past medical history developed right sided neck pain while running a race. The patient completed the race at her typical pace, finishing top five in her age group. After the race, her right sided neck pain persisted. Around thirty minutes post-race she began to have sudden onset dizziness, causing her to fall to the ground. While on the ground, she soon developed severe vertigo, nausea, and emesis. EMS was immediately called and she was transported to the hospital. During transport the patient had loss of consciousness.

PHYSICAL EXAMINATION: Examination in the emergency room found the patient to be hemodynamically stable. She was noted to be lethargic but arousable, unable to stand due to vertigo, and had continued nausea and emesis. The rest of her physical exam was benign.

DIFFERENTIAL DIAGNOSIS:

Cardiac arrest
Carotid artery dissection
Exercise associated hyponatremia
Exercise associated hypotension
Hemorrhagic stroke
Hypoglycemia
Ischemic stroke
Vertebral artery dissection

TEST AND RESULTS: BMP, CBC, Troponin, UDS, EKG, and CT Head without contrast were all normal. CT angiography of the neck: Acute focal right vertebral artery dissection at C2-C3. MRI of the brain and MR angiography of the neck: Right cerebellar vermis infarct and confirmed right vertebral artery dissection at C2-C3 with associated thrombus. Cerebral angiography: Dissection of the right vertebral artery with associated non-occlusive thrombus and distal occlusion of the right PICA.

FINAL WORKING DIAGNOSIS: Right vertebral artery dissection and right cerebellar vermis infarct

TREATMENT AND OUTCOMES:

The patient was started on a heparin drip with transition to warfarin for anticoagulation and secondary stroke prevention. The patient will continue on warfarin for at least 3 months.

The patient was admitted to inpatient stroke rehabilitation and discharged to home after 5 days at an independent level.

The patient continued to suffer from vertigo for which she was started on Clonazepam 0.5mg three times daily as needed which controlled her symptoms.

She is enrolled in vestibular outpatient physical therapy.

The patient is determined and plans to run the 2017 Boston marathon which she has already qualified for.

2346 Board #6 June 1 5:45 PM - 6:45 PM

Sternoclavicular Injury - Rugby Union (15-players-a-side)

Victor Lopez Jr, (Sponsor: Robert C. Cantu, MD, FACS¹), Richard Ma², Douglas E. James³, Michael S. Wilinski⁴, Answorth A. Allen⁵. ¹Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY. ²Missouri Orthopaedic Institute & Thompson Laboratory for Regenerative Orthopaedics, Columbia, MO. ³State University of New York Medical Center (Downstate), Brooklyn, NY. ⁴Lake Erie College of Osteopathic Medicine, Bradenton, FL. ⁵Hospital for Special Surgery, New York, NY.

Reported Relationships: V. Lopez Jr: Contracted Research - Including Principle Investigator; USAR New England and Empire GU RFU's and National Operating Committee on Standards for Athletic Equipment.

HISTORY: A 19-year-old men's college Rugby-15s winger collapsed during match play. The player had no impact with another player, dizziness and no loss of consciousness. A medical history revealed the player had sustained a right clavicular injury in a previous match 25 days prior to this incident. Where he complained of right shoulder pain, after impacting the ground with a multi-player tackle. The player had presented to an Urgent Care facility after that injury and provisionally diagnosed with shoulder sprain -vs- pectoralis strain, placed in arm-sling and sent home on oral analgesics. Right shoulder radiographs at Urgent Care visit were read as normal. **PHYSICAL EXAM:** Exam in ED revealed slurred speech, and complaints of localized pain and tenderness on right medial clavicle. Right sternoclavicular joint pain on palpation. Limited upper extremity range of motion secondary to pain, no facial droop, decreased left sided upper and lower extremity sensation, reflexes and strength. Symmetrical radial pulses with brisk capillary refills. **DIFFERENTIAL DIAGNOSIS** 1. Cervical Neck Injury 2. Stroke 3. Fracture Clavicle 4. Rib Fracture 5. Scapular Fracture 6. Sternal Fracture **TEST AND RESULTS:** Chest anterior-posterior radiographs: -abnormal right SCJ MRI Brain no contrast: -Large area/acute infarction. Mass effect of right lateral ventricle. No hydrocephalus. Midline shift 1-2mm. CT brain no contrast: -Right MCA infarction with right frontal/parietal lobes, insular cortex, thalamus, caudate nucleus, internal/external capsule, and lentiform nucleus. -Mass-effect on the right lateral and third ventricles. Increased midline shift 8mm. No hydrocephalus. Carotid Duplex: -Arteries bilaterally, normal velocities/waveforms. CT chest: -Right clavicular head dislocated posterior to the sternum, in the superior mediastinum. Subperiosteal hematoma around proximal right clavicle. **FINAL/WORKING DIAGNOSIS:** Missed posterior sternoclavicular joint dislocation with brachiocephalic artery compromise leading to hemiparesis **TREATMENT AND OUTCOMES:** 1. Surgical Emergency. Often missed on radiograph. 2. Open repair of brachiocephalic artery, right clavicular reduction/SCJ capsulorrhaphy with hamstring tendon allograft. 3. Patient recovered with left sided hemiparesis. No return to sport. Sponsor: NOCSAE.org

2347 Board #7 June 1 5:45 PM - 6:45 PM
Exercise Vital Sign and Health Care Utilization
 Alex Mroszczyk-McDonald, Sponsor: Robert Sallis, FACSM.
Kaiser Permanente Southern California, Fontana, CA.
(No relationships reported)

Background: It is well established that >150 minutes of weekly physical activity significantly improves health and Kaiser Permanente Southern California (KPSC) has pioneered the use of an Exercise Vital Sign (EVS) to record Physical Activity (PA). However, there is less data on exercise and impact on healthcare utilization.
Purpose: To evaluate the correlation of EVS and healthcare utilization, in our SCKP patient population. Specifically, do those patients who report consistent exercise for >150 minutes per week have reduce utilization of the health care system.
Methods: KPSC Electronic Health Record data was abstracted to determine 3 cohorts of adults (18-65yrs) (N=2,534,895) who were Consistently Sedentary (CS) (EVS=0min/wk consistently), Insufficiently Active (IA) (EVS=1-149min/wk), or Consistently Active (CA) (EVS>150min/wk consistently), meeting the World Health Organization recommendations. Each cohort had at least 3 encounters and self reported EVS that were consistent. Each cohort was then compared to their health care utilization over a 1, 3 and 5 year period. Because KPSC is a closed system we were able to accurately capture utilization of pharmacy, hospital, radiology, laboratory and outpatient departments. Data was adjusted for age, gender and ethnicity.
Results: Compared to CS patients, CA patients have consistently lower use of the KPSC health care system. This relationships held true across the 1, 3 and 5 year analysis. Of note patients who were CA were 75% less likely to be hospitalized (OR 0.23-0.26), 43% less likely to use the ER (OR 0.55-0.58) and 45% less Urgent Care services (OR 0.54-0.56), 25% less laboratory blood draws (OR 0.73-0.74), and 27% less pharmaceuticals fills (OR 0.71-0.74). Other factors that were associated with lower health system utilization were female gender, caucasian ethnicity and
Conclusion: Based on EVS data, and analysis of health utilization we conclude that CA individuals have significantly lower utilization of the health care system than those who are CS.

2348 Board #8 June 1 5:45 PM - 6:45 PM
Association of Interrelated Neuromechanical Factors with Injury Occurrence among College Football Players
 Gary B. Wilkerson, (Sponsor: Daniel C. Herman, FACSM).
University of Tennessee at Chattanooga, Chattanooga, TN.
Reported Relationships: G.B. Wilkerson: Honoraria; Arkansas Athletic Trainers' Association, American College of Sports Medicine, National Athletic Trainers' Association.

PURPOSE: The purpose of this prospective cohort study was to assess the predictive value of injury risk screening methods that collectively assess aspects of environmental awareness, cognitive processing of neural input, and motor control, as well as any persisting effects of previous injuries.
METHODS: Prior to participation, 43 NCAA Division I-FCS college football players (20.2 ±1.2 years; 185.7 ±5.8 cm; 105.4 ±20.6 kg) completed the 10-item Sport Fitness Index (SFI) survey and performed both a 60-second Reactive Peripheral Response (RPR) test and a 10-second Unilateral Forefoot Squat (UFS) test of postural stability. The 0-100 SFI score quantified perceptions of persisting effects of previous injuries. The RPR represented the number of outermost target hits (rings 4 and 5 of 64 target buttons arranged in a pattern of 5 concentric rings on a 1.2 m x 1.2 m board) while simultaneously reciting text that scrolled across a centrally located screen. The UFS test utilized a smartphone accelerometer to quantify the root mean square (RMS) of instantaneous change in body mass acceleration (Jerk) on the dominant extremity. All sprains, strains, and head injuries sustained from the beginning of practice sessions to the end of the 13-game season were documented, along with the number of player appearances in games.
RESULTS: Injuries were sustained by 14 of 43 players (33%). Univariable associations of binary risk classification with injury occurrence were: SFI ≤ 86 (OR=1.77), UFS Jerk RMS ≥ 0.06 (OR=4.19), RPR ≤ 11 Hits (OR=2.95), and Games Played ≥ 8 (OR=3.16). A large SFI X UFS X RPR interaction effect was identified (OR=11.20). Logistic regression results for the combination of the 3-way interaction (Adjusted OR=21.32) with Games Played ≥ 8 (Adjusted OR=6.19) yielded a strong prediction model ($\chi^2 = 9.04, p = .011; R^2 = .265$). Cox regression results for a binary SFI X UFS X RPR risk classification, adjusted for the potentially confounding effect of differential game exposure among players (0-13 games), demonstrated a strong association with time to injury occurrence (HR=4.65; 90% CI: 1.74, 12.44).
CONCLUSIONS: The findings support the potential for reduction of football injury risk through targeted interventions that address modifiable deficiencies in peripheral visual awareness, reaction time, and postural stability.

2349 Board #9 June 1 5:45 PM - 6:45 PM
Sex Differences in Competition Volume, Club Sport Participation, Specialization, and Injury Among High School Athletes
 Eric G. Post, David R. Bell, Stephanie M. Trigsted, Dan A. Schaefer, Madeline M. Miller, Adam Y. Pfaller, Scott B. Hetzel, M. Alison Brooks, Timothy A. McGuine. *University of Wisconsin-Madison, Madison, WI.*
(No relationships reported)

Female adolescent athletes are at greater risk for certain injuries, such as ACL injuries or overuse knee injuries. One theory for this increased risk is the increasing trend towards intense, year-round sport participation and specialization. However, it is unknown whether characteristics of sport participation, including competition volume, club sport participation, specialization, or history of lower extremity injury (LEI) differ between female and male athletes.
PURPOSE: To compare level of competition volume, club sport participation, sport specialization, and previous lower LEI between males and females in high school athletes.
METHODS: 1525 high school athletes (780 female, age=16.1±1.1 years old, grades 9-12) from 29 high schools were recruited to complete a pre-season questionnaire regarding their sport participation patterns and previous injury history. Sport competition volume in the previous 12 months was classified as high (>60 competitions), moderate (30-60 competitions), or low (<30 competitions). Sport specialization status was classified as low, moderate, or high using a widely utilized 3-point specialization scale. Chi-square tests were used to investigate associations of competition volume, club sport participation, specialization, and LEI by sex (a-priori p<.05). **RESULTS:** Females were more likely than males to participate in high competition volume (23.2% vs 11.0%, $\chi^2=84.7, p<0.001$), participate on a club team (61.2% vs 37.2%, $\chi^2=88.3, p<0.001$), and be highly specialized (16.4% vs 10.4%, $\chi^2=19.7, p<0.001$). A total of 487 subjects (31.5%) reported sustaining a total of 599 previous time-loss LEI. Female athletes were more likely to report a previous LEI than males when considering all sports (36.5% vs. 27.0%, $\chi^2=15.9, p<0.001$) and when the sample was restricted to sex-equivalent sports (37.3% vs. 28.2%, $\chi^2=9.0, p=0.003$). **CONCLUSIONS:** Female athletes were more likely to participate in sports at high volumes, on club teams in addition to their high school teams, be highly specialized, and report previous LEI. Female high school athletes may be at greater risk of injury due to these differences in sport participation patterns.
 Supported by grants from the American Medical Society for Sports Medicine and the National Federation of State High School Associations.

2350 Board #10 June 1 5:45 PM - 6:45 PM
An Analysis of Female Athlete Triad Components in Elite Para-Athletes
 Cheri A. Blauwet¹, Emily M. Brook¹, Adam S. Tenforde¹, Elizabeth Broad², Elizabeth G. Matzkin¹. ¹Brigham and Women's Hospital/Harvard Medical School, Boston, MA. ²United States Olympic Committee, Chula Vista, CA.
(No relationships reported)

The Female Athlete Triad (Triad) is a syndrome defined as the interaction of three interrelated conditions: low energy availability with or without disordered eating, menstrual dysfunction, and low bone mineral density (BMD). The Triad may also impact males, and may have long term health consequences if unaddressed. Although participation in elite para-sport is rapidly growing, no studies have assessed the prevalence of Triad risk factors in this population.
PURPOSE: To evaluate the prevalence of Triad risk factors in an elite para-athlete population and association to sex and para-sport type.
METHODS: Subjects were United States para-sport athletes who were training to qualify for the 2016 Summer or the 2018 Winter Paralympic Games. Participants completed an online questionnaire characterizing nutrition, menstrual status (if female), bone health, and awareness of the triad. Responses were analyzed to determine overall prevalence of Triad components, and significant differences based on sex and sport type (leanness vs. non-leanness).
RESULTS: A total of 248 (144 male, 104 female) athletes completed the survey. Of these, 137 athletes competed in leanness sports and 109 athletes in non-leanness sports. Of the cohort, 40% (53 male, 45 female) of athletes indicated that they were currently trying to lose weight, and 61% (n = 151; 90 male, 61 female) indicated they were attempting to change their body composition to improve sport performance. Only 3% (1 male, 6 female) of athletes indicated that they had been previously diagnosed with an eating disorder. For pre-menopausal women, 32% (n = 29) reported less than 9 menstrual cycles in the past year. A total of 21% (27 male, 25 female) of athletes reported a history of a bone stress injury, yet 9% (8 male, 13 female) reported a diagnosis of low BMD based on DXA scan. There were no differences in risk factor prevalence between sexes or those competing in leanness versus non-leanness sports. Only 9% of athletes were aware of the Triad.

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CONCLUSIONS: Elite para-sport athletes have high prevalence of Triad components, regardless of sex or sport type. Awareness of the Triad in athletes is low. While consequences of the Triad in a para-athlete population are poorly understood, screening tools and education to increase awareness are required to optimize overall health of this population.

2351 Board #11 June 1 5:45 PM - 6:45 PM

Pre-Race Medical Screening and Educational Intervention Reduces Medical Complications: A SAFER Study in 153208 Runners

Martin Peter Schwellnus, FACSM¹, Karen Schwabe², Sonja Swanevelder³, Esme Jordaan³, Wayne Derman⁴. ¹University of Pretoria, Pretoria, South Africa. ²University of Cape Town, Cape Town, South Africa. ³South African Medical Research Council, Cape Town, South Africa. ⁴Stellenbosch University, Cape Town, South Africa.

(No relationships reported)

We previously reported a high rate of medical complications (1/121 race starters) in a cohort of 65 865 runners participating in 21.1km and 56km races over a 4-year period (2008-2011) (SAFER study 1). PURPOSE: To determine if an online pre-race medical screening and educational intervention program reduces medical complications in distance running events. METHODS: An online pre-race medical screening (based on the European guidelines for pre-screening of leisure athletes participating in moderate- to high-intensity sports) and an educational intervention program was designed and introduced as part of the race registration process, in the period 2012 to 2015 at the Two Oceans Marathon races (21.1km and 56km). The incidence of medical complications (per 1000 race starters; all and serious life-threatening) during the 4-year post-intervention period (2012-2015: 87 343 race starters) was compared with the pre-intervention period (2008-2011: 65 865 race starters). RESULTS: Compared to the pre-intervention (baseline) period, there was a significant reduction in the incidence (per 1000 starters, 95% CI; adjusted for age group, gender and race distance) of all medical complications in all runners by 29% [pre=8.6 (7.9-9.4); post=6.1 (5.6-6.7), $p<0.0001$], 21.1km runners by 19% [pre=5.1 (4.4-5.9); post=4.1 (3.6-4.8), $p=0.0356$], and 56km runners by 39% [pre=14.6 (13.1-16.3); post=9.0 (7.9-10.1), $p<0.0001$]. Serious life-threatening complications were significantly reduced in all runners by 64% [pre=0.6 (0.5-0.9); post=0.2 (0.1-0.4), $p=0.0003$; adjusted for age group and gender]. CONCLUSION: A pre-race medical screening and educational intervention program significantly reduced medical complications and serious life-threatening complications among all runners in community-based mass participation distance running events. The reduction in all medical complications was significant in both the 21.1km and 56km races. Pre-race screening and educational intervention programs could be introduced to reduce medical complications during endurance running events.

E-10 Thematic Poster - Cardiovascular Responses to Heat Exposure

Friday, June 2, 2017, 9:30 AM - 11:30 AM
Room: 404

2391 **Chair:** Vienna E. Brunt. *University of Colorado-Boulder, Boulder, CO.*

(No relationships reported)

2392 **Board #1** June 2 9:30 AM - 11:30 AM

Impact Of Progressive, Chronic Dehydration On Cardiovascular Responses To Exercise In A Heated Environment

Kate S. Early¹, Bailey Theall², Nathan Lemoine², Brian Harrell³, Conrad P. Earnest, FACSM⁴, Neil M. Johannsen². ¹Columbus State University, Columbus, GA. ²Louisiana State University, Baton Rouge, LA. ³Baton Rouge General, Baton Rouge, LA. ⁴Texas A&M, College Station, TX. (Sponsor: Conrad Earnest, FACSM)

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(No relationships reported)

PURPOSE: 1) To examine the effects of chronic hypohydration on cardiovascular (CV) responses during exercise in a heated environment; 2) determine if resting CV health influences CV responses during exercise. **METHODS:** Participants (n=18, 21±1y; mean±SD) followed 3 days of self-determined dehydration (DEH) or hydration (HYD) in a counterbalanced, cross-over design. Exercise trials included 30-min of cycle ergometry in a heated environment (30.2±0.8°C, 26.5±7.4%RH). Heart rate (HR) and blood pressure (BP) were taken every 10-min. Weighted skin temperature (T_{sk}) (4 site: chest, arm, thigh, leg) and skin blood flow (SkBF) were collected continuously during exercise, followed by calculations of total body (T_b) temperature from T_{sk} and rectal temperature (T_{re}), and heat storage [HS = (0.97*weight*ΔT_b)/(body surface area*time)]. Resting CV health was assessed by brachial-artery flow-mediated dilation (FMD), pulse wave velocity (PWV), and heart rate variability (HRV). **RESULTS:** Weight (P<0.005), urine color, and specific gravity (P<0.001) were different between DEH and HYD pre-exercise. HR was greater in DEH vs. HYD at 10, 20 and 30-min (P=0.05). Body temperature responses (n=12) after 30-min of exercise were not different between HYD and DEH (T_{sk} P=0.47, T_b P=0.72). SkBF tended to be greater in the HYD vs. DEH (SkBF slope: HYD vs. DEH, 3.5±2.6 vs. 2.4±1.1, P=0.05; ΔSKBF: HYD vs. DEH, 370.0±156.3% vs. 169.0±130.4%, P=0.05). Though no association was found with PWV and T_{sk} (P=0.80) and T_b (P=0.69), greater changes in T_{sk} and T_b were associated with increased FMD (P=0.006) and increased rate of HS associated with decreased HRV (P=0.04) across all trials (n=24). **CONCLUSIONS:** Progressive, chronic dehydration alters CV and SkBF response during exercise. Resting CV profile was related to increased rate of HS and greater change in T_b, suggesting CV health plays a role in the mechanism of heat dissipation, especially when hypohydrated.

2393 **Board #2** June 2 9:30 AM - 11:30 AM

The Independent Effect of Heart Rate on Stroke Volume When Skin Temperature is Hot and Cool During Exercise

Ting-Heng Chou, John D. Akins, Charles K. Crawford, Jakob R. Allen, Edward F. Coyle, FACSM. *The University of Texas at Austin, Austin, TX.*

Email: tinghengchou@gmail.com

(No relationships reported)

There are two hypotheses of how stroke volume (SV) is affected during hyperthermic exercise. The traditional hypothesis is that an increase in cutaneous blood flow (CBF) is thought to lead to a decline in SV. An alternate hypothesis is that a decline in SV is due to an increase in heart rate (HR). However, these two hypotheses have not been tested under the same thermal stress. **PURPOSE:** 1) To determine the independent effect of HR on SV by using low dose β₁-blockade (BB) when skin temperature (T_{sk}) is high (>38°C) during exercise. 2) To see how the rapid lowering of T_{sk} reverses the changes in cardiovascular variables. **METHODS:** Tsk was manipulated by wearing a water perfused suit that covered the whole body, except head, hands, and feet and maintained a perfused water temperature of 30 or 50°C. Subjects (n=8, active men 24 ± 4 y) cycled at 60% VO_{2peak} for 20 min in three conditions: 30°C water with placebo (30-PL), 50°C water with PL (50-PL), and 50-BB. Tsk was rapidly cooled at 20 min of exercise in all trials by perfusing cold water through the suit (0°C) plus fans. Subjects continued to cycle for another 20 min with cool Tsk. Esophageal temperature (T_{es}), Tsk, VO₂, cardiac output (CO), HR, mean arterial pressure (MAP), cutaneous blood flow (CBF), and forearm venous volume (FVV) were measured during exercise. **RESULTS:** Mean Tsk during the first 20 min of exercise were 33.4 ± 0.2, 38.1 ± 0.2, and 38.2 ± 0.2 °C, for 30-PL, 50-PL, and 50-BB, respectively. Mean Tsk during

the last 20 min of exercise were 29.5 ± 0.2, 29.8 ± 0.3, and 30.0 ± 0.3 °C, for 30-PL, 50-PL, and 50-BB, respectively. When HR was lowered to the same level as 30-PL (147.9 ± 3.8 bpm) by BB in 50-BB (151.7 ± 4.0 bpm), SV was also restored to the same level as 30-PL (132.0 ± 7.3 ml) in 50-BB (135.6 ± 7.5 ml). SV was restored even with a significantly higher CBF (77.1 ± 3.4% vs 55.9 ± 3.6% for 50-BB vs 30-PL; p<0.05) and lower MAP (98.5 ± 2.6 mmHg vs 105.4 ± 3.3 mmHg for 50-BB vs 30-PL; p<0.05). When Tsk was rapidly cooled, HR and CBF were significantly decreased while SV was maintained in 50-PL. There was no apparent effect of Tsk on FVV responses. **CONCLUSION:** The increase in HR was responsible for the decrease in SV when Tsk was above 38°C. Rapidly cooling Tsk while T_{es} remains elevated decreased CBF and HR.

2394 **Board #3** June 2 9:30 AM - 11:30 AM

Heart Rate Variability as Potential Indication to the Mechanism of Heat Intolerance

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(No relationships reported)

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BACKGROUND: Heat intolerance is a phenomenon associated with relative inability to properly maintain body temperature during exposure to heat stress. Since normal thermoregulatory function is influenced by mechanisms mediated by the autonomic nervous system (ANS) (e.g. sweat rate, vasodilatation), heart rate variability (HRV) which is an established, non-invasive tool for assessing ANS activity, can serve as an assistive tool for evaluating candidate mechanisms of heat intolerance. **PURPOSE:** To determine whether non-linear HRV measures during heat tolerance test (HTT) may be used as an indication to the mechanism of heat intolerance. **METHODS:** HTTs from the IDF Institute of Military Physiology database performed between the years 2012-2015 were analyzed. Analyses of the non-linear HRV indices D2, SD1/SD2 and ApEn have been made for the full HTTs (120 minutes) by a researcher blinded to the HTT results and to the patients' clinical records. HRV indices were then compared between heat intolerant (HI) and heat tolerant (HT) individuals. **RESULTS:** Our data included 283 HTTs (215 HT; 76%, and 68 HI; 24%) HI. We found significant differences between HT and HI tests in D2 (HI - 0.0355±0.0261, HT - 0.0896±0.104, p<0.001) and ApEn (HI - 1.429±0.079, HT - 1.395±0.11, p=0.0207) but not in SD1/SD2 (HI - 0.331±0.067, HT - 0.335±0.007, p=0.721). We found a weak correlation between the HRV indices and the initial and final core temperatures and heart rates. **CONCLUSIONS:** We found that HT and HI individuals differ in some non-linear HRV measures during an HTT. Although the differences are statistically significant, the values overlap between HT and HI individuals, thus HRV during an HTT (using the non-linear methods examined in this study) does not seem to be valuable tool for heat intolerance diagnosis, but it may serve as potential indirect indicator to the relative contribution of the ANS to HT vs. HI states, and thus to the mechanism associated with HI phenomenon.

This work was supported by a grant from the Israeli MOD.

2395 **Board #4** June 2 9:30 AM - 11:30 AM

Whole-body Heat Stress Sensitizes β1-adrenergic Receptor Mediated Cardiac Systolic Function

Gilbert Morales¹, Ken Kouda², Michinari Hieda¹, Satyam Sarma¹, Steven A. Romero¹, Matthew N. Cramer¹, Amy N. Adams¹, Manall F. Jaffery¹, Craig G. Crandall, FACSM¹.

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(No relationships reported)

Whole-body heat stress improves cardiac systolic function, which is vital towards the maintenance of stroke volume despite reductions in central blood volume and cardiac filling pressure. However, the mechanisms by which cardiac systolic function is enhanced during heat stress are unclear. **PURPOSE:** To test the hypothesis that whole-body passive heat stress sensitizes β₁-adrenergic receptor mediated increases in cardiac systolic function. **METHODS:** In ten healthy participants (five females: age 23 ± 2 and five males: age 26 ± 3), echocardiographic indices of cardiac systolic function (average peak systolic tissue velocity at the septal and lateral mitral sites - S'_{avg}) were obtained prior to and during intravenous infusion of a low (5 μg/kg/min) and a moderate (15 μg/kg/min) dose of dobutamine (a β₁-adrenergic receptor agonist) under normothermic (NT) and hyperthermic (HT; increase internal temperature of 1.2 ± 0.1°C) conditions. **RESULTS:** HT increased S'_{avg} at baseline (NT, 9.5 ± 0.5 cm/s vs HT, 14.0 ± 1.0 cm/s, P<0.01). However, the low dose of dobutamine during HT further increased S'_{avg} (Δ 6.5 ± 1.2 cm/s) compared to S'_{avg} in NT (Δ 4.0 ± 0.7 cm/s, P=0.03).

Furthermore, the infusion of the high dose of dobutamine during HT also resulted in greater increases in S'_{avg} ($\Delta 13.3 \pm 1.3$ cm/s) compared to NT S'_{avg} ($\Delta 9.4 \pm 1.2$ cm/s, $P < 0.01$). **CONCLUSION:** These data suggest that cardiac β_1 -adrenergic receptors are sensitized during hyperthermia, which likely contributes to increases in cardiac systolic function and accompanying preservation of stroke volume during whole-body heat stress.

2396 Board #5 June 2 9:30 AM - 11:30 AM
Effect of Exercise Mode on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress

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Cycling has been reported to result in greater cardiovascular drift (CV drift) compared to running in a temperate environment. It remains unknown whether this holds true in a hot environment. It also remains unknown whether a greater magnitude of CV drift during cycling is associated with a greater decrement in maximal oxygen uptake ($\dot{V}O_{2max}$) compared to running. **PURPOSE:** To test the hypothesis that cycling elicits a greater magnitude of CV drift and accompanying greater decrement in $\dot{V}O_{2max}$ compared to running in the heat. **METHODS:** Seven men (mean \pm SD; age = 25 ± 6 y, body fat = $12.0 \pm 2.2\%$, bike $\dot{V}O_{2max} = 54.7 \pm 5.5$ mL/kg/min, treadmill $\dot{V}O_{2max} = 58.9 \pm 4.3$ mL/kg/min) completed a graded exercise test on a cycle ergometer and a treadmill (separate days) in ~ 22 °C to determine $\dot{V}O_{2max}$. Then on separate visits (counterbalanced) they cycled or ran for either 15 or 45 min at 60% mode-specific $\dot{V}O_{2max}$ in 35 °C. CV drift was measured between 15 and 45 min during the 45-min trials. The purpose of the separate 15- and 45-min trials was to measure $\dot{V}O_{2max}$ over the same time interval that CV drift occurred. **RESULTS:** The increase in heart rate (HR; $\sim 13\%$ for bike and treadmill, $p < 0.001$) and decrease in stroke volume (SV; $\sim 12\%$ and $\sim 15.5\%$ for bike and treadmill, respectively, $p < 0.001$) between 15 and 45 min were not different between exercise modes ($p = 0.91$ and 0.53 for mode \times time interaction for HR and SV, respectively). $\dot{V}O_{2max}$ decreased 15% from 15 to 45 min ($p = 0.002$), but the reduction was not different between exercise modes ($p = 0.54$ for mode \times time interaction). **CONCLUSIONS:** Contrary to our hypothesis and to previous findings in a temperate environment, the magnitude of CV drift during prolonged exercise in the heat was not different between cycling and treadmill running. The rise in HR and concomitant decrease in SV associated with CV drift in the heat—regardless of the exercise mode—corresponded to a proportional decrease in $\dot{V}O_{2max}$.

2397 Board #6 June 2 9:30 AM - 11:30 AM
Blood Pressure and Cardiovascular Responses to Emergency Calls in Volunteer Firefighters and Emergency Medical Technicians

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Hypertension and obesity are both primary risk factors for cardiovascular (CV) disease. Among the firefighter (FF) population cardiac events remain the leading cause of line-of-duty deaths. Work related stress can cause a surge in heart rate and blood pressure (BP) and studies have noted that FF and Emergency Medical Technicians (EMTs) have increased heart rate and BP throughout the day. Thus, understanding the risk factors associated with work related stress in FF and EMTs, including BP surges and CV disease risk are important factors in continual need of study. **PURPOSE:** To examine the relationship between BP responses to emergency calls and CV health. **METHODS:** Eight FF and EMTs (7M/1F; 2EMTs/6FFs; 32.8 ± 9.3 yrs) wore ambulatory brachial BP cuffs during a 12-hour work shift to observe BP responses to emergency calls. Additionally, plasma glucose levels, total cholesterol levels and triglyceride (TG) levels, and central BP through radial artery tonometry was obtained and measured after a 10-hour fast. In addition, a preliminary sub-analysis was completed between 4 lean and 4 obese (BMI > 30 kg/m²). **RESULTS:** Average 12-hr BP was $118.2 \pm 8.0 / 74.0 \pm 8.7$ mmHg. With emergency calls, the brachial BP surge was $20.7 \pm 14.9 / 10.0 \pm 6.7$ mmHg compared to the measured brachial BP immediately before alarm. When compared to the mean 12-hr BP, the BP surge was larger ($22.9 \pm 11.7 / 13.6 \pm 6.2$ mmHg). We found no relationship between central BP surge and CV health measures in the group and no relationship between core BP and BP surge. In the sub-analysis, the average brachial BP for lean group (BMI 22.9 ± 4.7 kg/m²) was $118.4 \pm 2.3 / 71.7 \pm 4.1$ mmHg, and the average brachial BP for the obese group (BMI 37.2 ± 6.3 kg/m²) was $136.3 \pm 5.1 / 84.9 \pm 4.4$ mmHg. Central BP in the lean population was $103.6 \pm 6.6 / 72.9 \pm 5.8$ mmHg, while in the obese population it was $118.5 \pm 9.0 /$

85.0 ± 11.8 mmHg. We found a relationship between diastolic BP surge and glucose levels in both groups, as well as a correlation between diastolic BP surge and TG in the lean group ($p < 0.05$). **CONCLUSION:** This pilot data suggests that both systolic and diastolic BP surge during emergency calls. The data also preliminarily indicates that obese emergency workers exhibit higher brachial and central BP. Further research is needed to determine whether obese firefighters are at risk of CV events during emergency calls.

2398 Board #7 June 2 9:30 AM - 11:30 AM
12-hour Period Of Firefighting Is Associated With Short But Intense Periods Of Cardiac Strain

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 (No relationships reported)

Firefighters' work routines vary worldwide, but generally include fire suppression, rescues and medical emergencies. These job activities may expose firefighters (FF) to an elevated cardiac strain. **PURPOSE:** We evaluated the heart rate (HR) and blood pressure (BP) profile during a routine 12-hour work period among career FF. **METHODS:** 30 male military FF, aged 40 ± 3.2 yrs, BMI = 26.3 ± 3.1 kg/m², were recruited from a Brazilian Fire Department. BP and HR were measured in a basal condition on an off-duty day (Eva1) and before (Eva2) and after (Eva3) a 12-hour period of work, in resting supine (SUP) and orthostatic (ORT) postures. HR was also continuously measured during work period by the Polar_V800 and on-duty cardiac strain was categorized by the absolute and relative time spent on 4 intensity zones: light ($< 63\%$ Max_age_predicted_HR), moderate (63-76%), hard (77-93%) and very hard ($\geq 94\%$). HR and BP were compared between the 3 evaluations (Friedman test), at 5% level of significance. **RESULTS:** $97.3 \pm 4.2\%$ of on-duty time was spent on light and $1.8 \pm 2.8\%$ on moderate intensities. An important absolute time was performed on hard (4.7 ± 10.0 min) and very hard (0.7 ± 2.8 min) intensities. 46.7% of FF engaged on hard and 16.7% on very hard intense activities. Mean on-duty peak HR was equivalent to $76.8 \pm 17.1\%$ of Max_HR and achieved $107.1 \pm 10.7\%$ among those who performed very hard activities. HR and BP comparisons in the 3 evaluations are shown on Table. **CONCLUSION:** Our data show a significant increase in resting HR after 12-hour on-duty, suggesting a change on resting cardiovascular regulation toward a more stressful condition. The majority of FF was exposed to high cardiac strain during a routine 12-hour shift work. Although the time spent on vigorous activities was short, its intensity might represent an acute elevated risk for fatal and non-fatal cardiovascular event in susceptible firefighters.

HR and BP in SUP and ORT position, at control condition (Eva1), before (Eva2) and after work (Eva3)				
	EVA 1	EVA 2	EVA 3	P
SBP SUP	122.9 \pm 10.4	122.3 \pm 10.4	124.6 \pm 11.9	0.36
SBP ORT	121.2 \pm 13.5	119.8 \pm 11.8	125.2 \pm 18.6	0.11
DBP SUP	75.9 \pm 10.4	74.0 \pm 7.5	76.4 \pm 7.9	0.17
DBP ORT	80.0 \pm 11.2	79.2 \pm 10.6	83.0 \pm 10.9	0.06
HR SUP	57.3 \pm 7.0	64.3 \pm 8.5	68.3 \pm 15.3	0.003
HR ORT	69.1 \pm 7.3	75.5 \pm 14.0	80.2 \pm 18.1	0.002
p: p-value for Friedman test				

2399 Board #8 June 2 9:30 AM - 11:30 AM
Vagal Modulation and its Association With Cardiorespiratory Fitness During a Routine Firefighting Shift-work
 Luiz Guilherme G. Porto¹, Rosenkranz M. Nogueira², Edgard M. K. V. K. Soares³, Eugenio C. Nogueira², Carlos Janssen G. da Cruz⁴, Guilherme E. Molina⁵, Keila E. Fontana⁶, Maria Korre⁷, Denise Smith⁸, Stefanos N. Kales⁹, Luiz Fernando Junqueira Jr¹⁰.
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Firefighting is a hazardous profession with high on-duty cardiovascular mortality, which might be associated with cardiac autonomic dysfunction (CAD) and/or low cardiorespiratory fitness (CRF).

PURPOSE: We aimed to evaluate the vagal modulation of the heart in resting supine (SUP) and orthostatic (ORT) postures during a routine 12-hour work period among career firefighters (FF), in association with the CRF.

METHODS: We evaluated 30 male military FF, aged 40±3.2 yrs, BMI = 26.3±3.1 kg/m², CRF = 11.4±1.4 METs, recruited from a Brazilian Fire Department. Vagal modulation was evaluated by means of the short-term time-domain heart rate variability index PNN50%, which is the percentage of successive R-R intervals greater than 50 ms and reflects the beat-to-beat parasympathetic modulation. CRF was estimated by a validated self-reported physical activity questionnaire (Jackson & Blair, MSSE, 1990). PNN50% was measured in a basal condition on an off-duty day (Eva1) and immediately before (Eva2) and after (Eva3) a 12-hour period of work, in resting supine (SUP) and orthostatic (ORT) postures. PNN50% values were compared between the 3 evaluations (Friedman test), two postures (Wilcoxon-test) and by CRF categories (<12 METs vs ≥ 12 METs) after 12 hours of work in ORT (Kruskal Wallis test), at 5% level of significance.

RESULTS: Median (min-max) values of PNN50% in SUP and ORT in Eva1-3 are shown on Table. Those with better CRF (n=10) showed higher values of PNN50% in ORT after 12-hours of routine work: 3 (0-60%), as compared to FF with lower CRF: 0 (0 - 8%) (p = 0.047)

CONCLUSION: Our data show a physiological decrease on PNN50% to active standing up. We also observed a significant reduction on the vagal modulation in ORT-Eva3 as compared to Eva1. The association between the reduced resting vagal modulation after a 12-hour period of work and low CRF reinforce previous recommendation for implementing physical training among FF as a cardioprotective strategy.(CNPq 480092/2013-3)

PNN50% in SUP and ORT, at control (Eva1), before (Eva2) and after a routine work (Eva3)			
	SUP	ORT	p*
Eva1	11.4 (0.0 - 54.0)	2.6 (0.0 - 31.5)	<0.01
Eva2	7.8 (0.0 - 53.6)	1.0 (0.0 - 25.2)	<0.01
Eva3	11.4 (0.0 - 61.4)	0.35 (0.0 - 60.3)	<0.01
p#	0.67	<0.01	
#: Friedman test	*: Wilcoxon text		

E-11 Thematic Poster - Exercise Psychology - Cognition and Emotion
 Friday, June 2, 2017, 9:30 AM - 11:30 AM
 Room: 403

2400 **Chair:** J. Carson Smith, FACSM. *University of Maryland, College Park, MD.*
 (No relationships reported)

2401 Board #1 June 2 9:30 AM - 11:30 AM
Moderate Intensity Exercise Ameliorates Negative Impacts of Simulated Altitude on Executive Function.
 Laura Q. Jimenez, Brian Arwari, Arlette C. Perry, FACSM, Joseph F. Signorile, FACSM, Soyeon Ahn, Sarah Kamakawiwo'ole, Kevin A. Jacobs, FACSM. *University of Miami, Coral Gables, FL.* (Sponsor: Dr. Kevin Allen Jacobs, FACSM)
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PURPOSE: The present study was conducted to examine the behavioral cognitive and neurophysiological effects of acute exposure to simulated moderate and high altitudes at rest and during exercise in an effort to delineate whether there is a level of simulated altitude beyond which executive cognitive functions are impaired and whether exercise improves or worsens cognitive function during exposure to simulated altitude. **METHODS:** Fourteen recreationally active college students (M=9, F=5) aged 18-35 participated in this study, which consisted of six experimental days, with three simulated altitude conditions: sea level (SL), simulated moderate altitude (MA; 15.4% F_IO₂, ~2400 m) or simulated high altitude (HA; 12.8% F_IO₂, ~3900 m); and two exercise conditions: rest or moderate intensity cycling exercise at 60% altitude-specific peak power output, in a randomized-order, crossover design. Dependent variables included accuracy and reaction time on two executive cognitive function tasks (a modified Flanker task and a Stroop task), and the amplitude and latency of their associated event-related potentials.

RESULTS: For the Flanker task, both MA and HA slowed down reaction time (p=0.04), while exercise improved reaction time (p=0.01). Similarly, for the Stroop task, HA (though not MA) slowed reaction time (p=0.02), while exercise improved reaction time (p=0.04). Accuracy was preserved under all conditions. These effects were partially explained by alterations in associated event-related potential amplitudes and latencies, such as slower N200 latencies with altitude (p=0.04) but faster latencies with exercise (p<0.01), as well as reduced P300 amplitude and slower latency with altitude (p<0.01), and reduced amplitude but faster latency with exercise (p=0.03).

CONCLUSIONS: Acute exposure to simulated altitudes slows behavioral cognitive reaction time on executive function tasks while preserving task accuracy. An acute bout of moderate intensity cycling exercise improves reaction times so that they are comparable to those achieved without exercise or simulated altitude exposure, at least in instances where exercise does not exacerbate the peripheral oxygen saturation drops seen with simulated altitude.

2402 Board #2 June 2 9:30 AM - 11:30 AM
Relation Between Affective Valence During Exercise and Exercise Behavior
 Zachary Zenko¹, Panteleimon Ekkekakis, FACSM². ¹Duke University, Durham, NC. ²Iowa State University, Ames, IA.
 (No relationships reported)

Theories currently used to understand exercise behavior focus on cognitive constructs but overlook the potential role of affect. However, recent studies have yielded evidence of an association between exercise-induced affect and exercise behavior, focusing on single assessments of affect during and post-exercise or pre-post changes. We extend this line of research by (a) tracking the affective response with multiple assessments during exercise and calculating individual slopes of change and (b) setting exercise intensity at the ventilatory threshold (VT), where interindividual variability in affective responses is expected to be maximized, according to the dual-mode theory. **Purpose:** To assess the relations between slope of affective valence (AV; i.e., pleasure-versus-displeasure) and the mean AV during exercise at the VT with exercise behavior. **Methods:** Volunteers (N=93; 62.4% female; VO_{2peak}: 31.77±8.73 ml·kg⁻¹·min⁻¹; BMI: 25.05±4.86 kg·m⁻²; age: 25.27±9.11 years) completed a maximal exercise test to determine the VT. One week later, participants completed a 5 min warm up followed by 10 min of exercise at the watts corresponding to the VT. During exercise, AV was assessed every 2 min using the Feeling Scale (FS; Hardy & Rejeski, 1989). Leisure-time moderate- and vigorous-intensity exercise behavior were assessed one week earlier using the International Physical Activity Questionnaire (Craig et al., 2003). **Results:** As anticipated, considerable heterogeneity in the slope of AV during exercise was evident; 62% of participants reported declines whereas 23.9%

reported improvements. The slope of AV was related to moderate ($r=.22, p=.03$) but not vigorous exercise behavior ($r=.04, p=.72$). Mean AV during exercise was also related to moderate ($r=.28, p=.006$) but not vigorous exercise behavior ($r=.08, p=.46$). **Conclusions:** AV during exercise is associated with moderate, but not vigorous, exercise behavior. Future investigators should determine if changes in AV during exercise correspond to changes in exercise behavior in longitudinal studies.

2403 Board #3 June 2 9:30 AM - 11:30 AM
Does A Mentally Demanding Cognitive Task Influence Motor Reaction Time?

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PURPOSE: Recent research has reported mental fatigue not only impairs endurance, but also sport-specific technical performance. Therefore we sought to examine the effect of a mentally fatiguing task on a motor-reaction time (M-RT) task.

METHODS: A M-RT task was developed with Fitlight-hardware and -software in order to evaluate the effect of mental fatigue on stimuli-type (simple vs. response inhibition) and visual-field position (central vs. peripheral). Eleven untrained healthy subjects (age: 25 ± 4 y; 6 female, 5 male) performed two experimental trials in a randomized crossover order. Participants first completed a baseline M-RT task (~6min30sec), followed by a Flanker task. Next they performed either a 90min mentally fatiguing task (Stroop task; MF) or watched a 90min documentary (CON). Immediately thereafter again the Flanker task and the M-RT task were completed. Accuracy (ACC) and reaction time (RT) were followed up in all tasks but the documentary. In addition multiple physiological and psychological measures were assessed during the protocol.

RESULTS: ACC on both the Stroop task ($p=0.021$) and the Flanker task (~3%; $p=0.048$) dropped over time in MF. Participants got faster over time on the Stroop task in MF ($p \leq 0.004$). RT on the Flanker task did not change over time in both MF and CON. Subjectively, higher ($p=0.001$) mental fatigue was perceived in MF compared to CON. Concerning the M-RT-performance, no effects were observed for the simple stimuli. For the response inhibition-stimuli, only in MF participants became significantly slower in time (~7.5%; $p=0.007$).

CONCLUSION: Mental fatigue negatively affects sport-specific response inhibition-RT. Therefore, besides endurance capacity, also sport-specific cognition appears to be impaired by mental fatigue. The impairment in RT was independent from the visual-field position of the stimulus and was not perceived by the participants.

2404 Board #4 June 2 9:30 AM - 11:30 AM
Regulating Pleasure During Exercise: Impact on Exercise Adherence

Nicole B. Doolen, Walter R. Bixby, FACSM. *Elon University, Elon, NC.*
(No relationships reported)

PURPOSE: To compare the impacts of an affect-based exercise prescription (Feeling Scale) versus an intensity-based exercise prescription (Rating of Perceived Exertion) on changes in exercise adherence. **METHODS:** Participants were assigned to an FS prescription ($n = 26$) or an RPE prescription ($n = 24$) for a 6-week intervention consisting of at least 30 minutes of cardiovascular exercise on at least 3 days per week. The FS prescription required participants to maintain a perceived FS value of at least +3 (good), and the RPE prescription required participants to maintain a perceived RPE value of 12-13 (somewhat hard) throughout each exercise bout. Exercise logs were used to assess exercise participation and minutes of exercise per week at 1, 3, and 6 months post-intervention. **RESULTS:** For the 26 participants in the FS group who began the intervention, 77% completed the 6 weeks, 62% reported exercise at 1 month, 46% reported exercise at 3 months, and 31% reported exercise at 6 months. For the 24 people in the RPE group who began the intervention, 67% completed the 6 weeks, 38% reported exercise at 1 month, 21% reported exercise at 3 months, and 25% reported exercise at 6 months. For minutes of exercise per week, a 2 (group) x 3 (time) ANOVA with repeated measures on the time factor revealed a significant main effect for time, $F(2, 48) = 3.20, p = 0.049$. Minutes of exercise for the FS and RPE groups varied at 1, 3 and 6 months: FS = 96.2, 61.4, & 57.3; RPE = 89.1, 37.7, & 94.5. **CONCLUSION:** Drop-out rate was lower for the FS group across all time points. Three months post-intervention, more participants in the FS group reported exercise and they did more minutes of exercise per week. At 6 months, this trend in adherence for the FS group had disappeared. A more robust intervention may have improved 6 month adherence.

2405 Board #5 June 2 9:30 AM - 11:30 AM

Effect Of High-intensity Intermittent Games-based Activity On Cognitive Function In Adolescents

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Whilst moderate intensity exercise has been shown to enhance cognition in adolescents, the activity patterns of young people are typically high-intensity and intermittent in nature, with team games providing an enjoyable and attractive exercise model. Yet, the effect of games-based exercise on cognition remains unknown.

PURPOSE: To examine the effects of a bout of games-based exercise on adolescents' cognitive function. **METHODS:** Following ethical approval and familiarisation, 28 adolescents (12.2 ± 0.7 y) completed an exercise (E) and resting (R) trial in a counter-balanced, randomised crossover design. Following a standardised breakfast of 1.5 g carbohydrate per kg body mass, participants completed 1 h of games-based activity (basketball), during which average heart rate was 154 ± 8 beats min^{-1} and maximal heart rate was 196 ± 8 beats min^{-1} . A battery of cognitive function tests (Stroop test, Sternberg paradigm and Trail Making test) were completed 30 min pre-exercise, immediately post-exercise and 45 min post-exercise. Data were analysed using mixed effect models in R. **RESULTS:** Response times on the simple level of the Stroop test were unaffected, but on the complex level there was an improvement in response times immediately (E: -78 ms, R: +1 ms, $p = 0.004$) and 45 min (E: -96 ms, R: +21 ms, $p < 0.001$) post-exercise. Accuracy on the simple level of the Stroop test was better maintained 45 min post-exercise (E: +0.8%, R: -3.1%, $p = 0.015$), but unaffected immediately post-exercise and on the complex level. Response times on the one item level of the Sternberg paradigm were enhanced immediately post-exercise (E: -37 ms, R: -2 ms, $p = 0.014$) and on the 5 item level were enhanced immediately (E: -79ms, R: -1 ms, $p = 0.002$) and 45 min (E: -70 ms, R: -8 ms, $p = 0.047$) post-exercise. Accuracy on the Sternberg paradigm was unaffected, as was the time taken to complete both levels of the Trail Making test (all $p > 0.05$). **CONCLUSION:** Cognitive function was enhanced following intermittent high-intensity team games-based activity in adolescents, as observed by improved response times and accuracy on the Stroop test and improved response times on the Sternberg paradigm. These data support the inclusion of opportunities for team games-based exercise during the school day to enhance cognitive function; a key consideration for school policy makers.

2406 Board #6 June 2 9:30 AM - 11:30 AM

Comparison Of The Effects Of Self-selected And Prescribed Intensity Exercise On Exertion And Feeling

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PURPOSE: To determine if participants rate an exercise intensity as more enjoyable when permitted to self-select rather than when the intensity is prescribed to them. **METHODS:** Twenty-three healthy (13 females) participants (age = $20.9 \pm .55$) completed a graded exercise test (VO2 max male: 39.4 ± 6.8 & female 33.9 ± 3.8), a session of self-selected exercise, and a session of prescribed intensity exercise, all on a Lode recumbent bicycle. Each session was separated by 48 hours. During exercise, perceptions of the exercise were recorded using the Ratings of Perceived Exertion (RPE), Feeling Scale (FS), and Felt Arousal Scale (FAS). Following completion of each test, participants rated their enjoyment of the session using the Physical Activity Enjoyment Scale (PACES). The intensity of the prescribed intensity session was identical to the self-selected condition, although participants were not aware of this. **RESULTS:** A 2 (day) x 5 (time) repeated measures ANOVA was conducted. For RPE, there was a significant time main effect $F(4, 59.5) = 165.25, p < 0.001$. For FS, there was a significant condition main effect, $F(1, 22) = 6.76, p = 0.016$, and a significant time main effect, $F(4, 69.1) = 11.12, p < 0.001$. For PACES, a one factor repeated measures ANOVA revealed a significant effect of condition, $F(1, 22) = 5.02, p = 0.035$. **CONCLUSIONS:** In line with self-determination theory, when participants were able to self-select their intensity, they felt better throughout and reported greater enjoyment after the exercise session when compared to a prescribed intensity that was identical. Based on hedonic theory, this would suggest that self-selecting intensity may lead to increased adherence in the future.

2407 Board #7 June 2 9:30 AM - 11:30 AM
Postseason Emotion Dysregulation in High School Athletes
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Sex, contact level, and concussion history have been associated with preseason aggression, impulsivity, anxiety, and depression in high school athletes. However, postseason scores have not been investigated. **PURPOSE:** Determine the association of postseason depression, anxiety, aggression, and impulsivity with sex, contact level and concussion history in high school athletes. **METHODS:** Postseason concussion history and emotion dysregulation measures were collected at one high school during 2013-2014 and 2014-2015 and at three high schools during 2015-2016. Sports were categorized into no-contact (cross country, swimming, tennis, track), low-contact (baseball, basketball, diving, softball, volleyball), and high-contact sports (field hockey, football, lacrosse, soccer, wrestling). Concussion history and incident concussion were analyzed as dichotomous variables (any vs. none). One-way analysis of variance was used for all analyses. Preseason emotion dysregulation scores and sport were used as covariates for all analyses. **RESULTS:** Postseason data were collected from 717 athletes (n=392 males, 325 females; age=15.7 ±1.2 years) who averaged 5.7 ± 3.5 years of sport participation. Females reported significantly lower aggression scores compared to the males (B= -10.489, p=0.008, 95% CI: -18.219,-2.759). Low contact sports reported significantly lower postseason aggression compared to high contact sports (B= -10.4887, p=0.0079, 95% CI: -18.2188,-2.7586). No other significant postseason behavior dysregulation differences were found between sex (p≥0.020), contact levels (p≥0.0202), concussion history (p≥0.1110), or incident concussion (p≥0.2060). **CONCLUSIONS:** In univariate analyses, sex and contact level were associated with emotion dysregulation in high school athletes. Concussion history and incident concussion were not associated with postseason emotion dysregulation in high school athletes. Longitudinal studies over several years may be needed to determine these relationships.

2408 Board #8 June 2 9:30 AM - 11:30 AM
A Randomized Control Intervention Investigating the Effects of Acute Exercise on Emotional Regulation
 Meghan K. Edwards, Paul D. Loprinzi. *The University of Mississippi, Oxford, MS.*
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 (No relationships reported)

PURPOSE: To examine the effects of an acute bout of aerobic exercise on emotional regulation among young adults. **METHODS:** Participants (N= 27, mean age = 24.2 years) were randomly assigned to stretch (control group, n= 10), walk (n= 9), or jog (n= 8) for 15-minutes (exercise 1), after which they were exposed to a film clip (3 min) intended to elicit a negative emotional response (e.g., sadness, anger, anxiousness). Participants then completed the same stretching, walking, or jogging protocol (exercise 2) for a second time. Notably, walking and jogging occurred at a self-selected intensity on a treadmill. Participants' emotions were monitored before and during both exercise bouts, as well as after the film clip using the Exercise Induced Feelings Inventory (EFI) and an affective circumplex scale. **RESULTS:** A group x time split-plot (baseline vs. post-film clip) ANOVA interaction effect was significant for anger (P=.046) and anxiousness (P=.038). Follow-up analyses (paired t-tests) showed that only the stretching group (P=.048) had a significantly increased anger score from baseline to post-film clip, suggesting a protective emotional effect from walking and jogging. For anxiousness, the P-values for the stretching, walking, and jogging groups were .21, .21, and .06, respectively, suggesting that anxiousness was more significantly different between baseline and post-film clip in the jogging group (vs. walking or stretching). **CONCLUSIONS:** Fifteen minutes of aerobic exercise (via walking or jogging) was more effective in regulating anger and anxiousness after a stressful event (i.e., there was an attenuated negative emotional response) when compared to a stretching control group. These findings provide evidence supporting the potential utility of exercise in regulating emotions, after exposure to an environmental stressor.

E-12 Thematic Poster - Moving Beyond Cancer

Friday, June 2, 2017, 9:30 AM - 11:30 AM
 Room: 505

2409 **Chair:** Kristin L. Campbell. *University of British Columbia, Vancouver, BC, Canada.*
 (No relationships reported)

2410 Board #1 June 2 9:30 AM - 11:30 AM
Progressive Resistance Training In Breast Cancer Patients Undergoing Adjuvant Therapy: Adherence To Training Principles

Joachim Wiskemann¹, Martina E. Schmidt², Cornelia M. Ulrich³, Andreas Schneeweiss¹, Karen Steindorf². ¹*National Center for Tumor Diseases, Heidelberg, Germany.* ²*German Cancer Research Center, Heidelberg, Germany.* ³*Huntsman Cancer Institute, Salt Lake City, UT.* (Sponsor: Kathryn Schmitz, FACS M)
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 (No relationships reported)

Progressive resistance training (PRT) is recommended for breast cancer patients (BC) to prevent or mitigate treatment-related side effects. However, little attention has been paid to the following of principles of exercise training in various cancer treatment settings.

PURPOSE: To investigate principles of exercise training in BC undergoing a 12-week twice-weekly supervised PRT concomitant to adjuvant radiotherapy (RT) vs. chemotherapy (CT).

METHODS: PRT documentation sheets were analyzed from 128 BC participated either in a randomized controlled trial investigating the effect of 12-week PRT vs. a relaxation control group during adjuvant CT (BEATE-Study; NCT01106820) or RT (BEST-Study; NCT01468766). Extracted variables were: Exercise frequency, progression and depression steps made, as well as %-change in weight load during the intervention period for three lower and four upper extremity machine-based exercises. Furthermore, %-change of maximal isokinetic peak torque (MIPT) in knee extensors and flexors measured by stationary dynamometry were available.

RESULTS: Training frequency in CT patients were significantly lower than in RT patients (1.38 vs. 1.77 sessions/week; p<.001). Progression steps were made in 76% of patients under CT vs. 78% in RT treated patients. Comparable results were found for depression steps made (37% vs. 33%). The number of progression steps was significantly higher in shoulder external rotators for RT patients (p=.045) and borderline significant results were found in leg press and seated row (p=.07 and .15). In general, number of progression steps made for each exercise was low (median: 2, range: 0-11). Change in training weight load was significantly different in favor for the RT treated patients in four out of seven exercises (p<.05) and borderline significant in the other three (p=.07 to .15). The correlation between change in training weight load and change in MIPT for knee flexors and extensors was weak (r=.10 and .22). **CONCLUSIONS:** BC undergoing CT faced greater challenges to adhere to principles of PRT than patients undergoing RT treatment. As a consequence increases in training weight load during the intervention period was lower. Correlation analyses further indicate that changes in training weight load do not necessarily result in higher strength values.

2411 Board #2 June 2 9:30 AM - 11:30 AM
Cancer Survivor Preferences, Barriers, And Facilitators To Exercise After Participation In A Cancer-specific Community Exercise Program

Kirsten Suderman¹, Kathryn Nishimura¹, Nicole Culos-Reed², Janice Yurick³, Margaret McNeely⁴. ¹*University of Alberta, Edmonton, AB, Canada.* ²*University of Calgary, Calgary, AB, Canada.* ³*Cross Cancer Institute, Edmonton, AB, Canada.* ⁴*University of Alberta, Cross Cancer Institute, Edmonton, AB, Canada.*
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 (No relationships reported)

Including cancer survivors and their families in the planning of cancer-specific community exercise programming supports person-centred care, and allows for the identification of exercise barriers, facilitators and preferences to optimize program uptake and sustainability. The Alberta Cancer Exercise (ACE) pilot multi-centre randomized controlled trial examined the feasibility of implementing a cancer specific community-based exercise program. The current project was a sub-study (Edmonton site) utilizing an integrated knowledge translation (iKT) approach to inform future ACE program implementation. iKT can be described as involving knowledge users in the research process, in this case cancer survivors, to yield research that is more

applicable and helpful to the knowledge users. **PURPOSE:** To identify barriers, facilitators and preferences towards exercise of cancer survivors after participation in the ACE pilot study. **METHODS:** A longitudinal descriptive design using mixed methods research methodology was used to better understand the participant exercise experience. Following study completion, a post-study satisfaction questionnaire was administered and a focus group session was held. Quantitative data were analyzed descriptively and qualitative data used to interpret, clarify and further describe quantitative results. **RESULTS:** 82% of participants indicated a preference for a combination of unsupervised and supervised exercise, 77% preferring to exercise with other cancer survivors, and 67% for exercise programming to occur in a community facility. 76% perceived little to no difficulty in continuing to exercise independently. A major theme emerging was the lack of counselling from healthcare providers on exercise during the cancer treatment period. Oncologist referral to the ACE pilot was minimal, with 93% of survivors indicating they self-referred to the program. Specifically, participants identified a lack of (1) communication on the value of exercise for recovery and (2) provision of information on the availability of cancer-specific exercise programming. **CONCLUSIONS:** An iKT approach, involving survivors and their families, can help inform exercise programming issues and the need for program modification to optimize survivor satisfaction and adherence.

2412 Board #3 June 2 9:30 AM - 11:30 AM

Cardioprotection in Breast Cancer Survivors: Sports Activity Vs Exercise As Prescription Model

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PURPOSE: Cardiotoxicity is the second leading cause of long-term morbidity and mortality among cancer survivors. Regular exercise program and sport are normally proposed to maintain myocardial performance. No data is available about actual myocardial benefits when different levels of physical exercise are allowed. The study aims to report clinical and cardiac outcomes, by the 2D Speckle tracking (ST) analysis, in order to detect the eventual differences between the sports activity and exercise model to protect patients survived to breast cancer. **METHODS:** From a cohort of 55 previous cancer patients, a group of 23 subjects trained in competitive sports activity Dragon Boat Athletes (DBA) for at least 5 yrs, were selected. They were evaluated by echo exam including LV Longitudinal Strain (SI) assessment (XStrain - Esaote) and matched with a group of 23 previous cancer patients following the Exercise as prescription therapy program. They were compared with two groups of healthy subjects: 20 athletes (HA) from different kinds of non competitive sports, and 20 volunteers submitted to the exercise as prescription program. **RESULTS:** All data were compared by T-Student test. Despite not significant differences of the EF values, the SI resulted to be different among the groups. Significantly higher in healthy subjects (p<0.01) both athletes and volunteers. No difference between the cancer subjects, athletes if compared to the exercise prescription model.

Groups	LV Global SI % (GLS)	LV SI-Medium %	LV SI Bas Lat %	LV SI Bas Sept%	LV SI Lat Apex %	LV SI Sept Apex %	EF %
Dragon Boat Athletes	-21.87±5.3	-20.02±5	-19.14±7.9	-19.29±5.3	-18.0±5.8	-24.0±5.9	57.2±5.5
Healthy Athletes	-25.4±2.1*°	-24.1±2.1*°	-25.0±4.1*°	-23.5±5.5*°	-23.8±5.5*°	-25.9±3.8*°	64.8±5.1
Patients submitted to Exercise as Prescription	-19.93±4	-19.21±4.4	-20.81±5.9	-17.89±5.7	-17.64±5.3	-20.52±7.2	59.95±7.3
Healthy subjects submitted to Exercise as prescription	-22.19±4.4	-21.87±3.8	-22.0±6.7	-19.22±4.9	-21.59±5.8	-24.35±6.8	61.39±5.4

Legend: * HA > ALL; ° HA > DBA; **CONCLUSIONS:** appropriate cardiac management by ST method can improve the supervision of the intensity of exercise. More than EF, 2D STE analysis can complete the exercise as prescription therapy. Regular 2D ST pattern revision can optimize and improve cancer therapy supporting and creating efficiencies within the health system. In addition 2D Lo Strain (S_i) confirms exercise as prescription therapy contributes in maintaining normal heart function at the same level of Dragon Boat Athletes.

2413 Board #4 June 2 9:30 AM - 11:30 AM

Effect of an Argentine Tango Intervention on Gait Variability in Cancer Survivors

Ajit M.W. Chaudhari, FACSM, Scott M. Monfort, Marie T. Lamantia, Maryam B. Lustberg, Lise C. Worthen-Chaudhari. *The Ohio State University, Columbus, OH.*
(No relationships reported)

BACKGROUND: Advances in cancer diagnoses and treatment have contributed to improved outcomes for many cancers. The increasing number of cancer survivors and increased risk of falling in cancer survivors support the need for interventions to mitigate functional impairments in this population. Argentine tango has demonstrated efficacy as a dance-based intervention in improving function in the elderly as well as patients with Parkinson's disease; however, the efficacy of this intervention in cancer survivors has yet to be elucidated.

PURPOSE: To investigate the efficacy of an Argentine tango intervention on a measure of fall risk (i.e., stride-to-stride gait variability) in a group of cancer survivors. **METHODS:** Seven cancer survivors (2m/5f; 63.9 ± 10.2yr; 1.74 ± 0.11m; 79.7 ± 12.1kg) participated in a 10-week Argentine tango intervention, which consisted of one hour of instructed class held twice a week. Gait assessments were conducted before starting the intervention – baseline, at a five week midpoint, and at the conclusion of the 10-week intervention. Gait analysis consisted of survivors walking on a treadmill while bilateral lower extremity kinematics were recorded (MTP Series 2 system, Metria Innovation). During all testing timepoints, survivors walked at the same self-selected speeds that were identified at the baseline timepoint. Mean, standard deviation (SD), and coefficient of variation (CV) of stride-to-stride fluctuations in speed, stride length, stride time, and step width were calculated. Linear mixed models for repeated measures with survivors as a random effect, and testing timepoint as the fixed effect, were used to estimate changes for each gait parameter.

RESULTS: The CV of stride-to-stride fluctuations in speed decreased post-intervention (pre: CV = 3.0%, post: 2.2%, p = 0.003). Additionally, the SD of stride-to-stride speed decreased post-intervention (pre: σ = 0.026 m/sec, post: 0.019 m/sec, p = 0.004). No other gait parameters differed significantly between study timepoints (p>0.05).

CONCLUSION: Argentine tango was found to improve stride-to-stride variability in gait speed. This study supports the efficacy of dance-based exercise interventions to improve gait variability and potentially decrease falls risk in cancer survivors.

2414 Board #5 June 2 9:30 AM - 11:30 AM

Exercise Maintenance After a Randomized Resistance Training Intervention in Breast Cancer Survivors Undergoing Adjuvant Therapy

Martina E. Schmidt¹, Joachim Wiskemann², Cornelia M. Ulrich³, Andreas Schneeweiss², Karen Steindorf¹. ¹*German Cancer Research Center (DKFZ) and National Center for Tumor Diseases (NCT), Heidelberg, Germany.* ²*University Hospital Heidelberg and National Center for Tumor Diseases (NCT), Heidelberg, Germany.* ³*Huntsman Cancer Institute and University of Utah, Salt Lake City, UT.* (Sponsor: Juergen Scharhag, FACSM)
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(No relationships reported)

Exercise is highly recommended for breast cancer patients and survivors and may be increased by supervised interventions. Yet, still little is known about factors influencing the longterm physical activity behavior after the end of an Intervention.

PURPOSE: To investigate the course and determinants of physical activity of breast cancer patients during and up to 12 months after a supervised resistance exercise intervention concomitant to adjuvant cancer treatment. **METHODS:** Physical activity was assessed in 227 breast cancer survivors before, during, and 3, 6 and 12 months after they participated in two randomized controlled trials investigating 12-week supervised resistance exercise vs. a relaxation control group concomitant to adjuvant chemotherapy (BEATE-Study, NCT01106820) or radiotherapy (BEST-Study, NCT01468766). To identify determinants of physical activity multiple ordinal logistic regression analyses were performed. **RESULTS:** During adjuvant therapy the intervention group exercised a median 1.8 h per week (interquartile range: 1.4-2.5), while 68% of controls did not engage in any exercise. Yet, irrespective of the intervention 32% of patients did not engage in any exercise at 12-month follow-up. Of the patients who cycled for transportation pre-diagnosis about half stopped cycling in the long run in both groups. In contrast, walking was maintained over time. Low levels of exercise at 12 months were determined by low pre-diagnosis levels of exercise (p<.001), lower education (p=0.0032), being postmenopausal (p=0.028), and having breast problems (p=0.0099) or depressive symptoms (p=0.059). At 12-month follow-up strength exercise was more common in the exercise group compared to the control Group. **CONCLUSIONS:** Breast cancer patients markedly decreased the exercise level and cycling for transportation after diagnosis and treatment. Yet, our resistance training intervention effectively counteracted this decline and boosted strength

exercise in the months following the intervention. However, in the longer term many survivors were insufficiently active. Our results that identified subgroups especially vulnerable to physical inactivity may help to develop better individually tailored strategies to improve the physical activity behavior in breast cancer survivors in the long run.

2415 Board #6 June 2 9:30 AM - 11:30 AM
Effects Of Exercise On Sleep Problems In Breast Cancer Patients Receiving Radiotherapy: A Randomized Trial

Karen Steindorf¹, Joachim Wiskemann², Cornelia M. Ulrich³, Martina E. Schmidt¹. ¹German Cancer Research Center, Heidelberg, Germany. ²University Hospital, Heidelberg, Germany. ³Huntsman Cancer Institute, Salt Lake City, UT. (Sponsor: Juergen Scharhag, FACSM)
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Sleep problems frequently affect breast cancer patients during and after treatment and reduce their quality of life. However, coping and treatment strategies are mostly unknown or understudied. Only few studies have investigated the effect of exercise on sleep quality, particularly during the course of radiotherapy. **PURPOSE:** To assess within a large randomized controlled trial whether a 12-week exercise program starting with the radiotherapy influences sleep trajectories. **METHODS:** Sleep problems were assessed via self-report in 160 breast cancer patients before, during, and 3, 6 and 12 months after they participated in a trial investigating 12-week resistance exercise versus a relaxation control group concomitant to adjuvant radiotherapy (BEST-Study, NCT01568766). In addition, 25 age-matched women without cancer were exercising and followed the same study protocol for comparison purposes. **RESULTS:** Ordinal logistic regression analyses revealed significant exercise intervention effects regarding the changes in sleep problems (scale: 0-100) from baseline to the end of radiotherapy (mean between-group difference (MD): -10.2, p=0.03) and to the end of intervention (MD= -10.9, p=0.01), with sleep problems decreasing in the exercise group and increasing in the control group. At 12 months, differences were still observed but were statistically non-significant (MD=-5.9, p=0.3). Further adjustment for potential confounders did not change the results. The course of sleep problems in exercising women during the exercising phase was similar in breast cancer patients and in healthy exercisers, yet, patients experienced significantly higher levels of sleep problems at all times. **CONCLUSIONS:** Our large randomized exercise intervention trial confirmed results from earlier but mostly small studies that radiotherapy aggravates sleep problems in breast cancer patients and that exercise represents an effective treatment option. Given the strong link between quality of life and sleep problems, our finding that a 12-week resistance training for breast cancer patients undergoing radiotherapy reduces sleep problems is of high importance for many cancer patients.

2416 Board #7 June 2 9:30 AM - 11:30 AM
Cancer Related Fatigue and Muscle Quality in Hodgkin's Lymphoma Survivors

Filipe Dinato de Lima¹, Claudio L. Battaglini, FACSM², Ricardo Jacó de Oliveira¹, Ritielli de Oliveira Valeriano¹, Lorena Cruz¹, Carlos Alexandre Vieira³, Martim Bottaro¹. ¹University of Brasília, Brasília, Brazil. ²University of North Carolina at Chapel Hill, Chapel Hill, NC. ³Federal University of Goiás, Goiânia, Brazil. (Sponsor: Claudio L Battaglini, FACSM)
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Cancer-related fatigue is the most commonly reported side effect in cancer patients. This debilitating fatigue is often accompanied by reductions in overall physical activity and physical function. Whereas fatigue in cancer survivors seems partially dependent on neuromuscular factors, these relationships have not been established in Hodgkin's lymphoma survivors (HLS).

PURPOSE: To assess self-perceived fatigue and muscle quality in Hodgkin's Lymphoma survivors.

METHODS: A total of 12 HLS, age 32.16 ± 8.06, and 36 control healthy subjects (CON) matched by age, gender and level of physical activity were enrolled in the study. Fatigue was measured using MFI-20. Muscle thickness of knee extensors (MT) was measured using B-mode ultrasound. Muscle quality was assessed by echo intensity (EI) of rectus femoris and specific torque (ST) of the knee extensors. The ST was calculated as follows: isokinetic peak torque (PT)/ MT. Isokinetic PT was measured by two sets of four maximal isokinetic knee extension at 60°/s⁻¹. Independent samples T-tests were used to compare physical characteristics, muscle function and fatigue between HLS and CON.

RESULTS: No significant differences (p > 0.05) in any physical characteristics between HLS and CON were observed. There was no difference in PT (HLS: 184.58 ± 55.91 vs. CON: 199.14 ± 60.57 N.m; p = 0.552), MT (HLS: 27.35 ± 8.70 vs. CON: 28.55 ± 7.58 mm; p = 0.439), EI (HLS: 63.18 ± 11.12 vs. CON: 65.36 ± 11.76; p

= 0.575), and ST (HLS: 6.89 ± 1.59 vs. CON: 7.05 ± 1.46 N.m.mm⁻¹; p = 0.737). However, there was a significant difference between HLS and CON for self-perceived fatigue (HLS: 14.00 ± 3.91 vs. CON: 10.80 ± 3.36; p = 0.009; ES = 0.8778). **CONCLUSION:** A higher level of self-perceived fatigue was observed in HLS when compared to CON. However, no differences in muscle quality were observed when HLS are matched by age, gender and physical activity level with CON. It appears that as HLS are further out from the completion of their major treatments, their muscle characteristics and function are preserved if they maintain certain level of physical activity. This study provides insight on the potential similarities between HLS and CON, with same physical activities level, regarding muscle characteristics, function, and performance, which should be considered when prescribing exercise training to this population.

2417 Board #8 June 2 9:30 AM - 11:30 AM
Exercise Effects On Mental Fatigue, Cognitive Impairment And Inflammation In 479 Cancer Patients

Karen M. Mustian, Ian Kleckner, Po Ju Lin, Calvin Cole, Charles Heckler. University of Rochester School of Medicine, Rochester, NY.
 (No relationships reported)

PURPOSE: Mental fatigue and cognitive impairment (CI) are side effects experienced by cancer patients that arise due to chronic inflammation and diminish functional capacity and quality of life (QOL). We conducted a nationwide, multi-site, phase III RCT examining the efficacy of exercise for improving mental fatigue, CI and inflammation through the URCC NCORP Research Base nationwide network.

METHODS: Non-metastatic cancer patients receiving chemotherapy were randomized into 2 arms: 1) chemotherapy and 2) chemotherapy plus a 6-week (wk) exercise intervention. The intervention used the Exercise for Cancer Patients (EXCAP) program: a home-based, personalized prescription of aerobic walking and anaerobic resistance band training. Mental fatigue, CI and inflammation were assessed via the Multidimensional Fatigue Symptom Inventory, FACT-Cog and standard serum Luminex assays, respectively, at pre- and post-intervention.

RESULTS: 479 patients beginning chemotherapy were accrued (94% female, 84% breast cancer, mean age = 54). ANCOVAs controlling for baseline mental fatigue, CI and chemotherapy cycle (1 wk, 2 wk, 3 wk) revealed significant differences in mental fatigue, CI total score, perceived CI, impact of CI on QOL, and perceived CI by others (all p < 0.05) with a trend for differences in perceived cognitive ability (p < 0.10) between groups at post-intervention. Exercisers demonstrated less mental fatigue and cognitive impairment (all domains) than participants in the chemotherapy-only arm. T-tests revealed an exercise-induced anti-inflammatory response with down-regulation of pro-inflammatory cytokines (IFNγ, IL-8, IL-1b) and up-regulation of anti-inflammatory cytokines (IL-6, IL-10, sTNFα) in exercisers (all p<0.05). Conversely, t-tests revealed down-regulation of IL-10 and less up-regulation of sTNFα in controls (all p < 0.05).

CONCLUSIONS: EXCAP exercise improves mental fatigue, CI and inflammation in cancer patients receiving chemotherapy. Clinicians should consider prescribing EXCAP to reduce mental fatigue, CI and inflammation. Funding: NCI UGCA189961 and K07CA120025.

E-13 Thematic Poster - Nutritional Status of Athletes I

Friday, June 2, 2017, 9:30 AM - 11:30 AM
 Room: 304

2418 Chair: Enette Larson Meyer, FACSM. University of Wyoming, Laramie, WY.
 (No relationships reported)

2419 Board #1 June 2 9:30 AM - 11:30 AM
75g/day Supplemental Protein Improves Lean Mass Index and Dance Performance Aesthetics in Female Collegiate Dancers

Ann F. Brown¹, Tom Welsh², Lynn Panton, FACSM², Robert Moffatt², Michael J. Ormsbee, FACSM². ¹University of Idaho, Moscow, ID. ²Florida State University, Tallahassee, FL. (Sponsor: Dr. Michael J. Ormsbee, FACSM)
 (No relationships reported)

Body composition and fitness are just as important as technique development for dancers. Supplemental protein may be a simple way to optimize body composition, performance, and aesthetics without dramatically changing classical training. To date, no studies have investigated the impact of supplemental protein on body composition and performance in dancers. **PURPOSE:** To determine the extent to which 12

weeks of supplemental whey protein (PRO) would optimize body composition and performance in female dancers compared to an isocaloric placebo (PLA; maltodextrin). **METHODS:** Female collegiate dancers (N=21; 19.6 ± 1.4 years) completed a randomized, double-blind study. Participants were randomly assigned PLA or PRO and consumed one dose (25g) three times daily for 12 weeks. Testing was completed at baseline, 6, and 12 weeks which included 24-hour urine collection, body composition assessment (DXA), performance tests, and a functional dance performance assessment. Data were reported as mean ± SD. Dependent variables were analyzed by one-way ANOVA. Significance was accepted at $p < 0.05$. **RESULTS:** There were no significant differences between groups at baseline. PLA consumed significantly lower protein (0.9 g/kg/day) than PRO every week of the study (2.4 g/kg/day; $p < 0.001$). Body weight, fat and lean mass did not change between groups or over time. Lean mass index (LMI; absolute value of fat change plus muscle change) was significantly higher in PRO (+0.6 ± 1.9) compared to PLA (-1.8 ± 3.1; $p = 0.048$) at week 12. PLA significantly increased peak power during the Wingate anaerobic power test from baseline to week 12 absolute (746.4 ± 92.9 W, 856.3 ± 51.6 W; $p = 0.005$). Although not significant, PLA completed the study in negative nitrogen balance whereas PRO was in positive nitrogen balance. Differences detected in aesthetic presentation from baseline to week 12 were significantly lower in PLA (1.9 ± 0.5; 1.0-5.0 scale) compared to PRO (2.6 ± 0.8; $p = 0.048$). **CONCLUSIONS:** Protein supplementation for 12 weeks significantly improved LMI as well as aesthetic presentation during dance performance. Additionally, protein supplementation provides a simple way to improve the diet and LMI in a group of dance athletes that require nutritional attention. This study was supported by a Dymatize Nutrition Sports Performance Institute grant.

2420 Board #2 June 2 9:30 AM - 11:30 AM
Inadequate, Habitual Dietary Protein Intake Amid Inadequate Caloric Intake In Collegiate Female Gymnasts
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 (No relationships reported)

Collegiate, women's gymnastics is a sport that requires explosive muscular contraction, muscular endurance, and demands twice-daily workout schedules. What is lesser known is if day-to-day variations in eating exist, and if so, would they tend to result in balanced energy requirements, or a deficit. **PURPOSE:** To determine if daily variations in energy intake and nutrient insufficiency occurs during a competition week for female gymnasts. **METHODS:** Female, NCAA gymnasts (n=14; 20.1±1.2 y; BMI=23.4±2.5 kg·m⁻²) provided 7-day food and physical activity recalls during a competition week. Athletes also completed a resting metabolic rate (RMR) test using indirect calorimetry with a calibrated metabolic system (Parvo Medics). The Mifflin-St. Jeor formula was also used to compare total daily energy expenditure (TDEE) estimation to the laboratory determination. Exercise-induced thermogenesis was determined using the activity recall and MET values from the compendium of physical activity. Dietary-induced thermogenesis was calculated as 10% of mean caloric intake. A nutritional database software package (Nutritionist Pro v. 5.0) was used to analyze the 7-day food recalls. **RESULTS:** By ANOVA, RMR estimated using Mifflin-St. Jeor was significantly less than that measured via indirect calorimetry (1320 ± 75 vs. 1618 ± 204 kcal; $p < 0.01$), which resulted in a significantly lower TDEE from the formula than lab measurement (1746 ± 131 vs. 2074 ± 261 kcal; $p < 0.01$). Daily kcal intake was significantly lower than lab TDEE (1832 ± 399 vs. 2074 ± 261 kcal; $p = 0.01$), but similar to the formula estimation (1746 ± 131 kcal). Dietary protein intake (1.20 ± 0.27 g/kg/d) was at the low end of the ACSM-recommended range for active athletes (1.2-1.7 g/kg/d), and remarkably lower than the recommended range for athletes in negative energy balance (2.0 g/kg/d). Daily leucine intake (2.7 ± 1.0 g/d) was also notably lower than the recommended intake (8 g/d). **CONCLUSION:** Female, collegiate gymnasts do not consume enough calories, dietary protein, or leucine to meet recommended guidelines for athletes. The Mifflin-St. Jeor formula for TDEE estimation underestimated the kcal expenditure for the athletes, but was similar to the athletes' dietary self-report. Gymnasts should consume almost twice their habitual protein intake during a competition week.

2421 Board #3 June 2 9:30 AM - 11:30 AM
Comparison Of Dietary Energy And Macronutrient Intakes Of Division Iii Athletes To Sports Nutrition Guidelines
 Trisha Sterringer, Elizabeth Goecke, Haley Murrell, Erin Simon, Kristen Ruckstuhl, Madeline Deabler, Lynn Cialdella-Kam. *Case Western Reserve University, Cleveland, OH.*
 (No relationships reported)

Sports nutrition guidelines have been proposed that aim to enhance sports performance and support overall health. However, collegiate athletes often struggle to meet these guidelines for several reasons (e.g., cafeteria meal plans, travel schedules, and lack of nutrition knowledge). **PURPOSE:** To determine if Division III athletes are

meeting recommended intakes for energy and macronutrients based on the guidelines set forth by American College of Sports Medicine Position Stand on Nutrition and Athletic Performance. **METHODS:** This retrospective chart review assessed energy and macronutrient intakes of 56 Division III athletes from 3-day food analyzed in Food Processor (Salem, OR). Data was summarized as means (standard deviations). Wilcoxon Sign Rank t-test was used to evaluate macronutrient intakes against recommendations. **RESULTS:** Energy and macronutrient intakes by sports are presented in Table 1. Overall, carbohydrate intake was 4.6(0.4) g/kg/d for all athletes and below targeted levels appropriate for their sports ($p < 0.0001$). Protein intake of 1.4(0.4) g/kg/d was adequate across sports and greater than lower end of recommended range for protein of 1.2 g/kg/d ($p = 0.0013$). However, ~one-third of athletes had intakes <1.2 g/kg/d. Dietary fat intake was on the upper end of recommendations (intake=32.6 (6.4)% of total kcal/d) with 19 athletes having intakes >35% of total kcal/d. **CONCLUSIONS:** Overall, collegiate athletes could benefit from strategies to include carbohydrate-rich foods in their diet and a possible reduction in saturated dietary fat intake.

Table 1: Energy and Macronutrient Intakes by Sports Expressed as Means (SD)

Description (SD)	Women's Basketball (n=5)	Women's Swimming (n=15)	Women's Tennis (n=8)	Men's Tennis (n=8)	Women's Track and Field (n=12)	Men's Wrestling (n=5)
Energy (kcal/d)	2,188 (307)	2,347 (389)	1,960 (372)	2,979 (594)	2,267 (510)	2,253 (540)
Carbohydrates (g/kg/d)	3.7 (0.6)	4.6 (1.1)	4.5 (1.0)	5.5 (1.4)	5.1 (1.3)	2.8 (1.0)
Protein (g/kg/d)	1.2 (0.1)	1.3 (0.3)	1.1 (0.2)	1.7 (0.6)	1.5 (0.2)	1.3 (0.5)
Fat (% of Total Kcal/d)	33 (7)	33 (6)	30(9)	31 (6)	33 (3)	37 (12)
Fiber (g/d)	31 (15)	24 (9)	25 (9)	24 (8)	27 (9)	23 (12)

2422 Board #4 June 2 9:30 AM - 11:30 AM
Effect of Vitamin D Supplementation on 25(OH)D Status in Elite Athletes with Spinal Cord Injury
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 (No relationships reported)

Recent studies suggests that a substantial proportion of elite athletes with SCI (spinal cord injury) have insufficient 25(OH)D status which may be associated with decreased muscle strength. **Purpose:** This study: 1) examined the effects of a 16-wk Vitamin D supplementation protocol on 25(OH)D concentration and 2) determined whether subsequent 25(OH)D status impacts muscle function/performance in elite athletes with SCI. **Methods:** Thirty-four members of the US Olympic Committee Paralympic program, and the Canadian Wheelchair Sports Association from outdoor and indoor sports participated. Serum 25(OH)D concentrations, lifestyle and dietary factors were assessed during the Winter and Spring. Participants were assigned to a 16-week sliding scale vitamin D3 (cholecalciferol) (KleanAthlete Brand) supplementation protocol based on initial 25(OH)D levels. Participants with deficient 25(OH)D (<20ng/mL⁻¹) status received 50,000 IU/wk for 8 wks, and participants with insufficient status (20-30 ng/mL⁻¹) received 35,000 IU/week for 4 weeks followed by a maintenance dosage of 15,000 IU/wk. Participants with sufficient status (>30ng/mL⁻¹) received the maintenance dosage of 15,000 IU/wk. Performance measurements were assessed using a 20 meter wheelchair sprint, and handgrip strength. A paired t-test was used to assess differences in 25(OH)D status and performance before and after supplementation, respectively. **Results:** 25 (OH) D concentrations increased significantly after supplementation ($P < .001$; 26.5 ± 9.7 ng/mL⁻¹; 44.5 ± ng/mL⁻¹; mean ± SD) for Winter and Spring, respectively, 26% of athletes had sufficient 25(OH)D concentrations prior to supplementation, and 94% had sufficient concentrations post supplementation. 60% of participants improved handgrip strength post supplementation. However, no change in wheelchair sprint performance time was observed. **Conclusion:** The 16-week sliding supplementation protocol used in the current study is effective for achieving sufficient vitamin D concentrations during the winter months in elite athletes with SCI. Furthermore, handgrip strength improved in 60% of participants post supplementation.

2423 Board #5 June 2 9:30 AM - 11:30 AM
Evaluation of Nutrient Intakes of Masters Athletes
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 Jacqui Van Grouw¹, Rachel C. Kelley², Francesco Alessio¹,
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Optimal nutrition enhances athletic performance. Eating adequate amounts of energy and meeting recommendations for macronutrients are essential and a priority for athletes. **PURPOSE:** To evaluate the dietary intakes of macronutrients of Masters Athletes. **METHODS:** This cross-sectional study included 25 Masters Athletes (14 females, 11 males), 39.4±10.1 years of age. Body composition was determined by dual-energy X-ray absorptiometry (DXA). Participants completed a self-administered Block Food Frequency Questionnaire (FFQ) used to assess dietary patterns over the previous year. The FFQs were analyzed by a third party source; however, statistical analyses were conducted by the researchers. For the purposes of this study, athletes were classified as either lean or non-lean based on percent body fat. Female athletes with < 24.4% and male athletes with < 17.4% body fat were considered lean. **RESULTS:** Average carbohydrate intake was 44.7±6.6% and 47.7±7.6% of total energy intake for lean and non-lean athletes, respectively. Average protein intake was 15.3±2.8% and 15.02±2.0% of total energy intake for lean non-lean athletes, respectively. Average fat intake was 38.1±7.4% and 36.5±4.9% of total energy intake for lean and non-lean athletes, respectively. There were no significant differences between groups in percent of carbohydrate, fat and protein consumed to total energy intake diet. **CONCLUSION:** Macronutrient recommended intakes for carbohydrates and proteins are being met for Masters Athletes, which helps to ensure optimal performance; yet proportional fat intake is above recommendations. Nonetheless, aside from the Dietary Reference Intakes, specific recommendations for Masters Athletes have not been established. These represent data from an unfunded research project

2424 Board #6 June 2 9:30 AM - 11:30 AM
Evaluating Diet Quality in SEAL Qualification Training Students
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BACKGROUND: Healthy Eating Index 2010 (HEI-2010) is a tool that was developed to assess diet quality and adherence to the 2010 Dietary Guidelines for Americans. Lower total HEI scores have been associated with higher rates of obesity, heart disease, cancer and chronic systemic inflammation. **PURPOSE:** To Evaluate the diet quality in Seal Qualification Training (SQT) students. **METHODS:** 264 SQT students (age: 24.3±2.6 (mean±SD), height: 179.5±6.6 cm, weight: 85.0±8.2 kg; body fat: 14.3±4.1) completed a 24-hour diet recall using the Automated Self-administered 24-hour recall (ASA24) diet assessment tool (National Cancer Institute). The HEI is made up of 12 food group components, broken down into 2 categories: adequacy (foods to eat enough nutrients for overall health) and moderation (foods to limit). **RESULTS:** The total HEI-2010 score was 56.2±15.0. The adequacy HEI-2010 component scores (mean±SD/max score, higher score = higher consumption) were: total Veg 3.0±1.5/5, Green/Bean Veg 2.3±2.3/5, Total Fruit 2.4±2.0/5, Whole Fruit 2.4±2.1/5, Whole Grain 3.8±3.6/10, Total Dairy 6.2±3.1/10, Total Protein 4.7±0.8/5, Seafood/Plant Protein 2.8±2.2/5, Fatty Acid Ratio 4.7±3.5/10. The moderation components of HEI-2010 (mean±SD/max score, higher score = lower consumption) were: Sodium 2.8±3.1/10, Refined Grains 7.5±2.9/10, 13.7±5.5/20. **CONCLUSION:** The HEI score for SQT was 56.2 (out of a total 100), slightly lower than the US population score of 59. Students scored particularly low in the Vegetable, Fruit, Whole Grain, Seafood/Plant Protein and Fatty Acid categories and had, higher consumption of empty calorie foods/beverages (with added sugar, fat and alcohol). A dietary pattern low in fruits, vegetables, whole grains and fish, high in refined foods with added sugar, fat and alcohol promotes a pro-inflammatory state, higher body fat and earlier onset of chronic disease. Improving diet quality by increasing fruit, vegetable, whole grains and healthy fats, may have implications in reducing systemic inflammation, which can aid with recovery from training, improved immune response, prevention of chronic diseases and improved overall health.

Supported by ONR N00014-11-1-0929.

2425 Board #7 June 2 9:30 AM - 11:30 AM
Behavioural Predictors Of Muscle Dysmorphia Symptomatology In Natural Bodybuilders
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Muscle dysmorphia (MD) is a psychological disorder characterized by a pervasive belief that one is insufficiently muscular, despite often being large and strong. Nosological similarities are recognized between MD and eating disorders (EDs).

PURPOSE: To identify predictors of MD symptomatology in natural competitive bodybuilders (BB).

METHODS: An online survey was developed to investigate the relationship between MD, ED and competition practices used in competitive bodybuilding. To be included, participants needed to have competed in a drug tested bodybuilding contest in the past 18 months. The survey assessed demographic characteristics, diet, supplementation and training practices, MD symptoms via the muscle dysmorphic disorder inventory (MDDI) and ED symptoms via the eating attitudes test (EAT-26). Stepwise linear regression was performed to assess the relationship between MD and ED symptoms, diet, supplementation and training practices.

RESULTS: Sixty participants (age 30±7 yrs) met inclusion criteria and completed the survey. Mean scores on the EAT-26 (8.5 ± 6.3) were low, and on the MDDI (35.2 ± 8.0), mid-range. No nutrition, supplementation or training factors were found to predict MD symptomatology. The EAT-26 score (β=0.268, p=0.032) and rate of pre-competition weight loss (β=0.307, p=0.012) were significant predictors of MD. Competition experience was negatively associated with MD (β=-0.243, p=0.051). The model explained 21.1% of the variance in MD. Despite its known association with ED, weight suppression was not associated with MD (p=0.746).

CONCLUSIONS: The predictive validity of eating disorder psychopathology underscores the salience of disordered eating pathology in presentations of MD. These results suggest that it is the presence of disordered eating attitudes and beliefs that separate BB with MD from BB without MD. In support of this, greater rate of pre-competition weight loss, which may reflect disordered eating practices, is also predictive of MD symptomatology. Lastly, an inverse relationship between competition experience and MD symptoms may suggest that although those susceptible to MD may be attracted to bodybuilding, their cognitive and behavioural symptoms may potentially impede longer-term engagement in the sport. Longitudinal studies are needed to confirm this.

2426 Board #8 June 2 9:30 AM - 11:30 AM
Water Loading in Combat Sport Athletes as a Means to Acutely Manipulate Body Mass
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Athletes in weight category sports practice various methods of acute weight loss, with recent research and long standing "grey literature" demonstrating the popularity of 'water loading' (the consumption of large volumes of fluid for several days, prior to withholding intake) as a means to increase body water losses following fluid restriction. No research has examined this technique or its risk of causing hyponatremia. **PURPOSE:** To determine the effectiveness and safety of water loading and assess potential mechanisms. **METHODS:** Male combat sport athletes (n=21, 77.5±8.1kg 177.5±6.1cm, 26.6±4.0years) were separated into a control (CON, n=10) and water loading (WL, n=11) group. Subjects were fed a standardised isoengetic diet based on fat free mass (assessed via DXA scan) controlling for macronutrient, sodium and fibre content for 6 days. Day 1-3 fluid intake was 40mL/kg CON and 100mL/kg WL. Day 4 fluid intake was 15mL/kg CON and WL. Day 5 no fluid was consumed until midday with both groups following the same rehydration protocol until day 6. Urine sodium, specific gravity (USG) and volume were recorded alongside training sweat losses and sleep quality/ duration (measured via actigraphy) throughout. Renal hormones (vasopressin, renin, and aldosterone), blood urea and electrolytes (U+Es) and body mass (BM) were measured each morning (fasted) and evening following 30 min supine rest. Physical performance was assessed pre and post intervention. Two way repeated measures ANOVAs were used to assess differences between groups. **RESULTS:** Following fluid restriction, significant differences with large effect sizes were found in fluid input/output ratio (39.11%, p < 0.01, ES=1.2) and BM loss (0.6%BM, p=0.02, ES=0.82). No differences in sleep or performance

measures existed. Time had a significant effect on USG, all U+Es and renal hormones ($p < 0.05$). An interaction effect existed between time and intervention on blood sodium, potassium, chloride, urea, creatinine, USG and vasopressin ($p < 0.05$) but not on other hormones or electrolytes. No mean U+Es differed from reference range or approached critical values. **CONCLUSION:** Water loading appears to be a safe and effective method of acute BM loss under the conditions utilised in this study. Changes in vasopressin may in part underlie the mechanism facilitating this technique.

E-14 Thematic Poster - Rehab and Recovery in Skeletal Muscle and Connective Tissue

Friday, June 2, 2017, 9:30 AM - 11:30 AM
Room: 101

2427 **Chair:** Matthew C. Kostek, FACSM. *Duquesne University, Pittsburgh, PA.*

(No relationships reported)

2428 Board #1 June 2 9:30 AM - 11:30 AM
Knee Morphology After Secondary Ipsilateral ACL Injury Compared to Those that Have Not Reinjured

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Modifiable and non-modifiable risk factors have been identified for primary anterior cruciate ligament (ACL) injury, however less research is available examining risk factors for a second ACL rupture. Identifying whether bony morphological factors are different (or more exaggerated) among those that experience a secondary ACL injury is critical to understanding if non-modifiable risk factors are associated with re-injury. **PURPOSE:** To identify if bony morphology is different among those that experience a secondary ACL re-injury as compared to ACL individuals that do not. **METHODS:** ACL participants were tracked after return-to-play following primary reconstruction, and if individuals experienced a second ipsilateral injury (ACLx2, n=14, 8f/6m, 17.9±4.0yrs), the primary clinical magnetic resonance imaging was analyzed for bony morphological risk factors. ACLx2 participants were matched to individuals (sex, age, height, gender and activity level) that had undergone reconstruction but did not experience re-injury (ACLx1, n=14, 8f/6m, 18.7±4.0yrs). 10 healthy controls were also enrolled (5m/5f, 20.8±3.9yrs) for the purposes of comparing our ACL data against healthy knees. Lateral and medial posterior tibial slopes (LPTS, MPTS), notch shape index (NSI), and medial tibial plateau depth of concavity (MDC) were compared between all ACL participants (combined ACLx1 and ACLx2 groups) and controls using independent t-tests and across groups (ACLx1, ACLx2, controls) using one-way ANOVAs. **RESULTS:** All ACL reconstructed patients had a steeper LPTS than controls (6.5±2.7deg vs. 3.9±3.7deg, $d=0.87$, 95% CI 0.11-1.60, $P=0.023$), however no difference in LPTS was found between ACLx1 and ACLx2 (6.8±3.2deg vs. 6.3±2.4deg, $P>0.05$). No differences in MPTS, NSI and MDC were found between all ACL participants (combined ACLx2 and ACLx1) and controls, or between ACLx1 and ACLx2 ($P>0.05$). **CONCLUSION:** Compared to healthy individuals, a steeper LPTS is a common bony abnormality among all ACL injured participants. Individuals that go onto experience a second ipsilateral ACL injury, do not have more exaggerated bony morphology than those that do not, suggesting that differences in modifiable risk factors at return-to-play may contribute to re-injury.

2429 Board #2 June 2 9:30 AM - 11:30 AM
Focused Shockwave Therapy & Low Level Laser Therapy In Patella Tendinopathy Among German Soccer Players

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(No relationships reported)

PURPOSE: To assess the feasibility and efficacy of combined focused extracorporeal shockwave therapy (ESWT) & low level laser therapy (LLLT) in addition to conventional eccentric training in patella tendinopathy among elite professional soccer players with patella tendinopathy.

METHODS: 34 German Bundesliga soccer players suffering from patella tendinopathy > 4 weeks underwent both, conventional and Power Doppler ultrasound determining the size of tendon diameter as well as the amount and location of neovascularisation by PowerDoppler ultrasound in my practice. The multimodal tendon treatment consisted of three sessions of: • Focused extracorporeal shockwave therapy (Storz Ultra device, 0.15-0.3mJ/mm2, 1000-2000 impulses per session) • Low

Level Laser Therapy (LLLT, Irradia 904nm 12-fold laser device) • Eccentric training on a 25° decline board (daily 6x15 repetitions per leg according to Alfredson's scheme) **RESULTS:** Pain at exercise (on a visual analogue scale 0-10) was reduced from 6±2 to 2±2 at six weeks and 1±1 after 12 weeks of treatment. Morning stiffness was reduced at six weeks by 56% and 87% after 12 weeks. The degree of neovascularisation in PowerDoppler ultrasound was reduced from Öhberg degree 3+ to 0-1+ after 12 weeks as was the tendon diameter by 38% in grey scale ultrasound. VISA-P scores improved by 32% at six weeks and 51% at 12 weeks. Players were able to return to sport at mean 18±12 days after initiation of the weekly therapy. **CONCLUSIONS:** Combined focused shockwave & low level laser tendon therapy accompanied by daily eccentric training are able to improve patella tendon function with a sustained effect in soccer athletes with an early return to game play.

2430 Board #3 June 2 9:30 AM - 11:30 AM

Progenitor Cells From Cartilage: Grade Specific Differences In Stem Cells Markers Expression

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BACKGROUND: Recent research confirmed the presence of Mesenchymal stem cell (MSC) - like progenitors (MPC) in both normal and osteoarthritic cartilage. However, there is only limited information concerning how MPC markers develop with osteoarthritis progression. The purpose of this study is to determine the prevalence of MPC markers in different OA grades. **MATERIALS AND METHODS:** Human osteoarthritic tibial plateau were obtained from ten patients undergoing total knee replacement. Each sample had been classified into a mild or severe group according to OARSI scoring. Tissue was taken from each specimen and mRNA expression levels of CD105, CD166, Notch 1, Sox9, Acan and Col II A1 were measured at day 0 and day 14 (2 weeks *in vitro*). Furthermore, MSC markers: Nucleostemin, CD90, CD73, CD166, CD105 and Notch 1 were studied by immunofluorescence. **RESULTS:** mRNA levels of MSC markers did not differ between mild and severe OA at day 0. At day 14, protein analysis showed that proliferated cells from both sources express all 6 MSC markers. Only cells from mild OA resulted in a significant increase of mRNA CD105 and CD166 after *in vitro* expansion. Moreover, cells from the mild OA showed significantly higher levels of CD105, Sox9 and Acan than those from severe OA. **CONCLUSION:** Results confirmed the presence of MSC markers in mild and severe OA tissue on both mRNA and protein levels. We found potential differences between cells obtained from mild compared to severe which suggests that mild OA derived cells may have a greater MSC potential.

2431 Board #4 June 2 9:30 AM - 11:30 AM

Relaxin Influences Knee Laxity Changes Across the Menstrual Cycle

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Greater knee laxity is associated with an increased risk for anterior-cruciate ligament (ACL) injury, particularly in women. Research suggests that the hormone relaxin may influence the structural integrity of the ACL, rendering a weaker and more lax ligament. **PURPOSE:** To assess the impact of relaxin on knee laxity once progesterone and testosterone (potential endocrine antagonists) are accounted for. **METHODS:** College-aged females (166.0±5.7cm, 65.9±8.5kg, 20.8±2.9yr) provided blood samples for the first 6 days of menses and first 10 days of luteal phase of one menstrual cycle. Knee laxity was recorded as anterior knee laxity (AKL; mm), genu recurvatum (GR; °), and general joint laxity (GJL; score, 0-9), and dependent variables were calculated as mean (X), cyclic Δ (max - min), coefficient of variation (CV), and standard deviation (SD). Progesterone (P; ng/ml), testosterone (T; ng/dl), and relaxin (R; pg/ml) were analyzed via ELISA assays. The sum of the 6 greatest hormone concentrations during menses (M) and luteal phase (L) and the change in exposure from M to L (MLΔ) were calculated. Only subjects with captured R and P peak were included in analysis (n=18). M and MLΔ for each hormone were entered into backward stepwise (in: $p=.05$, out: $p=.20$) multiple linear regression models to predict each laxity measure. **RESULTS:** R and P were significantly different between M and L ($p<.001$, $R_M=22.2±29.4$ vs. $R_L=147.0±96.3$; $p<.001$, $P_M=5.8±1.8$ vs. $P_L=89.7±36.6$), whereas T was less variable ($p=.07$, $T_M=203.8±63.0$ vs. $T_L=222.7±82.6$). All laxity

showed variation across the menstrual cycle (range [min-max]: AKL=5.9-7.6; GR=2.6-5.6; GJL=8-2.1). Significant models were observed for GR_X (p=.014; R²=.418; GR_X=3.501+1.024R_{MLA}-757R_M-395P_{MLA}), GJL_{MLA} (p=.044; R²=.253; GJL_{MLA}=-.469R_{MLA}-440T_M), and GJL_X (p=.035; R²=.379; GJL_X=-.317R_M-353P_M-440P_{MLA}-507T_M). Models for AKL_{MLA}, AKL_{CV}, GR_X, and GJL_{SB} approached significance (all p<.075). **CONCLUSION:** Once controlling for P and T, R was a significant predictor of knee laxity mean and cyclic changes. These findings would suggest that R, combined with other sex hormones, may affect the structural integrity of the ligament and impact injury risk. Further study is needed to explore potential mechanisms for this association.

2432 Board #8 June 2 9:30 AM - 11:30 AM
The Human Piriformis Muscle: Sensory, Postural, Or Just A Pain

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Piriformis syndrome is a form of low back pain that is debilitating and difficult to treat. Physical therapy is often effective but in some cases the Piriformis muscle is disconnected or removed entirely through surgery. The short term consequences of this procedure are negligible but the long term consequences have not been studied. Furthermore, because of its size and anatomical location, it is not thought to be a primary mover of the body. The purpose and necessity of the muscle is an area of speculation. We hypothesized that it is a sensory and postural muscle, which could explain why short term consequences of its removal are minimal. **PURPOSE:** To determine the density of muscle spindles and fiber type composition of the human Piriformis muscle. **METHODS:** Six human cadavers (male = 3, female = 3) had their right and left Piriformis muscles removed for histological analysis. Whole muscles were paraffin embedded, sectioned, H&E stained or stained with myosin heavy chain antibodies. Microscopy analysis examined spindle density and fiber type composition. **RESULTS:** The average spindle density per muscle was 3.4+1 and was not significantly different between male and female (p=0.46). Fiber type composition was 84+8% slow twitch and was not different between male and female (p=0.23). **CONCLUSIONS:** The human Piriformis muscle does not appear to be a sensory muscle due to the low concentration of muscle spindles but is very likely a postural muscle. The results of this characterization may better inform treatments including the surgical removal and long term rehabilitation.

2433 Board #6 June 2 9:30 AM - 11:30 AM
The Effects Of Cryo-compression Therapy On Recovery From An Acute Bout Of Resistance Exercise.

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Compression and cold therapy used separately have consistently shown to reduce these deterrents. However, the effects of combining compression and cold therapy (cryo-compression) as a single recovery modality has yet to fully be examined. **PURPOSE:** To examine the effects of Aquilo Cryo-compression Pants (Aquilo Sports, Louisville, KY) on recovery from a lower body resistance exercise bout typically used by recreationally active individuals. **METHODS:** Sixteen healthy adult men were matched and then randomly assigned to either Control (CON) or the Aquilo Cryo-Compression Pants (ACC) groups. Participants performed a typical lower body workout consisting of barbell back squats, stiff legged deadlifts, and Nordic hamstring curls. and then received 20 minutes of either cryo-compression using the Aquilo Cryo-Compression Pants (ACC) or nothing (CON) post exercise. Pain, soreness, mood, sleep quality, power, and reaction time, and muscle fatigue/damage biomarkers were measured at specific time points. **RESULTS:** The mean value comparisons show that after exercise ACC had significantly (P ≤ 0.05): lower levels of soreness 24hrs (ACC: 44.3, CON: 52.5) and 48hrs (ACC: 36.6, CON: 41.3); pain 60min (ACC: 3.0, CON: 4.1), 24hrs (ACC: 3.4, CON: 4.0) and 48hrs (ACC: 2.6, CON: 3.4); reduced muscle fatigue (reduced CK levels) 24hrs (ACC: 577 U/I, CON: 966 U/I) and 48hrs (ACC: 399 U/I, CON: 613 U/I); better sleep quality 24hrs (ACC: 58.0, CON: 52.5) and 48hrs (ACC: 56.75, CON: 47.6); better power output (reduced decrement) 24hrs (ACC: 5031.0 CON: 4087.2) and 48hrs (ACC: 5065.4, CON: 4879.8); and experienced a better overall mood 24hrs (ACC: 0.55, CON: 0.9) and 48hrs (ACC: 0.28, CON: 0.68). **CONCLUSION:** Aquilo Sports has developed a practical, portable recovery device that synergistically combines compression and cold therapy which effectively helps reduce muscle fatigue, soreness, pain, and poor sleep quality that may result from an acute bout of exercise. Funding, in part, was provided by Aquilo Sports, Inc.

2434 Board #7 June 2 9:30 AM - 11:30 AM
Performance-related And Molecular Effects Of External Pneumatic Compression Treatment As An Adjuvant To Heavy, Voluminous Resistance Exercise

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Purpose: We sought to determine the effects of external pneumatic compression (EPC) when used concurrently with resistance training on functional and molecular measures related to recovery. **Methods:** Twenty (N=20) resistance-trained male participants (aged 21.6±2.4 years) were randomized to sham or EPC intervention groups. The protocol consisted of 3 consecutive days of voluminous back squat exercise followed by EPC/sham treatment (Days2-4) and 3 consecutive days of recovery (Days5-7) with EPC/sham only on Days5-6. On Day1 (PRE), and Days3-7, venipuncture, flexibility and pressure-to-pain threshold (PPT) measures were performed. *Vastus lateralis* muscle was biopsied at PRE, 1-h post-EPC/sham treatment on Day2 (POST1) and 24-h post-EPC/sham treatment on Day7 (POST2). Isokinetic peak torque was assessed at PRE and POST2. **Results:** The PPT was significantly lower on Days3-6 with sham, indicating greater muscle soreness, though this was largely abolished in the EPC group. A significant decrease in flexibility with sham was observed on Day3 (+16.2±4.6% knee joint angle; P<0.01) whereas there was no change with EPC (+2.8±3.8%; P>0.01). *Vastus lateralis* poly-ubiquitinated proteins significantly increased at the POST2 time point relative to PRE with sham (+66.6±24.6%; P<0.025) and were significantly greater (P<0.025) than those observed with EPC at the same time point (-18.6±8.5%). 4-hydroxyphenol values were significantly lower at POST2 relative to PRE with EPC (-16.2±5.6%; P<0.025) and were significantly lower (P<0.025) than those observed with sham at the same time point (+11.8±5.9%). **Conclusion:** EPC mitigated a reduction in flexibility and the PPT that occurred with sham. Moreover, EPC appeared to reduce select skeletal muscle oxidative stress and proteolysis measures during recovery from heavy resistance exercise.

2435 Board #8 June 2 9:30 AM - 11:30 AM
Fascicle Lengthening During Eccentric Exercise Determines The Magnitude Of Muscle Damage

Dr Kirsty Hicks¹, Gladys Onambele-Pearson², Keith Winwood², Christopher Morse². ¹Northumbria University, Newcastle, United Kingdom. ²Manchester Metropolitan University, Crewe, United Kingdom. (Sponsor: Glyn Howatson, FACSM)
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 (No relationships reported)

The characteristics of the muscle-tendon interaction during eccentric contractions suggests that tendon properties and the magnitude of fascicle lengthening contribute to the extent and the variability of exercise-induced muscle damage (EIMD). The mechanical processes which predispose the severity of EIMD remains unclear. **PURPOSE:** To determine whether: 1) patella tendon stiffness, at rest and during eccentric contractions, 2) the magnitude of *vastus lateralis* (VL) fascicle lengthening during eccentric contractions, and/or 3) eccentric torque, are determinants of EIMD. **METHODS:** Combining dynamometry, electromyography and ultrasonography, patella tendon properties and VL architectural properties were measured pre and during the first of 6 sets of 12 maximal voluntary eccentric knee extensions (range of motion 20 - 90°, 0° = full extension). The eccentric phase of the contraction was performed at an isokinetic angular velocity of 30°s⁻¹ and the concentric phase was performed passively at an angular velocity of 60°s⁻¹. Maximal isometric torque loss and creatine kinase (CK) activity were measured pre-damage (-48 h), 48, 96 and 168 h post-damage as markers of EIMD. **RESULTS:** Compared to pre-damage, a significant reduction in maximal isometric torque (264 ± 35 Nm, 221.0 ± 48.4 Nm, p = 0.004) and a significant increase in CK (136 ± 114, 796 ± 723 UL, p = 0.014) was reported 48 and 96 hrs post EIMD respectively. Relative changes in CK correlated with the relative change in fascicle length during eccentric contractions (r = 0.53, p = 0.02) and eccentric torque (r = 0.50, p = 0.02). Additionally, the relative change in CK tended to correlate with estimated patella tendon lengthening during eccentric contractions (r = -0.41, p < 0.10). However, relative change in CK did not correlate with resting measures of patella tendon properties or VL properties. Similarly, torque loss did not correlate with any patella tendon or VL properties at rest or during eccentric contractions. **CONCLUSION:** The extent of fascicle lengthening during eccentric contractions is related to the magnitude of the CK response. Furthermore, at rest, patella tendon properties are not determinants of indices of EIMD. During eccentric contractions of the VL, the patella tendon might play a modulatory role during exercise, to the susceptibility of EIMD.

E-15 Free Communication/Slide - Balance, Slips, and Falls

Friday, June 2, 2017, 9:30 AM - 11:30 AM
Room: 110

2436 **Chair:** Brandi Row Lazzarini. *Willamette University, Salem, OR.*

(No relationships reported)

2437 June 2 9:30 AM - 9:45 AM

Lower Limb Muscle Fatigue Perturbs Gait Balance during Dual-Task Walking

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(No relationships reported)

Walking and simultaneously performing an attention demanding task may occur concurrently with increasing muscle fatigue toward the end of some daily activities or job performance. Although previous research have demonstrated independent effect of these factors, their interaction are rarely taken into consideration.

PURPOSE: To examine changes in gait balance and working memory performance in healthy college-age adults after lower extremity muscle fatigue.

METHODS: Ten healthy adults (5 females, 20.6±1.0 yrs) performed the following three tasks before and after a muscle fatigue protocol: 1) Walking with a self-selected pace, 2) Sitting and performing a 3-back test, in which participants listened a series of digits over a loudspeaker and were instructed to verbally respond "yes" whenever a digit is heard that is the same as presented three positions back in the series, and 3) Walking and performing a 3-back test simultaneously. Sit-to-stand task at a pace of 0.5 Hz was performed to induce muscle fatigue. Maximal voluntary isometric strength of knee extensors was assessed using Biodex before and after the fatigue protocol and at the end of study. Whole body motion data were collected from a set of 29 retro-reflective markers placed on bony landmarks with a 10-camera motion system. Gait balance control was examined using the total medial-lateral CoM displacement (M-LCoM). Two-way ANOVA with repeated measures were used to detect differences between single and dual-task conditions.

RESULTS: An average of 21% knee extensor strength reduction was observed immediately after the completion of fatigue protocol, and it was recovered to approximately 10% by the end of study. In both gait conditions, M-LCoM was found to increase significantly after fatigue (3.1±0.2 vs. 3.7±0.3 cm, $p = .01$). Accuracy of the 3-back test was not significantly affected by the fatigue or gait condition.

CONCLUSIONS: Our preliminary findings indicated that gait balance control, as measured by the CoM sway, during a dual-task gait task might be more sensitively affected by the acute muscle fatigue induced in the current study.

2438 June 2 9:45 AM - 10:00 AM

The Validity of the Zebris FDM System for Measuring Static Balance

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(No relationships reported)

There are various instrumented methods of assessing static balance. One of the most common devices used to assess balance is the Biodex Balance System SD (BBS) (Biodex Medical Systems, Inc.), a specialized force platform that utilizes strain gauges to measure center of pressure (COP) sway patterns in the anterior-posterior (A-P) and medio-lateral (M-L) directions. An alternative device used to assess balance is the Zebris FDM System (FDM) (Zebris Medical GmbH), which is a platform that uses pressure sensors to measure COP sway patterns in the A-P and M-L directions.

PURPOSE: To establish the validity of the FDM for assessing static balance by determining the relationship between measures of static balance using the FDM and the previously validated BBS. **METHODS:** Thirty-seven healthy individuals (14 M, 23 F; age range: 20-71 yr) participated in this study. Participants performed static balance tests using both the BBS and the FDM in accordance with the BBS Postural Stability Test protocol during quiet stance. **RESULTS:** The following measures of static balance were obtained using the BBS: 1) A-P Stability Index (0.19 ± 0.18), 2) M-L Stability Index (0.10 ± 0.06), 3) Overall Stability Index (0.24 ± 0.11), 4) standard deviation of A-P COP sway (0.21 ± 0.06), and 5) standard deviation of M-L COP sway (0.13 ± 0.05). The following measures of static balance were obtained using the FDM: 1) 95% confidence ellipse area (175.2 ± 107.2 mm²), 2) COP path length (274.4 ± 103.2 mm), and 3) COP average velocity (4.5 ± 1.7 mm/s). The coefficients of correlation between the measures of static balance obtained using the BBS and the FDM ranged between $r=0.42-0.66$. All of the measures of static balance obtained using the FDM were significantly correlated with all of the measures of static balance

obtained using the BBS ($p<0.01$). For all measures of static balance obtained using the BBS, the strongest and weakest correlations were with COP path length and the 95% confidence ellipse area, respectively, obtained using the FDM. **CONCLUSION:** The FDM pressure platform is a valid instrument for measuring static balance in clinical and research settings since all of its measures were significantly correlated with measures of static balance obtained using the BBS force platform (a widely used and previously validated instrument for assessing balance).

2439 June 2 10:00 AM - 10:15 AM

The Influence Of Proximal Versus Distal Strength On Balance Control In Athletes Versus Non-athletes

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(No relationships reported)

Minor correlations between measurements for lower-extremity muscle strength and balance in individuals, regardless of the age, have been revealed. Similarly, maximal strength and balance have been individually investigated between an athletic population and a non-athletic population. However, comparisons between lower extremity strength (specifically ankle strength and hip strength) and balance between an athletic versus a non-athletic population have not been established. **PURPOSE:** The purpose of this pilot study was to find correlations in hip strength and balance versus ankle strength and balance in an athletic (NCAA athletes) and non-athletic population. **METHODS:** Twelve NCAA Division-1 athletes (age: 20.42 ± 1.51 years, height: 179.27 ± 11.2 cm, mass: 79.07 ± 14.89 kg, gender: 6M, 6F) and twelve healthy college students (age: 22.58 ± 2.47 years, height: 171.65 ± 8.00 cm, mass: 72.72 ± 14.21 kg, gender: 6M, 6F) participated. Following informed consent, balance on the dominant leg was measured using a BOSU ball in timed trials with eyes open and eyes closed. Using a Biodex System 4 Isokinetic Dynamometer, the isokinetic muscular strength and directional torque of eight muscle groups in the sagittal and frontal planes were measured. Lastly, multivariate regression models were performed ($\alpha=0.05$). Eyes open and eyes closed analyses were performed separately. **RESULTS:** Athletes had a higher ability to balance (athletes: 61.61 ± 42.67s vs non-athletes: 26.48 ± 27.19s) ($p=0.030$) in the eyes open trial and presented a correlation for ankle dorsiflexion ($R=0.674$) ($p=0.008$) when regressed with eyes open and ankle eversion ($R=0.833$) ($p=0.002$) with eyes closed. Meanwhile, non-athletes demonstrated a correlation for hip extension when regressed with eyes closed ($R=0.705$) ($p=0.005$). **CONCLUSIONS:** This study revealed a stronger correlation for ankle strength and balance in an athletic population while a stronger correlation between hip strength and balance was observed for a non-athletic population. Hence coaches, clinicians, or physical therapists can use these findings to tailor exercise protocols specific to individual cases and potentially increase balance to prevent injuries and falls.

2440 June 2 10:15 AM - 10:30 AM

Limb Strength and Balance in Community-Dwelling Older Women

Yuanyuan Tian¹, Jia Han¹, Junpeng Zhu¹, Liping Lu¹, Roger Adams², Judith Anson², Gordon Waddington². ¹Shanghai University of Sport, Shanghai, China. ²University of Canberra, Canberra, Australia.

(No relationships reported)

Strength and balance deficits are important factors contributing to falls risk in the community-dwelling older women. **PURPOSE:** To investigate upper and lower limb strength and static and dynamic balance in community-dwelling older women. **METHODS:** Forty-three active female volunteers, aged 60 to 89, were divided into three groups: G1 (under 65 years, n=16); G2 (65 to 74 years, n=14); and G3 (75 years and above, n=13). Their upper limb strength - hand grip (HG), lower limb strength - 30 seconds chair stand (STS), dynamic balance - timed up-and-go test (TUGT) and static balance - bipedal anterior-posterior sway with eyes open and closed (APO and APC, respectively), and bipedal medial-lateral sway with eyes open and closed (MLO and MLC, respectively) were assessed. **RESULTS:** Polynomial Trend analysis showed that most variables decreased significantly and linearly across the 3 age categories (HG: $F=4.92$, $p=0.032$; STS: $F=5.82$, $p=0.021$; TUGT: $F=7.92$, $p=0.008$; APC: $F=6.27$, $p=0.016$; MLO: $F=5.63$, $p=0.023$; MLC: $F=4.59$, $p=0.038$), but HG and MLC also had a quadratic component ($F=11.31$, $p=0.002$ and $F=4.30$, $p=0.045$, respectively). Specifically, HG held up well into the mid-seventies, then dropped markedly; while MLC declined immediately after women turned 65. GH and STS were significantly inter-correlated ($r=0.39$ $p=0.01$), and both were significantly correlated with dynamic balance function - TUGT ($r=-0.40$ $p=0.008$ and $r=-0.65$ $p<0.001$, respectively); however neither of them was significantly correlated with any static balance measures. In addition, significant correlations were only observed between open and closed eyes balance conditions in the same postural sway direction (APO and APC: $r=0.55$ $p<0.001$; MLO and MLC: $r=0.55$ $p<0.001$), not between different postural sway directions.

CONCLUSIONS: These findings have important implications for therapeutic exercise interventions designed to maintain and improve strength and balance in community-dwelling older women.

2441 June 2 10:30 AM - 10:45 AM

Effects Of A Short, Intensive, Multi-component Physical Exercise Program In Elderly At Risk Of Falls

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(No relationships reported)

Among older adults, falls are the leading cause of injuries and are responsible for significant disability, hospitalization, loss of independence, and reduced quality of life. Previous research showed that physical exercise (PE) is effective in preventing falls and has the potential to reduce serious fall-related injuries, emergency department visits, hospitalizations, nursing home placements, and functional decline. In most clinical trials the effect of PE was assessed by means of tests which assess a single "balance system", while balance control is very complex and involves many different underlying systems. The BESTest Scale consists of 36 items, grouped into 6 systems: biomechanical constraints, stability limits/verticality, anticipatory postural adjustments, postural responses, sensory orientation, and gait stability.

PURPOSE: To investigate the effects of a short (4 weeks), intensive (75 min sessions 3 times per week) PE program which included strength, coordination, gait, multisensory training, and single- and dual-task balance exercises on the balance of elderly subjects at risk of falls.

METHODS: Thirty sedentary subjects aged 70+ years at risk of falls (Berg's Balance Scale < 52) were recruited and randomly allocated to a Multi-Component Exercise group (MCE) or a Control group (CON). Main outcome was change in BESTest Scale (BT) total score.

RESULTS: At baseline, the two groups were similar with respect to age, gender distribution, anthropometric measures and risk of falls (BESTest Scale Score 53.7±14.8 in CON and 55.0±10.8 in MCE, n.s.). At the end of the study, BT total score was 55.5±16.7 in CON group (n.s. vs. baseline) and 72.7±8.8 in MCE group ($p < 0.001$ vs. baseline). The change of BT total score was 1.8 (95% CI -1.9-5.5) in the CON group and 17.7 (13.4-22.1) in the MCE group ($p < 0.001$ between groups). Also, the MCE group significantly increased the scores of all the six balance subsystems of the BT. Eventually, the change of Berg's Scale score was 0.9 (-0.2-2.1) in CON and 6.0 (4.4-7.6) in MCE ($p < 0.001$). At the end of the study MCE subjects could not be considered at risk for falling any more.

CONCLUSIONS: A 4 weeks, intensive, multi-component training program significantly improved balance in elderly subjects at risk of falls. The improvement affected the many systems involved in balance control.

2442 June 2 10:45 AM - 11:00 AM

Relationship of Fall Risk Questionnaires to Computerized Dynamic Posturography in Older Adults: A Pilot Study

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(No relationships reported)

PURPOSE: Falling poses a significant potential health risk for older adults. Fall risk questionnaires have been identified as a quick and easy way to screen for the potential for falling compared to objective balance testing. However, the relationship between these questionnaires and formal balance assessments is not fully understood. Therefore, the purpose of this study was to elucidate the relationship between validated fall risk questionnaires and selected measures of balance using computerized dynamic posturography (CDP) in older adults of varying functional abilities. **METHODS:** Ten male (n=4) and female (n=6) elderly (72.7 ± 6.1 yrs) subjects completed testing and were included in the final analyses. All subjects passed the Mini-Mental Status Exam (MMSE) with a score > 24 prior to participating. Each subject completed two fall risk questionnaires (in random order): the Falls Efficacy Scale (FES) and the Activities-Specific Balance Confidence Scale (ABCS), as well as CDP testing for Limits of Stability (LOS) and the Sensory Organization Test (SOT) in a single session. The associations between the FES, ABCS, SOT composite score and selected LOS measures [end-point excursion (EPE), maximal excursion (MXE) and directional control (DCL) for forward (F) and backward (B) directions] were calculated using the Pearson correlation coefficient using pairwise deletion for missing variables. Alpha levels were set at 0.05. **RESULTS:** Scores on the FES and ABCS were significantly correlated ($r = -0.826$, $p = 0.003$) with one another. FES was significantly correlated with SOT ($r = -0.828$, $p = 0.011$), FEPE ($r = -0.574$, $p = 0.046$) and FMXE ($r = -0.684$, $p = 0.042$) but not with any backward measures. The ABCS was not significantly correlated with any CDP measures. No injuries occurred during the study. **CONCLUSION:** Although the ABCS and FES are similar tools and are highly correlated with one another this

data suggests that they are possibly capturing unique dimensions of balance confidence and capability in older adults. It is surprising that the ABCS, which includes a more robust mix of physical activities, was not significantly correlated with either SOT or LOS while the FES was. More investigation into the relationship of these questionnaires with objective balance measurements is warranted.

2443 June 2 11:00 AM - 11:15 AM

Treadmill-based Perturbation Training For Preventing Falls Among Young Adults

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(No relationships reported)

Falls present a serious challenge not only among older adults, but for young adults, especially those whose working condition exposes them to a high fall hazard. Treadmill-based perturbation training, as a task-specific training, has emerged as a new paradigm used to prevent falls. However, the training program contained up to 30 perturbation trials in previous studies. It is unclear if a reduced number of perturbation trials could still induce positive effect in preventing falls. **PURPOSE:** To investigate the effect of a treadmill-based perturbation training paradigm consisting of 8 slip perturbations on reducing slip-related falls in young adults. **METHODS:** Thirteen healthy young adults (24 ± 4.34 years) were randomly assigned into either training ($n = 6$) or control ($n = 7$) groups. The training group underwent 8 unexpected slip trials on a special treadmill during gait while the control group received a "mock" training in which they walked on the same treadmill. After the training, both groups were subjected to an unexpected slip induced by releasing a movable platform when walking overground (OG). Subjects wore a safety harness equipped with a load cell. Body kinematics were captured and used to calculate dynamic gait stability on the OG slip. The load cell force was used to determine the OG slip outcome (fall vs. no-fall). A Chi-square test and independent *t*-test were used to respectively compare the fall incidents and dynamic stability between groups. **RESULTS:** Responding to the OG slip, 4 out of 7 (57.1%) subjects in the control group while 1 out of 6 (16.7%, $p = 0.18$) in the training group fell. The training group displayed a lower instability than the control at recovery foot touchdown (-0.56 ± 0.12 vs. -0.69 ± 0.07, $p < 0.05$). **CONCLUSIONS:** This study suggests that treadmill-based perturbation training with less perturbation trials could lower the risk of falls among young adults when exposed to a real-life like OG slip. Given that treadmill-based slip training is easy to use, portable, controllable, and reproducible, this training could provide a relatively novel modality to reduce falls among both young and older adults. Further studies based on a large sample size are needed to symmetrically evaluate the effectiveness of this type of training. Supported by the PiMSA Graduate Student Grant.

2444 June 2 11:15 AM - 11:30 AM

A Cost-Effective Method for Repeated Slip Training Increases Recovery Rate Following Laboratory-Induced Slips

Leigh J. Allin¹, Maury A. Nussbaum², Michael L. Madigan¹. ¹Texas A&M University, College Station, TX. ²Virginia Tech, Blacksburg, VA. (Sponsor: Kevin Davy, FACSM)

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(No relationships reported)

Walking is commonly promoted as a way to increase physical activity; however, walking involves an inherent risk of slips and falls. Prior research has shown that repeated exposure to slips or slip-like perturbations improves balance recovery following actual slips. Researchers have explored repeated slip training (RST) as a fall prevention intervention by repeatedly exposing subjects to slips or slip-like perturbations in a safe, controlled manner. However, current methods for RST require non-trivial financial resources. **PURPOSE:** To evaluate the efficacy of a cost-effective method for RST compared to no-training (NT). **METHODS:** Twenty-four adults (18-28 years, 12 male) were randomized to RST or NT ($n = 12$ in each), and completed one training session and one session the following day to assess recovery rate after an actual slip. For RST, subjects repeatedly walked along a 10m walkway. During 20 randomly selected walks, a 0.9 x 0.9 m thin plastic sheet was placed at random locations along the walkway to induce a slip. The material of this sheet (e.g. polyethylene) was selected to provide low-friction with the floor and was camouflaged to match the floor surface. The NT group walked along the walkway 20 times. On the following day, vegetable oil was applied to the walkway to expose subjects in both groups to an actual unexpected slip. Balance was successfully recovered if less than 4.5% body weight, averaged over 1s periods, was applied to a safety harness worn during both sessions. Slip severity and slipping foot kinematics were measured using reflective markers on the calcanei, first metatarsal heads, and sacrum. **RESULTS:** Seven of 12 RST subjects recovered balance while only two of 12 NT subjects recovered ($p = .045$). RST subjects experienced less severe slips, with 94 cm/s slower peak slip speeds ($p < .001$) and 17 cm shorter slip distances ($p < .001$), and maintained slipping heel positions more proximal to the sacrum at heel contact ($p = .019$) and

non-slipping foot lift-off ($p=.002$) and touch-down ($p=.005$). **CONCLUSION:** RST increased recovery rate by reducing slip severity and maintaining slipping heel positions more proximal to the sacrum. This cost-effective method for RST may improve its potential for adoption as a slip-and-fall prevention intervention.

E-16 Clinical Case Slide - Foot and Ankle III

Friday, June 2, 2017, 9:30 AM - 11:10 AM
Room: 103

2445 **Chair:** Patrick Leary, FACSM. *Lake Erie College of Osteopathic Medicine, Erie, PA.*

(No relationships reported)

2446 **Discussant:** Stephen M. Simons, FACSM. *South Bend Notre Dame Sports Medicine Fellowship, South Bend, IN.*

(No relationships reported)

2447 **Discussant:** Leonardo P. Oliveira. *University of Chicago, Chicago, IL.*

(No relationships reported)

2448 June 2 9:30 AM - 9:50 AM

Medial Foot Pain in a Youth Soccer Player

Christine Bender¹, Heather Gillespie, FACSM¹, Abby Markham².
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(No relationships reported)

HISTORY: 13 yo male presents with right foot pain. Started 3 yrs ago with a forced eversion injury during soccer game when he collided with another player. He recalls swelling and bruising at that time. He went to the ER and had xrays done which were "inconclusive" as his mother recalls. Pain never completely went away and worsened several weeks ago. He has been doing a lot of hiking recently, very uneven surfaces and he reports pain with these activities. He has used an ankle brace and tried arch supports with no significant improvement.

PHYSICAL EXAMINATION: Inspection of feet and ankles reveal pes planus R>L on standing exam, with a neutral arch at rest while seated. Forefoot abduction R>L. Hindfoot valgus bilaterally. Tenderness to palpation of right foot over medial navicular eminence, slight tenderness over deltoid ligament and retrocalcaneal bursa. No tenderness at base of 5th metatarsal, medial malleolus, or lateral malleolus. Full active ROM but pain with inversion of right foot. No pain with eversion, dorsiflexion or plantarflexion. Pain with resisted inversion felt along distal posterior tibial tendon. No pain with heel or toe raise. No laxity with forced eversion. Negative talar tilt, anterior drawer, Thompson tests.

DIFFERENTIAL DIAGNOSIS: Posterior tibial tendonopathy
Navicular stress fracture
Deltoid sprain

Accessory navicular syndrome

Tarsal coalition Kohler disease **TEST AND RESULTS:** X-ray Right Foot: No evidence of acute or prior fracture or abnormal periosteal reaction. There is an accessory navicular noted.

FINAL WORKING DIAGNOSIS: Pes planovalgus with Accessory navicular syndrome

TREATMENT AND OUTCOMES:

Referred by PCP to orthopedics for evaluation of medial foot pain in setting of accessory navicular bone. Discussed option of surgical management (double calcaneal osteotomy and tendon transfer) given degree of planovalgus deformity but ultimately recommended conservative management. Discussed use of orthotics. Provided with a medial heel wedge and scaphoid pad to alter load on right foot. Also provided with exercises for hamstring and achilles. Offered short leg cast for 6wks but ultimately declined at this time due to upcoming activities.

2449 June 2 9:50 AM - 10:10 AM

Foot Injury in a Recreational Runner

Ashkan Alkhamisi, Glenn G. Shi. *Mayo Clinic, Jacksonville, FL.*
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(No relationships reported)

Foot Injury in a Recreational Runner

Ashkan Alkhamisi, MD, Glenn G. Shi, MD, and George G.A. Pujalte, MD, FACSM

HISTORY: A 37-year-old, healthy, young female presented with 5 weeks of left foot pain. She denied any major trauma or precipitating event, but did recall doing holiday

shopping for 10 hours straight a few days prior to experiencing symptoms. Patient stated that she used to wear heels all the time at work as a school-teacher. She reported numbness and tenderness over the plantar aspect of the first metatarsophalangeal joint. She wore a metatarsal pad and took ibuprofen with no relief of symptoms. The pain was exacerbated with weightbearing.

PHYSICAL EXAMINATION:

Left foot: No tenderness to palpation of the hindfoot or midfoot. Pain was elicited with passive dorsiflexion and plantarflexion of first metatarsophalangeal (MTP) joint. Tenderness to palpation along the lateral aspect of the first MTP joint, with no erythema or swelling. Sensation was intact.

DIFFERENTIAL DIAGNOSES:

1. Sesamoid osteoarthritis
2. Sesamoid stress fracture
3. Sesamoid dislocation
4. Sesamoiditis

TEST AND RESULTS:

Left foot, standing, 3 views: Fragmentation of the left lateral hallux sesamoid, with small surrounding foci of mineralization. Remainder of osseous structures were intact. No focal soft tissue swelling.

FINAL DIAGNOSIS:

Left lateral (fibular-sided) non-union sesamoid fracture

TREATMENTS AND OUTCOMES:

1. Immobilization within a boot, with non-weightbearing status for 6 weeks
2. At 2 months post-injury, she continued to have pain and wanted to wear the walking boot for another 1-2 months
3. Repeat radiographs at 3 and 4 months post-injury showed continued non-union of the lateral sesamoid bone.
4. Orthopedic referral was made at 4 months post-injury and she decided to proceed with a left lateral sesamoidectomy with immobilization within a boot for 4 weeks.
5. At 4 months post-operatively, she was able to run with no pain and good range of motion of her left first MTP joint.



2450 June 2 10:10 AM - 10:30 AM

A Rare Cause of Foot Pain in an Adolescent Male Multisport Athlete

John Franco, Edward Laskowski, FACSM, Cara Prideaux. *Mayo Clinic, Rochester, MN.* (Sponsor: Edward Laskowski, FACSM)

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(No relationships reported)

HISTORY: A 13 year old male football, basketball, and baseball athlete presented to sports medicine clinic with a 3 month history of non-traumatic exertional right lateral foot pain. He reported 8/10 pain with strenuous activities, such as running and jumping. He had no pain with walking. He reported aching discomfort in the morning upon waking. He denied numbness, tingling, or abnormal sensation.

PHYSICAL EXAMINATION: There was no significant deformity. He was able to walk with a non-antalgic gait. There was tenderness to palpation over the lateral base of the 5th metatarsal. Range of motion of the foot and ankle was normal. There was normal strength upon manual muscle testing, but resisted ankle eversion reproduced pain. He was neurovascularly intact.

DIFFERENTIAL DIAGNOSIS: 1. Metaphyseal-Diaphyseal (Jones) Fracture 2. Fifth Metatarsal Stress Fracture 3. Traction Apophysitis (Iselin's Disease) 4. Insertional Peroneal Tendinopathy 5. Avulsion Fracture

TESTS AND RESULTS:

- Right foot radiograph:



Well-corticated bone fragment proximal and perpendicularly-oriented to the base of the 5th metatarsal, representing an accessory ossicle (os vesalianum) versus ununited fracture. No evidence of acute fracture and normal-appearing apophysis.

- Right foot MRI: Osseous body at base of the 5th metatarsal with irregular margins, hyperintense T2 fibrous union, and internal edema of the ossicle and adjacent proximal metatarsal, favored to represent a symptomatic os vesalianum. No increased apophyseal distraction.

FINAL WORKING DIAGNOSIS:

Symptomatic Accessory Os Vesalianum

TREATMENT AND OUTCOMES:

1. Immobilize in a walker boot for 6-8 weeks.
2. Physical therapy after immobilization, with emphasis on peroneal muscle strengthening and range of motion.
3. If complete resolution of symptoms, may gradually return to sport as tolerated. If symptoms persist, consider surgical excision.

2451 June 2 10:30 AM - 10:50 AM

Not Your Average Ankle Injury

Hassen Berri, Phillip Troy Henning. *University of Michigan, Ann Arbor, MI.* (Sponsor: Robert Kiningham, FACSM)

(No relationships reported)

Ankle Injury- Soccer

History: 43 year old male soccer player presented with persistent medial and lateral ankle pain since sustaining an injury 9 days prior during soccer. He came down strongly on his left heel. He heard a “pop” and felt immediate pain on both sides of his ankle. He also reported that his foot felt “numb”, but this resolved in about five minutes. He had severe pain with weight bearing but was able to limp off the field. He did not seek formal medical attention and used crutches for a few days. He continued to experience a snapping sensation along his lateral ankle that was mostly resolved by the day of appointment.

Physical Examination:

Ecchymosis and swelling diffusely at the ankle. Tenderness to palpation in deltoid and lateral ligaments, mild at peroneal tendon, no bony tenderness. Active and passive range of motion is uncomfortable but within functional limits except restricted dorsiflexion to just past neutral. There is a + anterior drawer test and a + talar tilt test for laxity. Negative squeeze test. No pain along the syndesmosis with passive dorsiflexion/eversion. Patient/examiner unable to sublux lateral tendon to reproduce snapping. Patient is otherwise neurovascularly intact

Differential Diagnosis: medial ankle sprain, lateral ankle sprain, peroneal tendon strain, posterior tibial tendon strain, peroneal retinaculum injury, ankle fracture

Test and Results: X-ray 9/6/2016- no evidence of acute fracture.

Final Working Diagnosis: Left ankle, multiple injuries: Peroneal Retinaculum Injury, Grade 3 lateral ankle sprain (complete rupture of anterior talofibular ligament and some injury to calcaneonavicular ligament), Deltoid ligament sprain without avulsion

Treatment and Outcomes:

Ankle support orthosis (ASO) brace, elevation, compression, PT, X-rays, No return to play until follow up in 4 weeks, NSAIDs vs. Tylenol for pain.

Follow up: Increased lateral tendon snapping recurring. Noncompliant with ASO.

MSK Ultrasound: partial avulsion of peroneal retinaculum off of distal fibula with effusion in the peroneal tendon sheaths. Dynamic evaluation shows anterior subluxation of the peroneal tendons into defect. **Management:** Stop PT. Discussed with ankle surgeon. Continue conservative care with ASO when ambulating. No return to sport. Follow up in 4 weeks. Consider surgery if not improving.

2452 June 2 10:50 AM - 11:10 AM

Not Your Ordinary Ankle Sprain

Juraj Zahatnansky, Robert Baker, FACSM, Mark Sytsma. *Western Michigan University Homer Stryker M.D. School of Medicine, Kalamazoo, MI.* (Sponsor: Robert Baker, FACSM)
Email: juraj.zahatnansky@med.wmich.edu

(No relationships reported)

HISTORY: This is a case of an otherwise healthy 19-year-old running back who sustained a left ankle eversion type injury during a football game when an opponent landed on his lower leg forcing it into external rotation. He did not finish playing due to the inability to bear weight.

PHYSICAL EXAMINATION: During initial evaluation, limited due to a significant amount of pain, he had tenderness over the deltoid, anterior talofibular, and calcaneofibular ligaments. During reevaluation two days later he was also complaining of some tenderness around the lateral aspect of his left knee. His exam showed mild edema at the level of his ankle, tenderness over ligaments as noted before, along with pain on external rotation of his foot, compression along his syndesmosis, and palpation over his tibiofibular joint with increased posterior translation of his proximal fibula compared to the contralateral side. His left knee exam revealed pain in the area of his fibular head with varus stress, but was otherwise unremarkable.

DIFFERENTIAL DIAGNOSIS:

- Ankle fracture
- Syndesmosis injury
- Proximal tibiofibular joint injury

TEST AND RESULTS:

Stress radiographs of left ankle at the stadium:

- no acute fracture and no obvious opening of his syndesmosis or medial joint space
- Repeat weight bearing radiographs of left ankle:
- ossification of his syndesmosis likely indicative of previous injury, as well as decreased overlap between distal tibia and fibula
- no clear evidence of medial ankle joint space widening

MRI of left calf and ankle:

- no ligamentous tear of the proximal tibiofibular joint, but changes consistent with chronic avulsion injury of the syndesmosis membrane from the distal portion of the tibia and probable injuries to his anterior inferior tibiofibular ligament and anterior talofibular ligaments

FINAL WORKING DIAGNOSIS:

Syndesmosis injury with proximal tibiofibular joint instability

TREATMENT AND OUTCOMES:

1. Non-weightbearing for the initial 10 days post injury.
2. Open reduction and internal fixation of distal syndesmosis using a single tightrope fixation, along with stabilization of the proximal tibiofibular joint using the same technique.
3. Non-weightbearing for the following 6 weeks.
4. Gradual return to physical activity.

E-17 Clinical Case Slide - Hip and Pelvis II

Friday, June 2, 2017, 9:30 AM - 11:30 AM
Room: 401

2454 **Chair:** James Patrick MacDonald, FACSM. *Nationwide Children's Hospital, Bexley, OH.*

(No relationships reported)

2455 **Discussant:** Joshua T. Goldman. *University of California, Los Angeles, Los Angeles, CA.*

(No relationships reported)

2456 June 2 9:30 AM - 9:50 AM

Hip Injury- Marathon

Jaimi Weber¹, Caroline Hu², William O. Roberts, FACSM¹, Kelly Roberts Lane, FACSM³, Steven D. Stovitz, FACSM¹. ¹University of Minnesota, Minneapolis, MN. ²University of Minnesota Medical School, Minnesota, MN. ³Fix It Physical Therapy, Mahtomedi, MN. (Sponsor: William Roberts, FACSM)

(No relationships reported)

Hip fracture - Marathon

Title - The Piggy Back Sign

Jaimi Weber, Caroline Hu, Kelly Roberts Lane, William Roberts, Steven D. Stovitz,
Email: jweber@umn.edu

Sponsor: William Roberts FACSM

HISTORY: 25 yo woman developed R hip pain while running her 1st marathon. She first noticed R hip pain during training runs approximately 2 wks before the event. Her pain was present at the beginning of her runs, subsided during, and then ache afterwards. During the marathon, she first noticed hip pain around mile 20-21, but this didn't affect her stride until mile 24 when she began to feel cramping and her stride changed. In the last mile, which was downhill, she knew something was wrong and about 100 m from the finish line she felt a "pop" in her R hip. She was unable to weight bear and was piggy-backed over finish line about 3h:20min after the start.

PMH: History of severe GERD in 2013, currently on ranitidine 75mg daily. Avid Nordic skier and mountain biker. Suffered a mountain bike crash 1 yr prior to the race and was unable to exercise for 6 mo due to severe concussion symptoms. Started running 5 mo before the race and ramped up to the marathon distance. Reports normal menstrual cycles. Non-vegan vegetarian for 15 yrs. No iron supplementation due to GERD.

PHYSICAL EXAM: Brought to medical tent in a wheelchair, unable to bear weight on her R leg. She had no tenderness to palpation of her hip musculature. Her R leg appeared to be slightly shorter and externally rotated compared to her L leg. She had excruciating pain with internal rotation of her hip.

DIFFERENTIAL DIAGNOSIS:

1. Hip fracture
2. Stress fracture/reaction
3. SI joint dysfunction
4. Gluteal muscle strain

TEST AND RESULTS:

Hip radiographs: R transcervical femoral neck fx

Hip CT: R transcervical femoral neck fx, no pathologic fx

Pending: DEXA scan, diet and activity analysis for energy deficit

FINAL/WORKING DIAGNOSIS: R transcervical femoral neck fx

TREATMENT AND OUTCOMES:

1. R femoral neck fx CRIF
2. Weight bear as tolerated with crutches prn
3. PT started 2 wks post-operatively
4. No "pounding" activities for 6 wks
5. Stationary bike for exercise as tolerated
6. Nutrition counseling

2457 June 2 9:50 AM - 10:10 AM

Looking Beyond the Joints, An Uncommon Case of Hip Pain

Ronan Cahill, Adam pourcho. *Swedish Medical Center, Seattle, WA.*

Email: ronan.cahill@swedish.org

(No relationships reported)

History: 47 yo female presented to this clinic with more than 2 years of right anterior thigh pain. She had previously been an ultramarathon runner and cyclist but had to stop these activities secondary to pain. Her pain started the day after running a marathon in September 2014. She completed that marathon with symptoms of mild calf tightness and anterolateral thigh "giving out" during the last mile. The following day she developed right posterolateral buttock pain with radiation to anterior and mid-thigh with ambulation. She had an extensive workup prior to presentation at the sports medicine clinic and was being treated under the working diagnosis of radiculopathy. She had MRIs of her right knee, right hip, and lumbar spine. She had tried physical therapy, chiropractic care, lumbar epidural injection and watchful waiting. None of these relieved her symptoms. At initial presentation to this clinic, she complained of right anterior thigh cramping that starts with 15 minutes of running and stops within an hour after rest. The pain is severe and rated 7/10 with activity. The pain does not radiate and is located in the anterior thigh. She denies lower back pain, numbness or tingling. She has no pain with squatting and minimal periodical pain with prolonged walking. **Exam:** On exam, the patient had a normal gait, a small right knee effusion and tenderness to palpation over the distal myotendinous junction of rectus femoris and vastus lateralis. Hip ROM was full and non-painful, with negative FADIR and Stinchfield tests. Knee exam with no ligamentous laxity or point tenderness. She had bilateral weakness of hip abductors. **Differential Diagnosis:** 1 Hip labral tear 2 Femoral Acetabular Impingement 3 Iliac artery endofibrosis 4 Inflammatory Myopathy 5 Meniscal Tear of Knee **Tests and Results:** Diagnostic US of knee and hip - patellofemoral arthropathy - small knee effusion - CAM type femoral deformity - anterior acetabular calcification without labral tear Diagnostic Knee and Hip Injection without benefit Arterial Dopplers - abnormal ABI on right, normal on Left - Complete external iliac artery occlusion on right and <50% stenosis of left common iliac artery **Final Diagnosis:** Complete right external iliac endofibrosis **Outcome/Treatment:** - Right external thromboendarterectomy - Partial running on AlterG at 2 months - Full running at 3 months

2458 June 2 10:10 AM - 10:30 AM

Adolescent Track Athlete with Acute Right Hip and Groin Pain

Erin Moix Grieb, Kyle Nagle. *University of Colorado, Denver, CO.* (Sponsor: John Hill, FACSM)

(No relationships reported)

History: 11-year-old previously healthy female presents with acute-onset right hip and groin pain that started while doing hurdles at track meet. Patient led with her right foot over hurdle and felt a "pop," with immediate pain at right anterior hip and groin. Unable to bear weight without significant pain.

Physical Examination:

Gen: NAD, well-appearing.

CV: RRR, brisk pulses, <2 sec cap refill

Chest: No tachypnea, no increased WOB

Neurologic: NI muscle bulk and tone, abnormal gait with antalgia.

MSK: Right hip

-Inspection: No swelling, deformity or ecchymosis.

-Palpation: Moderate TTP over anterior hip. No tenderness over greater trochanter, iliac crest, ASIS, AIIS, adductors, distal femur, or knee. No tenderness of ischium, lumbar spine, or SI joints. No palpable joint effusion.

-Range of motion: ROM of hip limited in extension, flexion and internal rotation due to pain. External rotation intact and pain free. ROM of knee is full.

-Neurovascular: Strength 3/5 with resisted hip flexion. Distally NVI with brisk pulses, 2 sec cap refill, normal motor and sensory nerve examination.

-Special maneuvers: FABER negative. FADIR positive.

-Opposite limb: No swelling, deformity, TTP, or decreased ROM. Full strength. Skin intact.

Differential Diagnosis:

Iliopsoas tendon rupture

Femoral neck stress fracture

Greater Trochanter/Intertrochanteric/Subtrochanteric fracture

Gluteal, Hamstring, Adductor muscle tear

Labral tear

Tests & Results:

Hip/Pelvis Radiographs:

-Date of injury: Apophyseal avulsion of right lesser trochanter at iliopsoas insertion.

-1 month after injury: Increased ossification of avulsed fragment, stable positioning.

-2 months after injury: Slightly increased ossification; stable appearance.

Final/Working Diagnosis: Apophyseal avulsion fracture of right femoral lesser trochanter

Treatment and Outcomes:

-Protected weight-bearing with crutches x 5 weeks. No impact or explosive movements. Ice, Ibuprofen as needed for pain.

-After 5 weeks, started Physical Therapy and home exercise program. No ballistics or sprinting.

-After 4 weeks of PT, gradually progressed into sprinting, jumping, and ballistics under PT guidance.

-Complete resolution of pain and return to softball and track without further complications. Xrays with stable alignment, malunion with fragment displacement of ~1.7 cm.

2459 June 2 10:30 AM - 10:50 AM

Hip Pain in a Ballet Dancer

Sarah S. Jackson. *Boston Children's Hospital, Boston, MA.*

(Sponsor: Pierre d'Hemecourt, FACSM)

Email: ss.jackson25@gmail.com

(No relationships reported)

HPI

17yr old ballerina presents with bilateral hip pain, left > right that has become progressively worse over the last year. Groin pain and some posterior hip pain. She states that when standing in arabesque she has the most discomfort but also with standing in 3rd and 5th position.

PE

Normal, non-antalgic gait.

Right Hip: Negative log roll. Negative straight leg raise and Stinchfield testing.

Flexion to 150°, internal rotation 30°, external rotation 50°, abduction of 50°. Negative impingement. Minimal discomfort with extension and external rotation.

Left Hip: Negative log roll. Negative straight leg raise and Stinchfield testing. Flexion to 140° but painful from 110-140°. Internal rotation to 20°, external rotation to 50° and abduction to 50°. She has positive impingement testing. She also has a positive FABER and scour test. Significant pain with extension and external rotation.

Diff Dx

Labral tear

FAI

Psoas tendinitis/bursitis

Dysplasia

Tests/Results

AP and bilateral lateral Dunn- Prominence noted bilaterally over the posterior proximal metaphysis of both femoral heads.

MRI w/out contrast: Moderate sized sessile osteochondroma arising from the posterior proximal left femoral metaphysis. Moderate underlying bone marrow edema suggesting that this lesion is undergoing abnormal stress. There is a similar sessile osteochondroma arising on the right posterior proximal femoral metaphysis, less well pronounced. No associated bone marrow edema.

Dynamic U/S: Dynamic u/s exam of the posterior hip the bony prominence on the left femur shows significant impingement with the hip externally rotated while the patient is prone. This is less significant but still appreciated on the right posterior hip. With the patient is supine the left hip does appear to have anterior instability with the leg in extension and external rotation (position of apprehension) and the femoral head had ~3-4mm of anterior displacement.

U/S guided diagnostic IA inj (left hip): 100% relief, no pain with 3rd or 5th position and arabesque immediately s/p inj.

Final Working Dx

Posterior bony impingement with secondary anterior instability
Osteochondroma (unlikely)

Treatments

Continue PT

Modify dance, except for performances.

Surgical planning in progress - open posterior femoral osteochondroplasty, possible arthroscopy

2460 June 2 10:50 AM - 11:10 AM

Right Hip Pain in a 36 year old Ironman Athlete

Alan J. Boucher, MD, Joel Shaw, MD, Joe Simko, PT.
OhioHealth Grant Medical Center, Columbus, OH.

(No relationships reported)

HISTORY: A 36 year old female long distance runner who was training for an Ironman that presented with a 1 week history of right hip pain. Onset of pain when standing up quickly from sitting position. Pain is reported laterally and worsening with activity. She said it is progressing to the point that it has disrupted sleep for the last 2 nights. Now she is unable to weight bear on her right leg.

PHYSICAL EXAMINATION: Her hips were with no obvious deformity or effusion to inspection bilaterally. She exhibited normal ROM with severe pain with internal rotation. Strength 5/5 in hip bilaterally. Tenderness of the anterior aspect of the right hip. Pain elicited with resisted hip flexion.

TEST AND RESULTS: Xray right hip revealed a large separated bony piece at the area of the anterior inferior iliac spine (AIIS) consistent with an avulsion, initially presumed as a chronic injury. Based on the severity and concern for stress fracture of the femoral neck she was placed on crutches with no weight bearing. MRI was ordered for further evaluation and she was informed to hold off all activity until results. MRI of right hip revealed acute-to-subacute avulsion fracture of the right anterior inferior iliac spine with associated partial tearing of the rectus femoris tendon, as well as mild edema in adjacent musculature and in fascial planes about the proximal rectus femoris muscle.

FINAL WORKING DIAGNOSIS: acute-to-subacute avulsion fracture of the AIIS.
TREATMENT AND OUTCOMES: Typically, in the adolescent population where these injuries are more commonly seen, the therapy consists of complete rest and non-weight bearing then progress with light activity and running at 8-10 weeks, with a goal to return to full activity in sports at 12 weeks following the injury. This patient followed a similar course of therapy but because of age and the idea was she would not need longer to heal based on her having a fused growth plate we were more aggressive with her return to running. Therefore, she was non-weight bearing and did core and hip strengthening for one month and then gradually progressed to running using AlterG at 4 weeks and typical road jogging in 6 weeks. After 3 months she had completed a 7 mile long run and had been able to start kicking and swimming. At 16 weeks from injury, she still reports little to no pain and is currently back to training for Ironman competitions.

2461 June 2 11:10 AM - 11:30 AM

Pelvic Injury in a 60 Year Old Rollerblader

Andrew Barclay. *LECOM Sports Medicine, Erie, PA.* (Sponsor: Patrick F. Leary, FACSM)

(No relationships reported)

Clinical Case Abstract

Pelvic injury - Rollerblading

Andrew D. Barclay, LECOM Sports Medicine, Erie, PA

Email: andrew.barclay@nv.touro.edu

(Sponsor: Patrick F. Leary, FACSM)

HISTORY: A 60 year old female presented on a Friday afternoon with right groin pain for one week. Onset of pain after a fall while rollerblading. She was unable to bear weight on her right leg after the injury and during

the evaluation. After examination, she was sent for radiographs of the pelvis and bilateral hips.

PHYSICAL EXAMINATION: Examination in the office of the right pelvis and hip revealed inability to flex the hip in supine position due to pain. Special testing revealed a negative log roll and FABER test, but positive

FADIR test. Gait posture was antalgic and the patient was unable to fully bear weight on right leg.

DIFFERENTIAL DIAGNOSIS:

- 1.Hip/pelvic fracture
- 2.Hip dislocation
- 3.Hip osteoarthritis
- 4.Bone contusion

TEST AND RESULTS:

X-ray Pelvis and Bilateral Hips:

-nondisplaced fractures right superior and inferior pubic rami
-mild osteopenia

Pelvic CT:

-minimally displaced comminuted fracture right inferior pubic ramus
-nondisplaced fracture proximal right superior pubic ramus adjacent to the acetabulum
Dexa Scan:

-T-score of -2.1

Labs:

-Vit D pending

FINAL/WORKING DIAGNOSIS:

-Pelvic ring fracture
-Osteopenia

TREATMENT AND OUTCOMES:

- 1.Crutches until pain free
- 2.Ice and electrical stimulation
- 3.Vitamin D3 supplementation
- 4.Physical therapy started 3 weeks post injury
- 5.Progressed through a gradual return to activity

E-18 Clinical Case Slide - Knee I

Friday, June 2, 2017, 9:30 AM - 11:30 AM

Room: 402

2462 **Chair:** Scott A. Magnes, FACSM. *Lovell Federal Health Care Center, North Chicago, IL.*

(No relationships reported)

2463 **Discussant:** Gregory Maletis. *Kaiser Permanente Hospital, Baldwin Park, CA.*

(No relationships reported)

2464 **Discussant:** Lisa Barkley, FACSM. *University of Central Florida, Orlando, FL.*

(No relationships reported)

2465 June 2 9:30 AM - 9:50 AM

Knee Injury- Ballet

Lindsay Ramey, Daniel Blatz. *Rehabilitation Institute of Chicago, Chicago, IL.* (Sponsor: Joseph Ihm, FACSM)

Email: lnr8t@virginia.edu

(No relationships reported)

History:

A 29-year-old male professional dancer presented with 6 weeks of right anterior knee pain after landing a jump in knee extension. His pain worsened with jumping & squatting and improved with rest. He denied systemic symptoms, other joint pain or medication use. He was evaluated by the company's physical therapist & treated for patellar tendinopathy, including eccentric strengthening, cho-pat strap & jump restrictions, without improvement.

Physical Examination:

Exam showed bilateral knee crepitus, right proximal patellar tendon tenderness and pain with right leg squat & hop. His exam was otherwise normal.

Differential Diagnosis:

- Patellar tendinopathy
- Patellar tendon tear
- Patellofemoral pain
- Avulsion fracture
- Subluxation

Tests and Results:

Knee US: Focal hypoechogenicity & fiber disruption in the right medial proximal patellar tendon

Right knee MRI: Increased signal on T2 & STIR confirming partial tear of the proximal patellar tendon

Diagnosis:

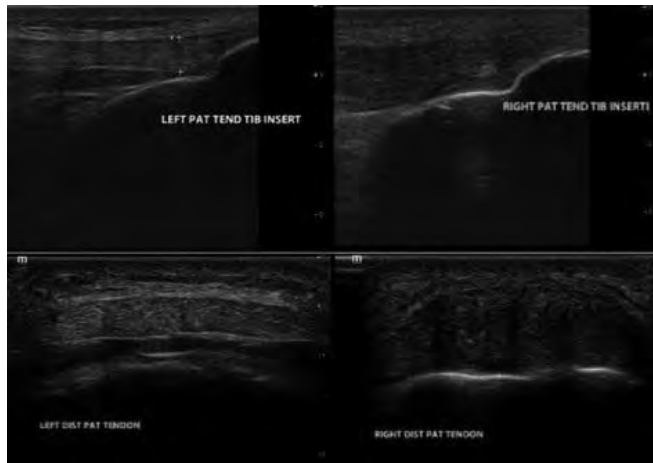
Right proximal patellar tendon tear

Treatment and Outcomes:

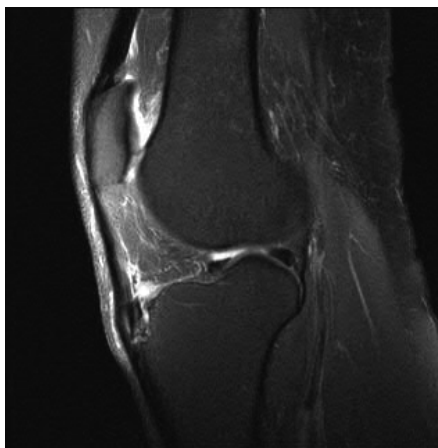
Initial treatment included knee immobilization, activity restriction, topical nitroglycerin & PT for 3 months without improvement. The patient pursued an US-guided platelet-rich plasma (PRP) injection without tenotomy at an outside facility. He had partial improvement but dance remained restricted. Subsequent US at 6 months showed

persistent tear. US-guided tenotomy and PRP injection were repeated, followed by activity restriction, PT and return to activity protocol. He noted limited relief at 4 weeks and pursued a third PRP injection at an outside facility.

He developed worsening, diffuse anterior knee pain. US showed new thickening and heterogeneity throughout the right patellar tendon.



MRI confirmed hypertrophic changes. Given prolonged course, he underwent open patellar tendon debridement & repair. Intra-operatively, the tendon was noted to be significantly thickened with abnormal color & texture. Post-operative follow-up is ongoing.



2466 June 2 9:50 AM - 10:10 AM

Knee Injury-jumping

Daniel P. Montero. *Mayo Clinic Florida, Jacksonville, FL.*
(Sponsor: George Pujalte, FACSM)

(No relationships reported)

HISTORY: 40 year-old female who injured her right knee jumping onto a dock. She had sudden, severe pain, 9 out of 10 in intensity. She could not bear weight or bend it initially. She had swelling the next day. She described locking and occasional "giving out". Within days, she could walk with minimal discomfort but could not exercise or lift weights. Symptoms slowly improved over the past 8 weeks as she presented for further evaluation **PHYSICAL EXAMINATION:** Thin, healthy-appearing. Normal gait. Full ROM both knees. No effusion or skin changes. Bony prominence of tibial tubercle without edema or erythema. Minimal point tenderness over patellar insertion. Nontender over origin and belly. Guarding on exam but negative anterior/posterior drawer tests, Lachman test, and patellar apprehension. Positive McMurray test.

DIFFERENTIAL DIAGNOSIS: Patellar strain/tear Meniscus tear Anterior cruciate tear Fracture of Osgood-Schlatter disease

TEST AND RESULTS: X-rays revealed hypertrophic changes of right tibial tubercle with mild associated soft tissue swelling. MRI revealed irregularity of tibial tubercle suggesting sequela of Osgood-Schlatter disease. There were surrounding inflammatory changes and edema with small amount of fluid in deep and superficial infrapatellar bursae. No internal derangement.

FINAL WORKING DIAGNOSIS: Fracture of Osgood-Schlatter disease in a 40-year-old female

TREATMENT AND OUTCOMES: 1. Modified rest for another 4 weeks (12 weeks from injury) 2. Physical therapy 3. Gradual return to jumps, squats, lunges, and weight lifting

2467 June 2 10:10 AM - 10:30 AM

Right Knee Pain - Runner

Ryan C. Kruse, Jonathan Finnoff, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Jonathan Finnoff, FACSM)
Email: kruse.ryan@mayo.edu

(No relationships reported)

HISTORY: A 60 year old male runner with a history of right common peroneal nerve entrapment status post-surgical decompression presented for evaluation of right lateral knee pain that had been present for 1 year. He described dull, lateral, aching knee pain, worsened by impact activity (e.g., running). He denied mechanical symptoms or effusion. Knee MRI demonstrated popliteus tendinopathy with partial-thickness intrasubstance tearing and a 10x5mm peritendinous cyst.

Ultrasound (US)-guidance was used to drain and fenestrate the cyst, and fenestrate and inject the popliteus tendon with leukocyte rich platelet rich plasma (PRP). The procedure was performed without complication. The patient used crutches for 5 days post-procedure, but on day 6 he walked 6 blocks without crutches. That evening, he developed pain and swelling with erythema in the suprapatellar region. No fever, chills, or knee drainage was present. Due to the symptoms, he returned to clinic for evaluation.

PHYSICAL EXAMINATION: Healthy appearing male in no acute distress. Mildly antalgic gait pattern. Grade 2 right knee effusion with erythema around the superolateral aspect of the knee. Well-healed injection site without erythema. Mild tenderness to palpation over the popliteus tendon insertion. Normal ligamentous and meniscal tests.

DIFFERENTIAL DIAGNOSIS: 1. Acute knee effusion secondary to overuse after recent PRP injection 2. Septic arthritis 3. Post-injection flare

TEST AND RESULTS: Right knee limited ultrasound - moderate effusion within suprapatellar recess Right knee aspiration - Appearance: straw colored - Cell count: 1283 - Neutrophils: 60 - Gram stain: negative - Culture: no growth - Crystals: intracellular CPPD crystals

FINAL WORKING DIAGNOSIS: Acute right knee pseudogout flair in a patient with no history of pseudogout, status post popliteus tendon PRP injection with peritendinous cyst aspiration and fenestration.

TREATMENT AND OUTCOMES: The patient was successfully treated with crutches, ice, compression, elevation, and NSAIDs.

2468 June 2 10:30 AM - 10:50 AM

Knee Pain - Soccer

Kenneth Y. Choi, Marissa S. Vasquez, Michael K. Fong, *Kaiser Permanente Los Angeles Medical Center, Los Angeles, CA.*

(Sponsor: Aaron Rubin, FACSM)

(No relationships reported)

HISTORY: 18 y/o male soccer player sustained a twisting injury with direct contact of his left knee during a game. He had no immediate or delayed swelling, but continued to have persistent posterior knee pain for two months before he pursued medical care. No instability or locking. Due to the severity of the pain, he had not played at all since the injury.

PHYSICAL EXAMINATION: Examination in the office revealed a trace effusion and tenderness to palpation over the proximal posteromedial tibia. Otherwise, the patient had full range of motion, no ligamentous laxity, and no meniscal signs.

DIFFERENTIAL DIAGNOSIS:

1. Fracture/stress reaction
2. Contusion
3. Capsular sprain
4. MCL sprain
5. Medial meniscus tear
6. Maligancy

TEST AND RESULTS:

1. MRI Left Knee Without Contrast
-7 mm x 6 mm x 7 mm intracortical lesion with periostitis and periosteal reaction -bone marrow edema in the proximal tibia with medial aspect surrounding the intracortical lesion
-clinical correlation required to differentiate whether bone marrow edema is from recent trauma or intracortical lesion
2. CT Left Knee Without Contrast
-4 mm x 3 mm x 4 mm intracortical extracapsular osteoid osteoma in the proximal medial tibial metaphyseal cortex

FINAL/WORKING DIAGNOSIS:

Osteoid osteoma of the proximal tibia

TREATMENT AND OUTCOMES:

1. Initially treated with rest and non-steroidal anti-inflammatory medication as needed
2. Had continued pain for three months after diagnosis, and was referred to orthopedic oncologist
3. CT-guided radiofrequency ablation performed successfully

2469 June 2 10:50 AM - 11:10 AM

Utility of Dynamic Sonographic Evaluation of Left Knee Pain & Locking in a Softball Catcher

Allison N. Schroeder, Kentaro Onishi, *University of Pittsburgh Medical Center (UPMC), Pittsburgh, PA.* (Sponsor: Tom Best, FACSM)

Email: aschroel@alumni.nd.edu

(No relationships reported)

HISTORY: An 18 year-old softball catcher presenting with a 3 year history of left progressive postero-lateral knee discomfort with associated knee locking when squatting or deep knee flexion. Onset was 3 years ago when she was in a squat position during a softball game. She had been avoiding aggravating activities and initially sought medical care 3 months ago, presenting to an orthopedic specialist's clinic. Following a negative MRI, she was referred to our clinic for diagnostic ultrasound of the knee. She reported no reliable way to reproduce locking, but, when locking does occur, she must manually unlock herself. Previous treatment included 8 weeks of physical therapy without benefit.

PHYSICAL EXAMINATION: No discoloration or swelling of the left knee. Non-antalgic gait. Valgus alignment with dynamic valgus on single leg squat. Posterior lateral joint line tenderness. No other focal tenderness. Full and symmetric bilateral knee active range of motion without pain, except in terminal flexion. Negative McMurray's, cruciate and collateral ligament testing and dial test. 9/9 Beighton criteria.

DIFFERENTIAL DIAGNOSIS: 1. Meniscocapsular separation 2. Lateral meniscus injury 3. Proximal tibiofibular ligament injury 4. Popliteus muscle/tendon injury 5. Anteriolateral complex sprain 6. PFL injury

TEST AND RESULTS: MRI: Subtle irregularity of posterior superior meniscocapsular fascicle deemed secondary to volume-averaging artifact. Otherwise, no discrete pathology was noted. Ultrasound: No discrete lesion of entirety of lateral meniscus on static exam. Development of a separation (3.1mm) between posterior

knee capsular tissue and posterior outermost fiber of left lateral meniscus when knee is in near full flexion. **FINAL WORKING DIAGNOSIS:** left postero-lateral meniscocapsular separation

TREATMENT AND OUTCOMES: Management options (expectant management, injection options to mitigate pain, and a surgery) were discussed. Patient elected surgical fixation of lateral meniscus. Arthroscopic fixation of lateral meniscus with 2 vertical mattress sutures using a FastFix device was performed. After 4 weeks of bracing to allow proper surgical healing, she was able to start using an elliptical at 6 weeks and jogging at 9 weeks. She remains void of pre-surgical pain and locking at 16 weeks post-operatively.

2470 June 2 11:10 AM - 11:30 AM

Knee Pain - Basketball

Nailah Coleman, FACSM, *Children's National Health System, Washington, DC.*

(No relationships reported)

HISTORY: a 12-year-old presents to clinic with left anterior knee pain for 2 to 3 years, after falling on his knee playing basketball. After his fall, someone fell on top of him and pressed further onto the back of his knee. Although his knee pain has improved, he notes it feels like someone is "pushing down on it." His pain is intermittent and associated with activity; he denies any particular functional disturbance and has been participating in sports and athletics during this time. He denies any sensation changes; he notes giving way and denies swelling, popping, or locking. For pain control he has been resting and working on some range of motion activities; he has required nothing else for pain control. In addition to the above, firm direct pressure in that same area can cause pain. He has had no other medical care for this concern. **PHYSICAL EXAM:** on physical exam he was a WDNW young man in NAD. His vital signs were WNL, and his BMI was normal for age and gender. Exam of his hips and knees was significant for symmetric appearance with intact skin and no deformities noted. He had a normal gait and was able to heel, toe, and duck walk without difficulty, although he did note mild pain with duck walk. He had full range of motion of his hips and knees. He had a negative apprehension test, negative Lachman's, negative McMurray, negative anterior and posterior drawer, and negative patellar grind. **DIFFERENTIAL DIAGNOSIS:** - Patellar contusion - Patellofemoral pain syndrome - Sinding Larsen Johansson syndrome - Osgood Schlatters disease - Osteochondral defect (OCD) **TESTS AND RESULTS:** - X-ray demonstrating a 12 x 16 mm OCD on the lateral side of the medial femoral condyle in the left knee - MRI pending **FINAL/WORKING DIAGNOSIS:** OCD **TREATMENT AND OUTCOMES:** - Continue with current comfort care measures - Avoid physical activities - Wear a hinged knee brace, locked in extension for ambulation and allowing flexion with sitting. - MRI to evaluate the extent of the lesion - Follow up with orthopedics after the MRI is completed.

E-24 Basic Science World Congress/Poster - Neurobiological Effects of Exercise

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2481 Board #1 June 2 9:30 AM - 11:00 AM

fMRI Assessed Neural Activation in Blood Flow Restricted Handgrip Exercise

Aaron W. Johnson, Tiffany D. deVries, Brock Kirwan, J W. Myrer, *Brigham Young University, Provo, UT.* (Sponsor: Pat Vehrs, FACSM)

(No relationships reported)

PURPOSE: Blood-flow-restricted (BFR) exercise is reported to improve strength and elicit muscle hypertrophy, although little is known about its neural effects. The purpose of this study was to investigate brain neural responses to BFR exercise and control conditions during handgrip exercise.

METHODS: Twenty-five subjects completed dynamic handgrip exercises during BFR and control conditions on two different days separated by 72 hours. fMRI scans were acquired during both exercise conditions. The exercise protocol consisted of five 30-second sets of squeezing a non-metallic handgrip exerciser (a reported 13.6 kg resistance), doing as many repetitions as possible, with 20-second rest intervals between sets.

RESULTS: There was a significant main effect of exercise condition in the neural activity in the premotor dorsal (F = 5.71, p = 0.022), premotor ventral (F = 8.21, p = 0.007), and right ventral striatum (F = 7.36, p = 0.01) areas. When considering anatomical regions of interest, we found no significant differences between exercise conditions in the bilateral primary sensory cortex (p = 0.82), primary motor cortex (p = 0.33), supplementary motor area (p = 0.66), cerebellum (p = 0.70), insular cortex (p = 0.45), anterior cingulate cortex (p = 0.24), or thalamus (p = 0.66). Significant linear trends (p = 0.001) over the five exercise sets were found in the bilateral anterior

cingulate cortex, right middle frontal gyrus, and the right primary sensory cortex. The right primary sensory cortex, left primary sensory cortex, and the right anterior cingulate cortex showed a main effect of set ($p = 0.02$).

CONCLUSIONS: Less total work was completed during BFR exercise with similar brain neural activation as a higher volume control exercise. BFR exercise has direct effects on the central nervous system.

2482 Board #2 June 2 9:30 AM - 11:00 AM
Functional Brain Activation During Lower Extremity Neuromuscular Fatigue In Older Women

Ranjana K. Mehta, Joohyun Rhee. *Texas A&M University, College Station, TX.*
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 (No relationships reported)

Fatigue is more than tiredness; it is a symptom that can cause disrupted behavior, disability and even mortality. Although the relationship between aging and fatigue is somewhat controversial, functional deficits such as increased incidents of falls, limitations of mobility and mortality rates are related to fatigue in the elderly. Understanding brain function changes during fatigue development is important because both central and peripheral fatigues are associated with an exhausted nervous system, particularly in the elderly. However, existing motor neuroscience investigations of fatigue are limited to upper and/or distal muscle groups due to physical constraints of the neuroimaging methods.

PURPOSE: Lower extremity muscles of the quadriceps are responsible in maintaining balance and preventing older adults from falling, however very little is known on brain function changes with fatigue of these large muscles. **METHODS:** We measured neural activity of frontal and motor brain areas from 13 older females (72.5 ± 4.7 years) during submaximal fatiguing leg exercise using functional near infrared spectroscopy (fNIRS). Physiological measures of joint force and electromyography measuring muscle activity of the vastus lateralis and rectus femoris, along with ratings of perceived exertion (RPE) were recorded simultaneously. Paired t-tests were used to test the effects of fatigue phases (early vs late) on force steadiness, muscle activity, RPE, and hemodynamic responses of each neural channel. **RESULTS:** As expected, the later phases of fatigue were associated with ~35% lower force steadiness, 20-23% increase in quadriceps muscle activity, and 137% higher perceived effort ratings (all $p < 0.05$). Increases in hemodynamic responses of right medial-lateral prefrontal cortex, left and right medial primary motor area, and left posterior medial sensory area was observed over the course of fatigue development, indicating distinct spatio-temporal pattern changes with fatigue development. **CONCLUSIONS:** These findings provide important insights on age-related changes in the neuromuscular control of large leg muscles that can inform innovative training or rehabilitative strategies in improving falls recovery or preserving mobility capabilities in older adults. Supported by NIH grant 1R15AG047553 - 01A1

2483 Board #3 June 2 9:30 AM - 11:00 AM
Fatigue Modulates The Effect Of Group III/IV Muscle Afferents On GABA_B-Mediated Inhibition And Corticospinal Excitability

Simranjit K. Sidhu¹, Joshua C. Weavil², Taylor S. Thurston², Eivind Wang³, Dorothea S. Rosenberger², Jacob E. Jessop², Russell S. Richardson², Chris J. McNeil⁴, Markus Amann².
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 (No relationships reported)

PURPOSE: To investigate the influence of group III/IV muscle afferents on GABA_B-mediated long-interval inhibition (LII) during cycling exercise in the absence and presence of locomotor muscle fatigue. **METHODS:** Nine recreationally active males performed brief, non-fatiguing (NFC; 30 s) and fatiguing (FC; 5 min) cycling exercise ($80\% W_{peak}$) under control-conditions (CTRL) and with lumbar intrathecal fentanyl (FENT) impairing feedback from group III/IV leg muscle afferents. Single and paired transcranial magnetic stimulation (TMS, TMS-TMS) and single and paired TMS-cervicomedullary stimulation (CMS, TMS-CMS) were used during NFC and at the start and end of FC to evaluate cortical versus spinal contributions to LII (LII_{TMS} , LII_{CMS}). **RESULTS:** While fentanyl blockade did not alter motor-evoked potentials (MEPs) during NFC, cervicomedullary-evoked motor potentials (CMEPs) were $15 \pm 10\%$ higher ($P < 0.05$), resulting in a $7 \pm 5\%$ decrease in MEP/CMEP in FENT compared to CTRL ($P < 0.05$). Furthermore, fentanyl blockade during NFC increased LII_{TMS} by $26 \pm 15\%$ ($P < 0.05$) without affecting LII_{CMS} ($P = 0.3$). During FC in CTRL, MEPs remained unchanged during the 5 minutes of exercise whereas CMEPs increased by $12 \pm 6\%$ ($P < 0.05$) resulting in an $8 \pm 3\%$ decrease in MEP/CMEP ($P < 0.05$). This paralleled a $33 \pm 11\%$ increase in LII_{TMS} ($P < 0.05$), but no change in LII_{CMS} . During FC in FENT, MEPs, CMEPs, LII_{TMS} and LII_{CMS} remained unchanged ($P > 0.2$).

CONCLUSION: These findings suggest that in the absence of fatigue, group III/IV muscle afferents may facilitate the excitability of motor cortical cells by limiting the activation of GABA_B intracortical inhibitory interneurons. In contrast, in the presence of fatigue, these afferents may disfacilitate the excitability of motor cortical cells by enhancing the activation of GABA_B intracortical inhibitory interneurons.

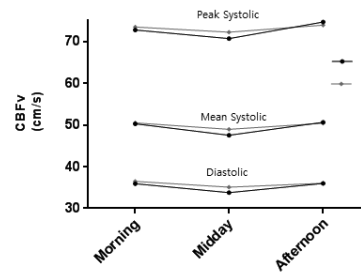
2484 Board #4 June 2 9:30 AM - 11:00 AM
Effects of Alternating Standing and Sitting Compared to Prolonged Sitting on Cerebral Blood Flow Velocity

Sophy J. Perdomo, Bethany Barone Gibbs, Robert J. Kowalsky, John M. Taormina, Jeffrey R. Balzer. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: John M Jakicic, FACSM)
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Reported Relationships: S.J. Perdomo: Contracted Research - Including Principle Investigator; This research was funded by the Humanscale company.

Preliminary evidence suggests that prolonged sitting may acutely reduce cerebral blood flow velocity (CBFv). Whether alternating bouts of standing and sitting while performing deskwork can attenuate decreases in CBFv is currently unknown. **Purpose:** To compare CBFv recorded at multiple time points during a simulated workday of alternating standing and sitting vs. prolonged sitting. **Methods:** This randomized crossover study enrolled working adults ($N=25$) with pre-to-Stage 1 hypertension, body mass index (BMI) from 25 to < 40 kg/m², and not using antihypertensive medications. Subjects participated in two 8-hr simulated workdays: 1) sitting continuously (SIT), and 2) alternating standing and sitting every 30 min (SS). Beat-to-beat peak systolic, mean systolic and diastolic CBFv were recorded bilaterally for 1 min via insonation of the middle cerebral artery using transcranial Doppler ultrasonography before (morning), between (midday) and following (afternoon) two 4-hr work periods. **Results:** Mean (SD) age was 42 (12) years, blood pressure (BP) was 132 (9)/83 (8) mmHg, and BMI was 32 (5) kg/m². Repeated measures ANOVA revealed a significant effect of time for peak systolic ($F = 4.08$, $P = 0.023$), mean systolic ($F = 6.76$, $P = 0.003$), and diastolic ($F = 5.67$, $P = 0.006$) CBFv. Post-hoc testing with Bonferroni adjustment revealed significant decreases from morning to midday in mean systolic ($P = 0.048$) and diastolic ($P = 0.024$) CBFv in SIT but not SS ($P \geq 0.14$). The only change from midday to afternoon was an increase in mean systolic CBFv ($P = 0.048$) in SIT. No significant effects were observed by condition or for the condition x time interaction ($P \geq 0.20$) (Figure). **Conclusions:** In individuals with elevated BP and BMI, CBFv differed across an 8-hr workday but not across sitting and alternating posture conditions. However, significant midday declines were observed only during prolonged sitting. Future studies should study trajectories and factors that influence CBFv during the workday.

Change in Cerebral Blood Flow Velocity



2485 Board #5 June 2 9:30 AM - 11:00 AM
Changes in Cerebral Oxygenation Following Anaerobic Exercise

Jeff Leiter¹, Travis J. Hrubeniuk². ¹Pan Am Clinic Foundation, Winnipeg, MB, Canada. ²University of Manitoba, Winnipeg, MB, Canada.
 (No relationships reported)

Currently there is a plethora of research identifying the fluctuations in cerebral oxygenation during aerobic exercise. Such alterations have been associated with respiratory compensation threshold (RCT), fatigue, and exercise cessation. However, there is a paucity of research investigating the effects of anaerobic exercise in this regard.

PURPOSE: To identify how cerebral oxygenation (Cox) changes throughout the recovery from a bout of maximal anaerobic exercise in comparison to baseline levels. **METHODS:** Twenty-eight physically active, healthy participants aged 18-35 were recruited, each partaking in two sessions. At the first session anthropometric measures were documented. During the second session, participants connected to a cerebral oximeter and 5 minutes of baseline measurements were recorded, followed by a 30-second Wingate test while connected to a metabolic cart. Responses to the

anaerobic test were monitored using both devices for 15-minutes post-test, with values noted at 0-, 60-, 90-, 120-, 300-, 600- and 900-second time points. Means and standard deviations were generated for all variables. Repeated measures ANOVA was used to determine differences between time points for Cox, end-tidal carbon dioxide (P_{ETCO_2}), heart rate (HR) and respiratory rate (RR). Significance was set at ($p < 0.05$).

RESULTS: Baseline Cox was $66.96 \pm 5.79\%$. Throughout recovery, Cox did not differ from baseline until 600s post-test, where it significantly increased to $68.73 \pm 7.22\%$. At exercise cessation, $PETCO_2$ was 25.84 ± 4.58 mmHg before a sudden influx at 60s, achieving 33.37 ± 4.18 mmHg; which was followed by a gradual decline through the 900s time point. As expected, both HR and RR peaked at exercise cessation and gradually declined throughout recovery.

CONCLUSION: Cox following anaerobic exercise did not deviate from baseline until a sudden rise approximately 600s post-test. This differs from previously outlined responses to aerobic exercise, which have found drastic reductions and consequential inlapses following maximal exercise. $PETCO_2$ and RR readings indicate that RCT was not achieved despite a rise in CO_2 levels, which may have prevented the drastic changes in oxygenation that are observed with aerobic exercise.

2486 Board #6 June 2 9:30 AM - 11:00 AM
Differences in Cerebral Oxygenation Following Aerobic and Resistance Exercise

Travis J. Hrubeniuk¹, Jeff Leiter². ¹University of Manitoba, Winnipeg, MB, Canada. ²Pan Am Clinic Foundation, Winnipeg, MB, Canada.

(No relationships reported)

Cerebral blood flow and oxygenation are important variables to consider for concussion diagnosis and treatment. As a result, monitoring these variables throughout progressive aerobic exercise has emerged as a potential concussion management tool, as well as an indicator for return to sport, school or work. However, such a mechanism may not be specific to the sport or workplace to which the individual is returning. Understanding how a healthy brain responds to various types of exercise has the potential to create more individualized methods of concussion management.

PURPOSE: To identify the differences in cerebral oxygenation recovery following bouts of maximal resistance and aerobic exercise.

METHODS: Twenty-eight physically active, healthy participants aged 18-35 were recruited, each partaking in two sessions. At the first session anthropometric measures and leg press 1-RM were determined. During the second session participants completed a maximal leg press resistance training protocol, followed 30 minutes later by a maximal aerobic protocol. Participants were connected to a cerebral oximeter and metabolic cart for monitoring. As such, cerebral oxygenation and ventilatory gas exchange variables were documented throughout the duration of exercise and for 15-minutes of passive recovery post-test.

RESULTS: Maximal aerobic exercise resulted in a progressive increase in cerebral oxygenation following cessation of exercise until peaking at $70.61 \pm 7.41\%$, 300-seconds post-test. This represents a significant rise from a baseline value of $66.00 \pm 5.48\%$. The rise in oxygenation following aerobic exercise differed from resistance exercise from 90-seconds onwards, as resistance exercise did not result in a significant change from its $66.89 \pm 5.62\%$ baseline value.

CONCLUSION: While maximal aerobic exercise resulted in significant increases in cerebral oxygenation from baseline levels throughout recovery, maximal resistance exercise did not elicit the same response. This indicates that aerobic exercise results in a metabolic strain on the brain which differs from the strain experienced as a result of resistance exercise. As such, expecting equivalent outcomes and utility as concussion management tools from both exercise methods may be misguided and requires additional research.

2487 Board #7 June 2 9:30 AM - 11:00 AM
Cognitive Function After Exhaustive Exercise: Effects Of Cerebral Oxygenation

Soichi Ando¹, Mizuki Sudo², Takaaki Komiyama³, Ryo Aoyagi³, Yasuki Higaki³. ¹The University of Electro-Communications, Tokyo, Japan. ²Physical Fitness Research Institute Meiji Yasuda Life Foundation of Health and Welfare, Tokyo, Japan. ³Fukuoka University, Fukuoka, Japan.

(No relationships reported)

It has been suggested that low to moderate exercise has beneficial effects on cognitive function. In contrast, less is known about the effects of exhaustive exercise on cognitive function, and the findings are still controversial. Furthermore, specific mechanisms by which exhaustive exercise affects cognitive function remain largely unclear. **PURPOSE:** The purpose of this study was to examine cognitive function after exhaustive exercise, and to identify physiological factors that determine cognitive function after exhaustion. **METHODS:** Thirty-two participants were assigned into Exercise (N = 18) and Control (N = 14) groups. The participants completed cognitive tasks that require working memory and executive function before and after an incremental exercise until exhaustion or resting period. Cerebral oxygenation was

continuously monitored during the cognitive task over the frontal cortex. Venous blood samples were collected before and after the exercise or resting period, and blood catecholamine, insulin-like growth hormone factor 1 (IGF-1), serum brain-derived neurotrophic factor (BDNF), blood lactate concentrations were analyzed.

RESULTS: In the Exercise group, reaction time (RT) of the cognitive task tended to decrease after exercise (Pre: 875 ± 312 ms vs. Post: 771 ± 168 ms, $p=0.07$). Number of error trials in the cognitive tasks increased after exercise (Pre: 1.2 ± 0.8 vs. Post: 2.6 ± 2.3 ms, $p<0.05$). Delta RT was negatively correlated with delta cerebral oxygenation ($r = -0.61$, $p<0.01$). Counterintuitively, delta number of error trials was negatively correlated with delta noradrenaline ($r = -0.56$, $p<0.05$) and dopamine ($r = -0.65$, $p<0.001$) concentrations. Alterations in IGF-1, BDNF, blood lactate concentrations were not associated with altered cognitive performance. In the Control group, cognitive performance and all physiological parameters were not altered.

CONCLUSIONS: The present results suggest that recovery of cerebral oxygenation affects response speed of the cognitive task after exhaustion. Impairments in accuracy may be ascribed to increased arousal level beyond the optimal level. However, venous blood samples appear not to reflect the arousal level directly.

2488 Board #8 June 2 9:30 AM - 11:00 AM
Cerebral Pulsatility and Habitual Exercise

Adam T. Corkery¹, Kathleen B. Miller¹, Ronée E. Harvey², Anna J. Howery¹, Jill N. Barnes¹. ¹University of Wisconsin-Madison, Madison, WI. ²Mayo Clinic College of Medicine, Rochester, MN. (Sponsor: Michael J. Joyner, FACSM)

(No relationships reported)

Increased pulsatility of the cerebral arteries has been correlated with an increased risk of developing cerebral pathology. Previous research has suggested that a 16-week endurance training intervention does not alter middle cerebral artery (MCA) pulsatility in young athletes; however, the effects of long-term habitual exercise on cerebral pulsatility have not been evaluated. **PURPOSE:** To compare MCA pulsatility in sedentary adults and habitual exercisers. **METHODS:** We evaluated 49 subjects, including 28 habitual exercisers (EX; age = 38 ± 16 y, women = 11, $VO_{2max} = 44 \pm 7$ ml/kg/min, BMI = 24.2 ± 3.0 kg/m²) and 21 sedentary controls (SED; age = 46 ± 20 y, women = 12, $VO_{2max} = 27 \pm 6$ ml/kg/min, BMI = 24.9 ± 2.0 kg/m²). Mean arterial pressure (MAP) and middle cerebral artery velocity (MCAv) were continuously recorded during rest. Pulsatility index (PI) was calculated by subtracting diastolic MCAv from systolic MCAv and dividing the result by the mean MCAv. **RESULTS:** Habitual exercisers had a lower MCAv compared to sedentary controls (EX = 57.2 ± 3.5 cm/s vs. SED = 68.3 ± 4.0 cm/s; $p<0.05$), and MAP was similar between the two groups (EX = 88 ± 2 mmHg vs. SED = 89 ± 2 mmHg; $p=0.69$). Habitual exercisers tended to have a lower PI (EX = 0.75 ± 0.03 vs. SED = 0.83 ± 0.04 ; $p=0.09$), and VO_{2max} was inversely associated with PI ($r = -0.341$, $p<0.05$) when evaluating all subjects. **CONCLUSIONS:** Habitual exercisers tended to have a lower PI, although the results did not reach statistical significance. The inverse association between VO_{2max} and cerebral PI suggests that individuals with a higher fitness may have a lower risk of developing cerebrovascular-related pathology. Supported by NIH grant HL118154

2489 Board #9 June 2 9:30 AM - 11:00 AM
Cerebral Autoregulation and Habitual Exercise in Young Healthy Adults

Kathleen B. Miller¹, Ronée E. Harvey², Anna J. Howery¹, Athena E. Goffinos¹, Alexa E. Carl¹, Jill N. Barnes¹. ¹University of Wisconsin-Madison, Madison, WI. ²Mayo Clinic College of Medicine, Rochester, MN. (Sponsor: Michael J. Joyner, FACSM)

(No relationships reported)

Cerebral autoregulation is the ability of the brain to maintain constant cerebral perfusion despite oscillations in systemic blood pressure. Exercise training improves cerebral vasomotor function; however, the impact of habitual exercise on cerebral autoregulatory function is unknown. **PURPOSE:** To evaluate static cerebral autoregulation in habitually exercising and sedentary young adults. We hypothesized that young adults who habitually exercise would show enhanced measures of cerebral autoregulation compared to sedentary controls. **METHODS:** We evaluated 20 habitual exercisers (EX; age = 28 ± 1 y; women = 6; $VO_{2max} = 47 \pm 1$ ml/kg/min) and 11 sedentary controls (CON; age = 29 ± 2 y; women = 7; $VO_{2max} = 31 \pm 2$ ml/kg/min). Middle cerebral artery velocity (MCAv), mean arterial pressure (MAP), heart rate (HR), and end-tidal carbon dioxide were recorded during three minutes of rest. Cerebral autoregulatory variables were assessed offline. **RESULTS:** HR was lower in habitual exercisers compared to sedentary controls (EX: 51 ± 3 bpm vs. CON: 58 ± 3 bpm; $p<0.05$). Habitual exercisers also had a lower MCAv (EX: 55 ± 4 cm/s vs. CON: 74 ± 4 cm/s; $p<0.05$) and no significant differences were found in MAP (EX: 94 ± 3 mmHg vs. CON: 98 ± 4 mmHg; $p=0.42$). Habitual exercisers displayed a significantly higher low-frequency coherence value (EX: 0.62 ± 0.04 vs. CON: 0.45 ± 0.05 ; $p<0.05$); however, no difference was found in low-frequency gain (EX: 0.63 ± 0.08 cm/s/mmHg vs. CON: 0.59 ± 0.07 cm/s/mmHg; $p=0.67$), or low-frequency phase (EX:

51 ± 6 degr. vs. CON: 46 ± 8 degr.; $p=0.64$). **CONCLUSIONS:** Our results indicate that low frequency cerebral autoregulatory function is not different between habitually exercising and sedentary young adults, as the higher coherence was not accompanied with a difference in phase or gain. Future studies may further examine if mode of exercise might influence cerebral autoregulation. Supported by NIH grant HL118154.

2490 Board #10 June 2 9:30 AM - 11:00 AM
Association Between Habitual Physical Activity and Mechanical Pain Sensitivity in Healthy Adults
 Katrina Maluf, Jaime Zinn, Luisa Davila-Pablo, Paige Kettenburg, San Diego State University, San Diego, CA.
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 (No relationships reported)

Routine engagement in physical activity is recommended for the prevention and management of chronic musculoskeletal pain. Previous studies have compared pain sensitivity between active and sedentary groups categorized based on self-reported levels of physical activity. However, the extent to which pain sensitivity varies with individual differences in objectively assessed habitual physical activity is not known. **PURPOSE:** To quantify associations between mechanical pain sensitivity and physical activity outcomes measured by accelerometry. **METHODS:** Healthy young (21.5 (2.2) years) adults wore an accelerometer (ActiGraph Model wGT3X-BT) on the waist while performing their usual activities for 7 consecutive days. Published calibration equations were used to classify each 1-min epoch of activity count data as sedentary behavior (SB, <100 cpm), light intensity physical activity (LPA), and moderate-to-vigorous intensity physical activity (MVPA). The amount of time spent in each category was expressed as a percentage of total daily wear-time, and was averaged across days with at least 10 hours of valid activity data. Mechanical pain sensitivity was quantified by applying a 1-cm² algometer probe to the ventral forearm at 50 kPa/sec. Pressure pain threshold (PPT_{hr}) was recorded as the pressure at which the stimulus first became painful, and pressure pain tolerance (PPT_{ol}) was recorded as the pressure above which the painful sensation could no longer be tolerated. Associations between physical activity and pain sensitivity outcomes were assessed with Pearson's correlation. **RESULTS:** On average, 74(SD 6)% of total daily wear time was spent engaged in SB. LPA and MVPA comprised 23(5)% and 4(2)% of daily wear time, respectively. PPT_{hr} ranged from 34 to 287 kPa, and PPT_{ol} ranged from 536 to 1576 kPa. PPT_{hr} was not associated with physical activity outcomes. PPT_{ol} was negatively associated with SB ($r = -0.60$), and positively associated with LPA ($r = 0.56$) but not MVPA. **CONCLUSION:** Healthy young adults who engage in less sedentary behavior and more light intensity physical activity have greater tolerance of mechanical pain. Future work should determine whether this relationship reflects activity-related adaptations in pain processing, or the effects of pain tolerance on willingness to engage in physical activities.

2491 Board #11 June 2 9:30 AM - 11:00 AM
Effect of Exercise Training on Cerebral Microcirculation in Men with and without Type 1 Diabetes
 Antti-Pekka E. Rissanen¹, Heikki O. Tikkanen², Anne S. Koponen¹, Jyrki M. Aho³, Juha E. Peltonen¹. ¹University of Helsinki, Helsinki, Finland. ²University of Eastern Finland, Kuopio, Finland. ³Foundation for Sports and Exercise Medicine, Helsinki, Finland.
 Email: antti-pekka.rissanen@helsinki.fi
 (No relationships reported)

PURPOSE: Effects of regular exercise on cerebral microcirculation in diabetes are unknown. We examined if exercise training leads to similar adaptations in cerebral microcirculation in men with and without type 1 diabetes (T1D). **METHODS:** Eight men with T1D (33±6 yrs) and eight healthy men (HC; 38±7 yrs) matched for age, anthropometry, and peak O₂ uptake (VO_{2peak}) ($p>0.05$), completed a 1-year individualized exercise training intervention. Individually collected data on training were similar in T1D vs. HC (mean±SD per month; $p>0.05$): 13±4 vs. 15±6 endurance training sessions, 3±1 vs. 3±3 resistance training sessions, 57±5 vs. 55±8 % of heart rate reserve, 16:58±6:07 vs. 16:52±4:39 h:min, 7759±4540 vs. 7762±3812 kcal, respectively. Before and after the intervention, the subjects performed step incremental cycling exercise to volitional fatigue. During exercise, alveolar gas exchange (mass spectrometry) and normalized relative concentration changes in deoxygenated hemoglobin (%Δ[HHb]) in the prefrontal cerebral cortex (near-infrared spectroscopy) were monitored; %Δ[HHb] reflects imbalance between local O₂ delivery and utilization. **RESULTS:** Training increased VO_{2peak} and peak work rate similarly in T1D (45±5 to 49±6 mL/min/kg fat-free mass [FFM], $p<0.01$; 237±34 to 254±27 W, $p<0.05$) and HC (48±3 to 52±5 mL/min/kg FFM, $p<0.05$; 255±17 to 282±36 W, $p<0.05$). Training also decreased minute ventilation at 160W (in T1D and HC) and 200W (in HC) ($p<0.05$) but had no effect on end-tidal CO₂ partial pressure, which estimates arterial CO₂ pressure affecting cerebral blood flow. Cerebral %Δ[HHb] did not change at any work rate in T1D but decreased at 200W in HC ($p<0.05$). No differences were observed between T1D and HC in the reported parameters before the intervention.

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CONCLUSION: Exercise training did not improve exercise-induced imbalance between local O₂ delivery and utilization in prefrontal microcirculation in T1D but did so at high exercise intensity (200 W) in HC. This between-group difference was not due to different respiratory adaptations and must thus be explained by other diabetes-related mechanisms (e.g., impaired cerebrovascular autoregulation, CO₂ reactivity, or neocapillarization) influencing cerebral blood flow. Supported by: Tekes, Ministry of Education and Culture, Finnish Medical Foundation.

2492 Board #12 June 2 9:30 AM - 11:00 AM
Aerobic Exercise Training and Dynamic Cerebral Autoregulation in Patients with Mild Cognitive Impairment
 Takashi Tarumi¹, Chang-Yang Xing², Marcel Turner², Justin Repshas², Rong Zhang¹. ¹UT Southwestern Medical Center, Dallas, TX. ²Texas Health Presbyterian Hospital Dallas, Dallas, TX.
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 (No relationships reported)

Aerobic exercise training may improve cerebral blood flow (CBF) regulation and reduce the risk of dementia. Cerebral autoregulation (CA) is the unique function of the brain which maintains CBF during changes in blood pressure. **PURPOSE:** To determine 1) the effects of aerobic exercise training and improvement of cardiorespiratory fitness on dynamic CA (dCA) and 2) the reproducibility of dCA metrics in patients with mild cognitive impairment (MCI). **METHODS:** Seventy MCI patients were randomized into 12 months of aerobic exercise training or stretching. Before and after intervention, beat-by-beat CBF velocity and blood pressure were simultaneously measured by transcranial Doppler (TCD) and finger plethysmography during a seated resting condition and a repeated sit-stand maneuver. Transfer function analysis was used to estimate dCA gain, phase, and coherence. Cardiorespiratory fitness was assessed by maximal oxygen uptake (VO_{2max}) that is measured on treadmill using a modified Astrand-Saltin protocol. **RESULTS:** Clean TCD signals were available from 54 patients at baseline, of which 29 patients completed exercise training (n=14) or stretching (n=15) program. After exercise training, dCA gain, phase, and coherence measured during rest and sit-stand maneuvers were not different from stretching group. Likewise, those dCA metrics measured from the patients who improved VO_{2max} were not different from the other patients who did not make improvement. The comparison of dCA metrics measured before and after 12 months showed significant intra-class correlations of dCA gain at very low frequency (rest: $R^2=0.33$, $P=0.001$; sit-stand: $R^2=0.10$, $P=0.029$). **CONCLUSIONS:** Although dCA metrics were reproducible over 1 year (particularly the gain at very low frequency during rest), neither aerobic exercise training nor the improvement of cardiorespiratory fitness altered dCA metrics in MCI patients. Supported by the NIH (R01AG033106 and K99HL133449) and the American Heart Association (14POST20140013)

2493 Board #13 June 2 9:30 AM - 11:00 AM
Effects Of Aerobic And Resistance Exercise On Cognitive Function.
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 (No relationships reported)

There is a substantial body of evidence to show that acute exercise improves cognitive function. The improvements seem to be observed irrespective of exercise mode (i.e. aerobic and resistance). However, it is unclear how aerobic and resistance exercise improves cognitive function. **PURPOSE:** To clarify the effects of acute aerobic and resistance exercise on cognitive function. **METHODS:** Sixteen subjects completed cognitive tasks before and after acute aerobic or resistance exercise in a randomized crossover design. In aerobic condition, they cycled an ergometer at the intensity corresponding to 40% peak oxygen uptake. In resistance condition, they performed resistance exercise using elastic bands. Exercise duration of each condition was 30 min. Cognitive task was a Go/NoGo task, which required executive function. Plasma catecholamine, insulin-like growth hormone factor 1 (IGF-1), serum brain-derived neurotrophic factor serum (BDNF), and blood lactate concentrations were measured before and after exercise. **RESULTS:** Compared with rest, reaction time on the Go/NoGo task tended to decreased after exercise (aerobic: 651 ± 143 vs. 586 ± 175 ms, resistance: 644 ± 212 vs. 604 ± 160 ms, $p = 0.06$). Neither exercise nor condition altered the accuracy on the cognitive task. Both aerobic and resistance exercise increased adrenaline (aerobic: 38.8 ± 14.4 vs. 71.5 ± 21.5 pg/mL, resistance: 41.8 ± 21.4 vs. 66.9 ± 30.3 pg/mL, $p < 0.01$), noradrenaline (aerobic: 341 ± 97 vs. 476 ± 142 ms, resistance: 369 ± 132 vs. 627 ± 293 pg/mL, $p < 0.01$), dopamine (aerobic: 7.8 ± 2.9 vs. 9.9 ± 3.4 pg/mL, resistance: 6.8 ± 2.1 vs. 12.7 ± 8.1 pg/mL, $p < 0.05$). In contrast,

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increases in IGF-1 (aerobic: 216 ± 62 vs. 214 ± 53 ng/mL, $p = 0.66$, resistance: 210 ± 47 vs. 223 ± 41 ng/mL, $p < 0.05$) and blood lactate concentrations (aerobic: 1.1 ± 0.3 vs. 1.4 ± 0.5 mmol/L, $p = 0.17$, resistance: 1.2 ± 0.3 vs. 2.8 ± 0.8 mmol/L, $p < 0.01$) were observed only after resistance exercise. BDNF concentrations did not change after exercise (aerobic: 25800 ± 5474 vs. 26192 ± 7048 pg/mL, resistance: 27417 ± 4668 vs. 25975 ± 7647 pg/mL, $p = 0.59$). **CONCLUSIONS:** Acute aerobic and resistance exercise improves cognitive function, probably due to increased central neurochemical activity. After resistance exercise, increases in IGF-1 and blood lactate concentrations might contribute to the improvements.

2494 Board #16 June 2 9:30 AM - 11:00 AM
Lifespan Physical Activity Profile, Cognitive Function And Brain Metabolism In Old Age
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 (No relationships reported)

Purpose: Physical activity during adulthood is discussed as a major preventive factor against loss of cognitive function in old age. The present study aims at analyzing the effects of lifetime physical activity (PA) on cognitive function and brain metabolism. **Methods:** Data were obtained from 50 cognitively unimpaired elderly subjects (72±5yrs, 27♀). Lifetime leisure PA was assessed by a validated questionnaire investigating five epochs across the lifespan (age in years: 14-21, 22-34, 35-50, 51-65, 66-80). Data were analyzed as average energy consumption (MET-h/wk) per epoch. Participants individual lifespan activity profile was defined as the behavior they engaged in for at least 60% of their lifetime (≥3 epochs). Referring to current activity guidelines (7.5 MET-h/wk ≈ 75' vigorous or 150' moderate PA-min/wk) and based on the individual activity profiles, subjects were stratified in 3 groups of lifetime activity behavior (MET-h/wk: <7.5 / 7.5-15 / >15). Cognitive assessment included testing of executive function (stroop interference test), verbal and non-verbal declarative memory and crystallized intelligence (MWT-B). Brain metabolism was recorded from a transversal slice just above the corpus callosum via magnetic resonance spectroscopic imaging (MRSI), and analyzed as the ratio of N-Acetylaspartate to choline (NAA/Cho). **Results:** Compared to individuals reporting less than the recommended minimum of 7.5 MET-h/wk (460ms), ANCOVA revealed significantly ($p < .05$) higher NAA/Cho values and shorter mean response times for stroop word test among those performing the recommended minimum (-50ms) and those performing ≥2 times the minimum (-60ms). Stroop interference scores were solely higher in participants performing ≥2 times the minimum recommendation. Correlation analysis showed significant associations of overall and vigorous mean lifetime PA with stroop performance ($r = .408$; $r = .410$; $p < .05$) and NAA/Cho ($r = .303$; $r = .310$; $p < .05$). **Conclusions:** The findings suggest that lifelong adherence to the minimum recommended amount of health enhancing PA results in positive effects on executive function and neuronal metabolism in old age. Exceeding minimum guideline recommendations in terms of intensity and duration might lead to additional benefits.

2495 Board #15 June 2 9:30 AM - 11:00 AM
Vascular Function And Progression Of Alzheimer's Disease
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Purpose: In aging, cerebral and systemic vascular functions (VF) decline likewise to cognitive decline. Also, reduced availability of nitric oxide (NO) in both cerebral and peripheral blood vessels results in further alterations of VF. So, changes in VF and NO availability may contribute to the development of Alzheimer's disease (AD). However, current literature lacks of evidence about the progression of AD and VF. To verify if VF is significantly reduced in AD patients compared with age-matched healthy counterparts and if VF declines further with the severity of AD. Potential correlation between VF and NO availability was also assessed. **Methods:** In 55 AD patients (severity of dementia distribution: 12 MCI, 15 AD₁, 19 AD₂, 9 AD₃), 13 healthy elderly (OLD), and 10 young (YG) subjects systemic vascular function was assessed by means of passive limb movement (PLM). NO availability was determined via plasma NO metabolites (NO₂+NO₃). **Results:** Δpeak PLM was 739 ± 150 ml/min, 284 ± 46 ml/min, 227 ± 39 , 182 ± 37 ml/min, 166 ± 22 ml/min, 155 ± 26 ml/min in YG, OLD, MCI, AD₁, AD₂, and AD₃ respectively. NO₂+NO₃ was 53 ± 9 μM, 47 ± 3 μM, 42 ± 2 μM, 40 ± 3 μM, 38 ± 3 μM, 35 ± 1 μM in YG, OLD, MCI, AD₁, AD₂, and AD₃ respectively. Correlation between Δpeak PLM and NO₂+NO₃ was $r = -0.9765$. **Conclusion:** Our results confirm that VF is reduced in aging. AD patients exhibited a further reduction of VF compared with healthy age-matched counterparts. Moreover, VF and NO availability were

progressively declined with the progression of dementia, implicating that AD and its progression might be the result of an intertwined decline of both neural and vascular functions, likely related to the NO availability.

2496 Board #16 June 2 9:30 AM - 11:00 AM
Cognitive Function is Preserved in Aged Mice Following Long-term HMB Supplementation
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Deficits to cognition and skeletal muscle strength are common in the geriatric population. These deficits worsen over time, and result in a significant decrease to one's quality of life. Thus, developing therapies that can combat these deficiencies is paramount. Beta-hydroxy-beta-methylbutyrate (HMB) is a nutritional supplement shown to enhance muscle strength with recent evidence suggesting a beneficial effect of long-term HMB supplementation on cognition. However, the specific mechanisms behind these improvements are unclear. Perivascular stem cells are located in a variety of tissue types and have substantial regenerative potential, yet the extent to which long-term HMB supplementation affects their function is unknown. **PURPOSE:** To assess the impact long-term HMB supplementation has on cognitive and skeletal muscle function in aged mice as well as the perivascular stem cell response to HMB. **METHODS:** 4 month old and 17 month old sedentary C57BL/6 mice were fed chow containing either Ca-HMB or Ca-Lactate (3.75 g/kg chow) for 24 weeks. Muscle function was measured by four-limb grip strength and body weights were recorded weekly. At 22 weeks, mice underwent rotarod testing followed by active avoidance testing. At 24 weeks, gastrocnemius muscles and brains were dissected. Half of the muscles and half of the brains were used for perivascular stem cell (muscle: CD146⁺CD31⁻CD45⁻; brain: PDGFRβ⁺CD31⁻CD45⁻) isolation via FACS. The other half was collected for histological and protein synthesis analysis. **RESULTS:** After 5 days of active avoidance testing, aged mice supplemented with HMB successfully avoided a significantly greater number of foot shocks compared to aged mice on the control diet (HMB effect, $p < 0.05$). The average time spent running on the rotarod was significantly reduced with age but unaffected by supplementation (age effect, $p < 0.05$). Neither grip strength nor muscle weight were affected. **CONCLUSIONS:** Long-term HMB supplementation beginning in middle age results in preserved cognitive function in aged mice comparable to that of young mice. These findings indicate the potential for prolonged HMB supplementation to prevent age-related declines to cognition. **Supported by Abbott Nutrition through the Center for Nutrition, Learning, and Memory at the University of Illinois at Urbana Champaign.**

2497 Board #17 June 2 9:30 AM - 11:00 AM
Learning To Suffer: High- But Not Moderate-intensity Training Increases Pain Tolerance: Results From A Randomised Study
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Purpose: To compare the effect of volume-matched high-intensity interval training (HIIT) and moderate-intensity continuous training (CONT) on ischaemic muscle pain tolerance and high-intensity exercise tolerance. **Methods:** Twenty healthy adults were randomly assigned to either 6 weeks of HIIT (6-8 x 5 min at halfway between lactate threshold and maximal oxygen uptake [50%Δ]) or volume-matched CONT (~60-80 min at 90% lactate threshold) on a cycle ergometer. Immediately pre- and post-training, participants completed a tourniquet test to examine ischaemic muscle pain tolerance and two time to exhaustion (TTE) trials at 50%Δ to examine exercise tolerance; the post-training TTE trials were completed at the pre-training 50%Δ (same absolute intensity) and the post-training 50%Δ (same relative intensity). **Results:** HIIT and CONT resulted in similar improvements in all markers of aerobic fitness ($P > 0.05$). Compared with pre-training, HIIT increased TTE at the same absolute and relative intensity as pre-training (148% and 43%, respectively) to a greater extent than CONT (38% and -4%, respectively) ($P < 0.05$). HIIT increased pain tolerance (41%, $P < 0.001$), which demonstrated moderate non-significant associations with the increase in TTE at the same relative intensity as pre-training ($r = 0.50$, $P = 0.07$), however pain tolerance was unaffected by CONT (-3%, $P > 0.05$). **Conclusion:** The repeated exposure to a high-intensity noxious exercise training stimuli increases ischemic muscle pain tolerance, which is independent of the improvements in aerobic fitness induced by endurance training. This increase in ischemic muscle pain tolerance may be an important contributor to the increase in high-intensity exercise tolerance following HIIT. **Key words:** Central nervous system; endurance; exercise tolerance; high-intensity interval training; muscle fatigue; muscle pain.

2498 Board #18 June 2 9:30 AM - 11:00 AM
Maximal Aerobic Exercise Alters Plasma BDNF And BDNF Expression In PBMCs In Obese And Non-obese
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 (No relationships reported)

Purpose: The purpose of the present study was to determine the effects of an acute bout of maximal aerobic exercise (VO_{2max}) on plasma brain-derived neurotrophic factor (BDNF) and BDNF expression in peripheral blood mononuclear cells (PBMCs) in obese and non-obese individuals. **Methods:** Anthropometric data, plasma BDNF and the BDNF expression in PBMCs as well as VO_{2max} were measured in 22 participants (9 obese, 12 non-obese). Blood samples were obtained at four time points; pre-, post-, 1-hour (R1H), and 2 hours (R2H) post-exercise. Plasma and PBMCs were isolated and analyzed for BDNF via ELISA and Western Blot techniques, respectively. A 2x4 repeated measures ANOVA was used with a Bonferroni test for post hoc comparisons. Pearson correlations were used to examine relationships between anthropometrics and VO_{2max} with BDNF measures. Significance was set at $p \leq 0.05$. **Results:** Significant group differences at pre-exercise were observed for BMI (34.5 ± 3.6 vs 21.9 ± 1.5 kg/m², $p < 0.01$), waist to hip ratio (115.5 ± 9.0 vs 94.7 ± 3.9 cm, $p < 0.01$) and V_{O2max} (31.5 ± 5.6 vs 45.7 ± 8.2 ml/kg/min⁻¹, $p < 0.01$). Post hoc comparisons revealed that plasma BDNF pre-exercise (1522.01 ± 689.18 pg/ml) was significantly ($P < 0.01$) higher than R1H (1119.52 ± 1326.40 pg/ml) and R2H (871.06 ± 815.97 pg/ml), but not post-exercise (2483.37 ± 1104.44 pg/ml) in obese individuals. Further, a significant ($p = 0.046$) group by time interaction was found from pre-exercise (0.8053 ± 0.2784 vs 0.9726 ± 0.2627 a.u.) to R1H ($1.003 \pm .4230$ vs 0.9255 ± 0.2790 a.u.) for BDNF expression in PBMCs in obese compared to non-obese individuals. A very strong correlation was observed between BMI and waist circumference ($r = 0.9$, $p < 0.01$), while moderate correlations existed between waist to hip ratio ($r = 0.51$, $p < 0.002$) and pre-exercise to R1H ($r = 0.58$, $p < 0.01$). **Conclusion:** Our results indicate a significant increase in PBMC BDNF expression from pre to R1H in obese individuals. This is consistent with other investigations suggesting a pro-inflammatory response mediated by maximal exercise. Correlations support the explanation that BDNF, both in circulation and within PBMCs is mediated by body mass, particularly when taking physical work capacity into account.

2499 Board #19 June 2 9:30 AM - 11:00 AM
The Effect of Two Types of Suspension and Un Suspension Resistance Training on Salivary Bdnf of Preadolescence Children
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Abstract

Force development, as a result of resistance training in children is mostly attributed to neural adaptations. According to high potential of neural plasticity in childhood, it is important to find the proper training methods to culminate this capability. On the other hand, BDNF is a member of the neurotrophins family which is engaged in neuromuscular adaptations due to increased muscular activity.

Purpose: the main purpose of this study is to investigate the effects of two types of suspension and unsuspension resistance training on salivary BDNF of prepubescent children.

Method: 24 immature boys (mean age 12.3 ± 0.55 , Tanner stage of 1 and 2) were divided into three groups of TRX suspension training (TRX), body weight training (BWT), and control (C). TRX and BWT groups completed training programs, two times a week for eight weeks. Saliva samples were collected before training and also 72 hours after last training session to measure salivary BDNF using ELISA method. One-way ANOVA test with significance level of 0.05 was used for comparison between groups.

Result: Although the effects of resistance training on muscle strength in the lower body was clearly observed in the experimental group, BDNF concentrations were not significantly different between the experimental and control groups ($F = 922$, $P = .411$). **Conclusion:** It is possible that the training protocol used in this study might not be long or intensive enough to make a significant change in BDNF concentration.

Keywords: Children trainability, Neurotrophic Factor, TRX

2500 Board #20 June 2 9:30 AM - 11:00 AM
Acute Forced Exercise Increases Expression of Bdnf IV and Induces Anxiety-Like Behavior in C57BL/6J Mice
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Acute exercise (AEX) is a promising intervention for improving learning and memory. The memory enhancing effects of AEX may be mediated by increased expression of neurotrophins, elevated catecholamine signaling, and modifications to postsynaptic glutamate receptors. Given the known memory enhancing effects of AEX in humans, it is important to explore how AEX and related noradrenergic signaling impact behavior in mice, which are commonly used to study the influence of exercise on brain plasticity and behavior. **PURPOSE:** To determine the effects of one acute bout of exercise on hippocampal *Bdnf* expression, AMPA receptor phosphorylation, and behavior in mice. **METHODS:** C57BL/6J mice were randomly assigned to 3 groups: control (CON; n=12); moderate-intensity AEX (MOD; n=12); and high-intensity AEX (HI; n=12). CON mice were placed on the stationary treadmill (TM) for 30 min and MOD and HI mice ran for 30 min at 12 m/min and 15-17 m/min, respectively. Mice were sacrificed immediately after AEX. mRNA from the hippocampus, including total *Bdnf* (exon IX), *Bdnf* exon IV (*Bdnf IV*), and glutamate receptor subunits were quantified with qPCR. Total and phosphorylated GluR1 (Ser845 and Ser831) protein were quantified with immunoblotting. Utilizing the same CON (n=15) and HI (n=15) TM protocol, object location memory following AEX was examined. Anxiety-like behavior was assessed in the open field task (OFT) in a subset of mice that were separated into 4 groups: CON - Saline (n=9); CON - DSP-4 (n=10); AEX - Saline (n=8); and AEX - DSP-4 (n=9). DSP-4 was used to lesion the central noradrenergic system. **RESULTS:** We observed higher *Bdnf IV* mRNA in hippocampus of HI compared to CON mice ($p = 0.03$). There was no effect of AEX on total *Bdnf* or any other mRNA or protein targets. There were no effects of AEX on memory performance in the object location task, though HI mice explored the testing arena significantly less (distance) during the initial phase of the task compared to CON ($p = 0.0003$). In the OFT, mice exposed to AEX traveled significantly less total distance ($p < 0.0001$) and spent more time grooming ($p < 0.0001$) than CON mice. There was no effect of DSP-4 on behavior. **CONCLUSIONS:** AEX increases *Bdnf IV* mRNA expression in an intensity-dependent manner; however, high-intensity AEX also induces behaviors suggestive of an anxious phenotype in C57BL/6J mice.

2501 Board #21 June 2 9:30 AM - 11:00 AM
Exercise Attenuates Chronic Unpredictable Mild Stress Induced Brain Microvascular Rarefaction In Obese Zucker Rat: Role Of Stat3 Signaling
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 (No relationships reported)

Metabolic syndrome (MetS) is associated with increased risk of mental illness. It is estimated over 7.6 % individuals in the US are affected by depression, however, pathophysiological mechanisms by which MetS and chronic stress interact to increase depression risk are largely unknown. Previous studies by our laboratories demonstrated exercise can improve chronic unpredictable mild stress (UCMS) associated cerebrovascular reactivity in lean and obese zucker rats (LZR/OZR), however, the effects of UCMS and exercise on brain microvascular density have not been examined. **PURPOSE:** The goals of this study were: 1) to determine how MetS affects brain vascular structure and function to increase the risk of depression 2) to investigate the efficacy of exercise to minimize MetS related brain vascular pathology. We tested the hypothesis that exercise prevents UCMS induced brain rarefaction in OZR, in part, by normalizing altered STAT3 signaling in brain. **METHODS:** LZR and OZR were assigned to the following groups: Control, Exercise (Ex), UCMS, and Ex_UCMS. After 8 weeks of each treatment, brains were isolated and serially section in 20 um for immunohistochemistry and western blot analyses. **RESULTS:** After 8 weeks of UCMS treatment, OZR had a significantly lower brain microvascular density (MVD) confirmed by CD31 immunostaining (100 ± 7 vs 75 ± 6 %, $p < 0.05$) and decreased CD31 protein expression (1.00 ± 0.10 vs 0.53 ± 0.06 AU, $p < 0.05$) compared with OZR control group. Decreased MVD in OZR+UCMS was accompanied with significantly elevated phosphorylation of STAT3 in the brain (1.00 ± 0.08 vs 2.48 ± 0.46 AU, $p < 0.05$). Exercise treatment significantly attenuated UCMS induced brain rarefaction (75 ± 6 vs 114 ± 6 %, $p < 0.05$) and normalized STAT3 activity in OZR+UCMS group (2.48 ± 0.46 vs 0.79 ± 0.14 AU, $p < 0.05$). Although STAT3 signaling was significantly elevated in LZR+UCMS group compared with LZR control, there was no changes in

brain MVD in LZr+UCMS group. **CONCLUSION:** Taken together, these results suggested that OZR is more susceptible to UCMS associated brain vascular structural alteration than LZr is. Importantly, exercise treatment appears to prevent UCMS associated brain rarefaction in OZR.

2502 Board #22 June 2 9:30 AM - 11:00 AM
Effects of Voluntary Wheel Running Exercise on the Circadian Alterations of Neuroendocrine Induced by Chronic Unpredictable Mild Stress in Rats
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(No relationships reported)

PURPOSE: To investigate the effect of voluntary wheel running exercise on the circadian rhythmic alterations of plasma hormone and peptide induced by the Chronic Unpredictable Mild Stress (CUMS).

METHODS: Ninety male SD rats were divided into three groups: CUMS group, EC group (Exercise plus CUMS), and Control group. The CUMS procedure consists of a variable sequence of 12 stressors. Rats were randomly exposed to two stressors every day for 3 weeks. Rats in EC group were trained in a voluntary wheel running program for a total of 8 weeks, plus CUMS procedure during the last three weeks. Blood samples were collected at each of six time points (ZT1 and 5, 9, 13, 17, 21). Plasma concentrations of corticosterone (CORT), melatonin (MT) and vasoactive intestinal peptide (VIP) were detected by ELISA kits. Data were analyzed by one-way ANOVA, and the circadian rhythms by single cosinor method.

RESULTS: Rats in Con group showed robust circadian rhythms in plasma CORT, MT and VIP. Rats in CUMS group showed an obvious disorder in circadian rhythm of plasma CORT, including phase advance and decrease in amplitude, and markedly blunted circadian rhythm. There also showed a markedly blunted circadian rhythm and decreased levels of plasma melatonin in CUMS rats compared to Con rats. VIP still has 24-hour rhythm, but the amplitude was significantly lower than that of the Con group, peak phase also delayed for 6 hours, expression was significantly higher than that of the Con group. 8-week voluntary wheel running exercise can significantly inhibit the disturbance of MT, CORT and VIP circadian rhythm, and also the abnormal expression of these hormones secretion.

CONCLUSION: CUMS induce these peptides and hormones desynchronized from SCN and voluntary wheel running exercise can rescue the disturbed circadian rhythms of these synchronizers.

Supported by the Sports Medicine key laboratory of General Administration of Sport of China/Sports Medicine key laboratory of Sichuan province Foundation.

Table1 The Comparison of CORT Circadian Property In Each Group (x±s)^a

observation times ^b	P Value ^c	Median ± SE ^d	Amplitude ^e (95%CL) ^f	Peak Phase ^g (95%CL) ^h
Con group ⁱ 30 ^j	<0.001 ^k	77.365±4.225 ^l	14.586 ^m (7.044, 22.129) ⁿ	-157.405 ^o (-182.181, -132.626) ^p
CUMS group ^q 30 ^r	<0.001 ^s	83.918±3.025 ^t	8.954 ^u (3.560, 14.354) ^v	-89.852 ^w (-116.942, 62.761) ^x
EC group ^y 30 ^z	<0.001 ^{aa}	74.366±3.356 ^{ab}	14.296 ^{ac} (8.305, 20.288) ^{ad}	-146.302 ^{ae} (-177.441, -115.161) ^{af}

Note: ^a360 degrees=24h; Phase reference: 00:00=0 degree; P<0.01, meaning existence of circadian rhythm by Single cosinor method.

Table2 The Comparison of MT Circadian Property In Each Group (x±s)^a

observation times ^b	P Value ^c	Median ± SE ^d	Amplitude ^e (95%CL) ^f	Peak Phase ^g (95%CL) ^h
Con group ⁱ 30 ^j	<0.001 ^k	5.769±0.167 ^l	1.093 ^m (0.795, 1.392) ⁿ	-359.232 ^o (-343.385, -15.081) ^p
CUMS group ^q 30 ^r	<0.001 ^s	2.773±0.158 ^t	0.718 ^u (0.436, 1.001) ^v	-149.495 ^w (-192.680, -106.311) ^x
EC group ^y 30 ^z	<0.001 ^{aa}	5.332±0.176 ^{ab}	1.037 ^{ac} (0.722, 1.351) ^{ad}	-356.925 ^{ae} (-339.267, -14.583) ^{af}

Note: ^a360 degrees=24h; Phase reference: 00:00=0 degree; P<0.01, meaning existence of circadian rhythm by Single cosinor method.

Table3 The Comparison of VIP Circadian Property In Each Group (x±s)^a

observation times ^b	P Value ^c	Median ± SE ^d	Amplitude ^e (95%CL) ^f	Peak Phase ^g (95%CL) ^h
Con group ⁱ 30 ^j	<0.001 ^k	64.420±1.823 ^l	5.915 ^m (2.661, 9.168) ⁿ	-258.505 ^o (-291.875, -225.130) ^p
CUMS group ^q 30 ^r	<0.001 ^s	81.120±2.055 ^t	3.422 ^u (0.654, 6.190) ^v	-348.738 ^w (-332.477, -14.998) ^x
EC group ^y 30 ^z	<0.001 ^{aa}	62.225±1.707 ^{ab}	5.033 ^{ac} (1.987, 8.080) ^{ad}	270.178 ^{ae} (307.429, 232.925) ^{af}

Note: ^a360 degrees=24h; Phase reference: 00:00=0 degree; P<0.01, meaning existence of circadian rhythm by Single cosinor method.

2503 Board #23 June 2 9:30 AM - 11:00 AM

Long-term Treadmill Exercise Reduces Obesity-induced Tau Hyperphosphorylation In Rat Brain

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(No relationships reported)

PURPOSE: To investigate the effects of aerobic exercise on tau phosphorylation and PI3K/Akt pathway in the hippocampus of obese rats, and provide some theoretical basis for physical activity improving obesity-related neurological disorders.

METHODS: Male Sprague-Dawley rats aged 3 weeks were randomly assigned to either a high-fat or a normal diet protocol for 12 weeks. Animals submitted to the high-fat diet were divided into two groups: sedentary group (HF-Sed) and exercise group (HF-Ex). The rats fed the normal diet were also divided into sedentary group (ND-Sed) and exercise group (ND-Ex). The rats in the HF-Ex and ND-Ex groups were underwent a treadmill training for 8 weeks. Then the hippocampus were isolated at 48h after last exercise. The protein and phosphorylation levels of tau, GSK3β, PI3K and Akt were assayed by Western blot.

RESULTS: After 8 weeks of treadmill exercise, compared with ND-Sed group, the phosphorylation levels of tau were increased significantly in the HF-Sed group. While the phosphorylation levels of tau were decreased remarkably in the HF-Ex group compared with HF-Sed group. Furthermore, compared with ND-Sed group, the activity of GSK3β was increased in the HF-Sed group by reducing Ser9 phosphorylation and increasing Tyr216 phosphorylation. But in the HF-Ex group, the activity of GSK3β was decreased significantly compared with HF-Sed group by increasing Ser9 phosphorylation and reducing Tyr216 phosphorylation. Moreover, compared with ND-Sed group, in the HF-Sed group the PI3K/Akt pathway was inhibited by reducing the protein levels of PI3K p110 and p85 subunits and the phosphorylation levels of Akt Thr308 and Ser473. But compared with HF-Sed group, the protein levels of PI3K p110 and p85 subunits and the phosphorylation levels of Akt Thr308 and Ser473 were increased remarkably in the HF-Ex group, and the activity of PI3K/Akt pathway was enhanced.

CONCLUSIONS: Obesity induces tau hyperphosphorylation in the rats hippocampus. While long-term aerobic exercise can reduce tau hyperphosphorylation by increasing PI3K/Akt pathway activity and inhibiting GSK3β activity. It has a positive effect on delaying neurofibrillary tangles formation and improving obesity-related neurological disorders.

2504 Board #24 June 2 9:30 AM - 11:00 AM

Role Of Neuronal Fractalkine In Reducing Diet-induced Hypothalamic Inflammation

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PURPOSE: Persistent exposure to an energy dense diet leads to hypothalamic inflammation and is considered an early and a determining factor for the development of metabolic disorders. Hypothalamic pro-inflammatory signals activate the glial cells, resulting in various inflammatory mediators resulting in neuronal dysfunction further promoting obesity and systemic metabolic disease. It has been reported from our lab that moderate intensity treadmill training could revert the diet-induced microglial activation in the hypothalamus. Several lines of evidence suggest that chemokines are involved in the regulation of neurodegenerative and neuroendocrine disorders.

Fractalkine (CX3CL1) is a chemokine that is secreted from neurons, which then binds to its receptor CX3CR1 on the microglia. This ligand-receptor interaction confers a resting - ramified phenotype to microglia thereby reducing hypothalamic inflammation.

AIM: The aim of the present study is to investigate the role of exercise induced fractalkine in reducing high-fat diet (HFD) induced hypothalamic inflammation.

METHODS: We determined the activation status of microglia and astrocytes in hypothalamus of C57Bl/6 mice in response to high fat-diet and exercise. High fat diet exposure for sixteen weeks induced microgliosis and astrogliosis. Microgliosis and astrogliosis were quantified by immuno-histochemical staining for Iba1 and GFAP respectively. **RESULTS:** High fat diet exposure for sixteen weeks induced microgliosis and astrogliosis. Treadmill running reversed microgliosis induced by HFD. Mice underwent an acute bout of exercise to elucidate the neuronal fractalkine response to exercise. Fractalkine mRNA expression (Q-RT-PCR) as well as protein levels (chemokine array) were increased after an acute bout of exercise. Furthermore data from RNA-sequencing after acute bout of exercise indicates that Rfx4 which is a transcriptional regulator of CX3CL1 is also up regulated in response to exercise.

CONCLUSIONS: On going studies using CX3CR1 knock out mice will elucidate the role of fractalkine-receptor signaling in HFD induced hypothalamic inflammation. Hypothalamus targeted fractalkine delivery might ameliorate diet-induced hypothalamic inflammation and associated metabolic complications.

2505 Board #25 June 2 9:30 AM - 11:00 AM
Voluntary Exercise and Expression of Energy Homeostasis-related Genes in Hypothalamus of High-fat Diet Fed Mice
 Francine P. Carvalho, Thais L. Moretto, Izabelle D. Benfato, Marcela Barthichoto, Camila A. M. Oliveira. *Federal University of Sao Paulo, Santos, Brazil.*
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 (No relationships reported)

Several strategies have been studied to combat obesity, including physical exercise. The knowledge of whether exercise can modulate the expression of genes involved in energy homeostasis in hypothalamus of diet-induced obese mice can bring additional information about the treatment of this pathology. **PURPOSE:** Investigate the effect of voluntary exercise on the hypothalamic expression of genes related to energy homeostasis in high-fat diet fed mice. **METHODS:** C57BL/6 mice were divided into 3 groups: control (C), high-fat (H) and high-fat exercise (HE). Mice had free access to food (C, chow or H, 34% fat) and running wheel (HE, 5 days/week) for 10 weeks. Hypothalamus was collected and expression of 84 obesity-related genes was assessed by RT PCR with the gene array system. The data was analyzed in the PCR Array System Data Analysis Software (Excel & Web based - SABioscience). Results are expressed as fold change. Significance was set at $p < 0.05$. **RESULTS:** High-fat diet modulated ($p < 0.05$) the expression of 14% of the 84 analyzed targets. The anorectic genes *Bdnf* (0.53 H vs C and 0.57 HE vs C), calcitonin receptor (H 0.63 and HE 0.57 vs C) and ciliary neurotrophic factor receptor (H 0.53 and HE 0.57 vs C) were downregulated in H and HE compared to C. The adrenergic receptor beta 1 (H 0.53 and HE 0.58 vs C) and interleukin 1 receptor type 1 (H 0.54 and 0.58 HE vs C) were also downregulated by high-fat diet. Neuropeptide Y receptor Y1 (H 1.06 and HE 1.15 vs C), protein tyrosine phosphatase non-receptor type 1 (H 1.07 and HE 1.15 vs C), corticotropin releasing hormone receptor 1 (H 1.06 and HE 1.14 vs C), 5-hydroxytryptamine receptor 2C (H 1.07 and HE 1.15 vs C) and zinc finger protein 91 (H 1.07 and HE 1.16 vs C) were upregulated by high-fat diet. Interleukin-1 alpha was upregulated in H (1.06 H vs C) but downregulated in HE (0.57 HE vs C). Only calcitonin receptor was not differentially expressed in HE compared to H. Except for interleukin-1 alpha, all the other genes were upregulated in HE compared to H. **CONCLUSIONS:** High-fat diet downregulated anorexigenic and prothermogenic genes and upregulated genes linked to positive energy balance, favoring obesity. Voluntary exercise only marginally modulated (small magnitude despite significant) the expression these genes, indicating a discrete central effect.

2506 Board #26 June 2 9:30 AM - 11:00 AM
Regulation Of Hypothalamic Expression Of Kiss-1 and Gpr54 Genes Mrna By Moderate-intensity Exercise In Diet Induced Obesity Rats
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 (No relationships reported)

More recently, kisspeptins are reported with a significant role in regulating glucose homeostasis, insulin secretion, as well as food intake and body composition. **Purpose:** To observe the effect of diet induced obesity on the hypothalamic expression of KiSS-1 and the G-protein coupled receptor (GPR) 54 mRNA and explore the modulatory role of moderate-intensity exercise in the diet induced obesity male rats. **Methods:** After 8 weeks high fat feeding, 20 obesity 11-weeks SD rats were randomly assigned to high-fat diet sedentary (FS, n=8) and high-fat diet exercise (FE, n=8) groups, 20 normal diet 11-weeks SD rats also were randomly assigned to sedentary (SS, n=8) and exercise (SE, n=8) groups. During the following 8 weeks, obesity rats were continued expose to high-fat-diet. SE and FE groups did the 60%-70% $V(\bullet)O_2$ max treadmill training (5 days/week, 1 hour/day). The $V(\bullet)O_2$ max of exercise groups were remeasured every two weeks. The hypothalamic expression of KiSS-1 and GPR54 mRNA were tested in each group. **Results:** After the first 8-weeks high fat feeding, the obesity rats were heavier than normal diet group (491.74±26.19g vs. 410.05±45.77g, $p < 0.01$). After 8-weeks training, the FE group was lighter than FS group (590.23±35.74g vs. 681±52.56, $p < 0.01$). The FS group had higher hypothalamic expression of KiSS-1 mRNA (1.51±0.66 vs 0.75±0.27, $p < 0.05$) and GPR54 mRNA (2.45±0.38 vs 0.61±0.15, $p < 0.01$) than SS group. The FE group had lower hypothalamic expression of KiSS-1 mRNA (0.69±0.13, $p > 0.05$) and GPR54 mRNA (0.58±0.10, $p < 0.01$) than FS group. **Conclusion:** There is stimulating effect of high-fat diet induced obesity on hypothalamic expression of KiSS-1 and GPR54 mRNA. 8-weeks 60%-70% $V(\bullet)O_2$ max treadmill training could cure this effect.

2507 Board #27 June 2 9:30 AM - 11:00 AM
Hypothalamic Leptin Signaling Modulates Spontaneous Physical Activity During Ageing in Mice.
 Izabelle Dias Benfato¹, Francine Pereira De Carvalho, MSc¹, Thais Ludmilla Moretto, MSc¹, Marcela Barthichoto, MSc¹, Sandra Mara Ferreira, PhD², José Maria Costa Júnior, PhD², Carolina Martinez, MSc¹, Carolina Prado de França Carvalho, PhD¹, Camila Aparecida Machado de Oliveira, PhD¹. ¹FEDERAL UNIVERSITY OF SÃO PAULO, SANTOS, Brazil. ²STATE UNIVERSITY OF CAMPINAS, CAMPINAS, Brazil.
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Spontaneous physical activity (SPA) comprehends all daily physical activities other than volitional exercise (e.g. sports-related activities). The energy spent in SPA can represent up to 50% of the total daily energy expenditure. Little is known regarding the biological regulation of SPA, especially during ageing, when SPA is known to decline. As a mediator of energy homeostasis, hypothalamic leptin signaling may be involved. **PURPOSE:** to investigate the temporal relationship between hypothalamic leptin signaling and SPA in mice from 4 to 10 months of age. **METHODS:** Male C57bl/6 mice were divided into three groups, according to age: 4 (4M, n=10), 6 (6M, n=10) and 10 (10M, n=20) months-old mice. SPA, distance travelled (DT), average speed of locomotion (AS) and energy expenditure (EE) were measured monthly from 4 to 10 months of age in the 10M group. Hypothalamic expression of STAT3 and phosphorylated STAT3 (pSTAT3) by Western Blotting, intraperitoneal glucose tolerance test (ipGTT), and retroperitoneal (RAT) and epididymal (EAT) adipose tissue weight were determined in all the groups (4M, 6M and 10M). Results are shown as mean + standard error of the mean. Repeated measures ANOVA or One-way ANOVA were employed and the Newman-Keuls post hoc test was used when necessary. Significance was set at $p < 0.05$. **RESULTS:** Compared to the 4th month, SPA, DT and AS started to decrease in the 6th month ($p < 0.05$) and persisted reduced all over (SPA 30%; DT 25%; AS 25% decrease in the 10th month). EE decreased ($p < 0.05$) in the last three months (19% decrease in the 10th month). Hypothalamic pSTAT3 decreased ($p < 0.05$) in 6M and 10M in relation to 4M (4M: 0.83 + 0.28; 6M: 0.52 + 0.16*; 10M: 0.53 + 0.17* arbitrary units). STAT3 decreased 45% in 10M compared with 6M, but it was not statistically significant ($p = 0.09$). The area under the curve of ipGTT (4M: 31,228 + 9,875; 6M: 36,776* + 11,629 10M: 40,544* + 13,514 mg/dL x 120 minutes), and the weight of RAT (4M: 3.76 + 1.19; 6M: 9.58* + 3.03; 10M: 9.76* + 3.25 mg/g) and EAT (4M: 14.59 + 4.61; 6M: 29.28* + 9.26; 10M: 26.87* + 8.96 mg/g) increased ($p < 0.05$) in 6M and 10M groups when compared to 4M group. **CONCLUSIONS:** Decreases in SPA, DT and AS were accompanied by a reduction of hypothalamic leptin signaling. Besides, glucose intolerance and increased fat pads weight manifested when SPA declined. **Supported by: FAPESP and CAPES.**

2508 Board #28 June 2 9:30 AM - 11:00 AM
Influences Of Swimming On Learning And Memory And Expression Of Orexin And Ncam In Rat Hippocampus
 Qiongjia Yuan, Female¹, Yeting Zhang, Male², Xue Li, Female¹, Lu Wang, Female¹. ¹Chengdu Sport Institute, Chengdu, China. ²Chengdu University, Chengdu, China.
 (No relationships reported)

PURPOSE: Through the different load intensity swimming exercise intervention in rats, we observed that the movement influenced on rats spatial learning and memory ability and detected the proteins expression of rat hippocampal. **METHODS:** 30 male SD rats were selected. After acclimatization to the laboratory for 1 week, the rats were randomly divided into 3 groups: Control Group(C), Medium load Group (M), over load Group (O). Group C were feed naturally; group M did swimming exercise intervention; group O did over load swimming exercise. The Morris Water Maze test (MWM) was performed to evaluate spatial learning and memory ability. Tissue samples were collected after the MWM test. 6 whole brain samples for immunofluorescence assay, while the bilateral hippocampus of the other 6 brains for western blot and real-time PCR analysis. **RESULTS:** (1) Blood testosterone detections: there was no significantly difference between group M and C ($P > 0.05$), the blood testosterone of group O was significantly lower than group M and C ($P < 0.01$); (2) MWM detection: during the navigation experiment, group M was easier to find the platform than group C ($P < 0.01$). During the space exploration, rats in group M crossed where the platform was fixed more often than group C and O ($p < 0.05$), rats in group C crossed where the platform was fixed more often than group O ($p < 0.05$); (3) mRNA detection: the expression of NCAM mRNA and OXA mRNA of group M were significantly higher than group C ($P < 0.05$), OX1R mRNA of group M was significantly lower than group C ($P < 0.05$); (4) Protein detection: the expression of NCAM of group M was significantly higher than group C ($P < 0.05$), the group O was significantly lower than group C ($P < 0.05$). **CONCLUSION:** Medium load swimming exercise could improve the rats spatial learning and memory ability and significantly improve the expression of OXA, OX1R

mRNA and OX1R, and significantly reduce the expression of OXA, OX1R mRNA, OX1R; Over load swimming exercise could damage the spatial learning and memory ability of rats, after over load swimming exercise, the expression of NCAM, OXA and OX1R was normal. **Acknowledgments:** Supported by the National Natural Science Foundation of China (No.31371202). Supported by the Sports Medicine key laboratory of State Administration of Sports/ Sichuan province Foundation.

E-25 Free Communication/Poster - Age and Gender Issues

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2509 Board #29 June 2 11:00 AM - 12:30 PM An Analysis of Female Athlete Triad Components in Elite Para-Athletes

Cheri A. Blauwet¹, Emily M. Brook¹, Adam S. Tenforde¹, Elizabeth Broad², Elizabeth G. Matzkin¹. ¹Brigham and Women's Hospital/Harvard Medical School, Boston, MA. ²United States Olympic Committee, Chula Vista, CA.
(No relationships reported)

The Female Athlete Triad (Triad) is a syndrome defined as the interaction of three interrelated conditions: low energy availability with or without disordered eating, menstrual dysfunction, and low bone mineral density (BMD). The Triad may also impact males, and may have long term health consequences if unaddressed. Although participation in elite para-sport is rapidly growing, no studies have assessed the prevalence of Triad risk factors in this population.

PURPOSE: To evaluate the prevalence of Triad risk factors in an elite para-athlete population and association to sex and para-sport type.

METHODS: Subjects were United States para-sport athletes who were training to qualify for the 2016 Summer or the 2018 Winter Paralympic Games. Participants completed an online questionnaire characterizing nutrition, menstrual status (if female), bone health, and awareness of the triad. Responses were analyzed to determine overall prevalence of Triad components, and significant differences based on sex and sport type (leanness vs. non-leanness).

RESULTS: A total of 248 (144 male, 104 female) athletes completed the survey. Of these, 137 athletes competed in leanness sports and 109 athletes in non-leanness sports. Of the cohort, 40% (53 male, 45 female) of athletes indicated that they were currently trying to lose weight, and 61% (n = 151; 90 male, 61 female) indicated they were attempting to change their body composition to improve sport performance. Only 3% (1 male, 6 female) of athletes indicated that they had been previously diagnosed with an eating disorder. For pre-menopausal women, 32% (n = 29) reported less than 9 menstrual cycles in the past year. A total of 21% (27 male, 25 female) of athletes reported a history of a bone stress injury, yet 9% (8 male, 13 female) reported a diagnosis of low BMD based on DXA scan. There were no differences in risk factor prevalence between sexes or those competing in leanness versus non-leanness sports. Only 9% of athletes were aware of the Triad.

CONCLUSIONS: Elite para-sport athletes have high prevalence of Triad components, regardless of sex or sport type. Awareness of the Triad in athletes is low. While consequences of the Triad in a para-athlete population are poorly understood, screening tools and education to increase awareness are required to optimize overall health of this population.

2510 Board #30 June 2 11:00 AM - 12:30 PM Sex Differences in Competition Volume, Club Sport Participation, Specialization, and Injury Among High School Athletes

Eric G. Post, David R. Bell, Stephanie M. Trigsted, Dan A. Schaefer, Madeline M. Miller, Adam Y. Pfaller, Scott B. Hetzel, M. Alison Brooks, Timothy A. McGuine. *University of Wisconsin-Madison, Madison, WI.*
(No relationships reported)

Female adolescent athletes are at greater risk for certain injuries, such as ACL injuries or overuse knee injuries. One theory for this increased risk is the increasing trend towards intense, year-round sport participation and specialization. However, it is unknown whether characteristics of sport participation, including competition volume, club sport participation, specialization, or history of lower extremity injury (LEI) differ between female and male athletes.

PURPOSE: To compare level of competition volume, club sport participation, sport specialization, and previous lower LEI between males and females in high school athletes.

METHODS: 1525 high school athletes (780 female, age=16.1±1.1 years old, grades 9-12) from 29 high schools were recruited to complete a pre-season questionnaire regarding their sport participation patterns and previous injury history. Sport competition volume in the previous 12 months was classified as high (>60 competitions), moderate (30-60 competitions), or low (<30 competitions). Sport specialization status was classified as low, moderate, or high using a widely utilized 3-point specialization scale. Chi-square tests were used to investigate associations of competition volume, club sport participation, specialization, and LEI by sex (a-priori p<.05). **RESULTS:** Females were more likely than males to participate in high competition volume (23.2% vs 11.0%, $\chi^2=84.7$, p<0.001), participate on a club team (61.2% vs 37.2%, $\chi^2=88.3$, p<0.001), and be highly specialized (16.4% vs 10.4%, $\chi^2=19.7$, p<0.001). A total of 487 subjects (31.5%) reported sustaining a total of 599 previous time-loss LEI. Female athletes were more likely to report a previous LEI than males when considering all sports (36.5% vs. 27.0%, $\chi^2=15.9$, p<0.001) and when the sample was restricted to sex-equivalent sports (37.3% vs. 28.2%, $\chi^2=9.0$, p=0.003). **CONCLUSIONS:** Female athletes were more likely to participate in sports at high volumes, on club teams in addition to their high school teams, be highly specialized, and report previous LEI. Female high school athletes may be at greater risk of injury due to these differences in sport participation patterns. Supported by grants from the American Medical Society for Sports Medicine and the National Federation of State High School Associations.

2511 Board #31 June 2 11:00 AM - 12:30 PM Chronic Training Load, But Not Stress Or Sleep, Is An Independent Predictor Of Illness In Female Youth Athletes

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(No relationships reported)

Although training load and subjective well-being have been suggested as risk factors for injury, their relationship with illness in youth athletes is unknown. **Purpose:** To determine whether training load, stress or sleep are independent predictors of in-season illness in female youth soccer players. **Methods:** 69 female soccer players (13-18 years) were monitored for 10 months of formal competition. Daily training load (TL) was determined by session-rating of perceived exertion (duration [min] x intensity [1-10]). Every morning, participants recorded sleep hours and rated stress from -3 to +3 (higher being better) and illnesses were recorded throughout the year. Data were aggregated weekly and 2, 3, and 4 week rolling averages were calculated as well as an acute:chronic workload ratio (A:C; weekly divided by 4-week TL). TL measures were converted to z-scores and Poisson regression analyses were used to compare the relative abilities of the different TL measures to predict the number of illnesses the following week. Based on this, 2-week TL was classified as low, moderate-low, moderate-high, high, or very high using z-scores, and the relative risk of subsequent illness was compared between the groups. Finally, a multivariable Poisson regression was developed to predict the number of weekly illnesses, using 2-week TL, sleep, and stress values as covariates. **Results:** 73 illnesses occurred during the 10 months of competition. Weekly illnesses were significantly and similarly predicted by the preceding 2-week TL (OR=1.74, p<0.001), 3-week TL (OR=1.71, p<0.001), and 4-week TL (OR=1.70, p<0.001), but not 1-week TL (OR=1.21, p=0.15) or A:C (OR=1.22, p=0.22). Compared to low 2-week TL, the risk of illness was increased following 2-week periods of high (RR=2.0) and very high TL (RR=3.5). After inclusion in the multivariable model, 2-week TL remained a significant, independent predictor of subsequent weekly illness (OR=1.81, p<0.001) while sleep (OR=0.78, p=0.80) and stress (OR=0.42, p=0.50) did not. **Conclusion:** After controlling for sleep and stress, chronic training load is a significant, independent predictor of illness risk, while weekly TL and A:C are not. Monitoring cumulative TL over 2 or more weeks during the competitive season may allow for intervention to reduce the risk of illness in adolescent female athletes.

2512 Board #32 June 2 11:00 AM - 12:30 PM Influence Of Year In School On Health-related Quality Of Life Among Collegiate Athletes

Jennifer L. Sanfilippo, Liga A. Blyholder, Timothy A. McGuine, Bryan C. Heidershceit. *UW-Madison, Madison, WI.* (Sponsor: Joseph Weir, FACSM)
(No relationships reported)

Transitioning from high school to college can be a difficult experience; freshmen must adapt to life away from home, new responsibilities, and higher academic demands. For collegiate athletes, this transition also requires adjusting to more rigorous training and greater performance pressures. Together, these stressors may negatively impact health-related quality of life (HRQoL) among freshmen collegiate athletes. **PURPOSE:** To examine changes in HRQoL over a competitive season among freshmen and senior collegiate athletes. **METHODS:** 69 freshmen (age=18.2±0.47, male=56) and 23 senior (age=21.4±0.49, male=14) collegiate athletes at a large, Division I university

completed the Short Form 12v2.0 Acute Recall (SF-12) prior to the start of the competitive season (PRE) and within 1 month following the end of the competitive season (POST). Participants included athletes who did not sustain an injury during the season or 6 months prior to PRE competing in football (freshman=36, senior=12), soccer (freshman=16, senior=3), and cross country (freshman=17, senior=8) over the 2013-2014 or 2014-2015 seasons. Raw scores were converted to norm-based scores via a linear z-score transformation. Changes (median (IQR)) in PRE to POST Mental Composite Score (MCS) and Physical Composite Score (PCS) were analyzed using Wilcoxon signed-rank tests. **RESULTS:** MCS significantly decreased ($p<0.001$) pre- to post-season among freshmen collegiate athletes (PRE=57.06 (54.79, 59.43), POST=54.67 (48.93, 57.06)). This decrease was observed in both males and females ($p<0.001$ and $p=0.027$, respectively). There was no change ($p=0.341$) in PCS among freshmen. Among senior collegiate athletes, MCS (PRE=55.34 (54.22, 58.26), POST=54.20 (49.50, 58.10)) and PCS (PRE=57.47 (54.39, 57.84), POST=56.71 (55.34, 58.40)) did not change significantly pre- to post-season ($p=0.487$ and $p=0.889$, respectively). **CONCLUSION:** Among freshmen collegiate athletes, mental aspects of HRQoL decreased over the course of the competitive season. Transitioning from high school to collegiate academics and athletics may produce high levels of psychological stress that can negatively impact HRQoL. University athletic programs should consider offering stress-management and counseling services to help incoming freshmen athletes adjust to college life.

2513 Board #33 June 2 11:00 AM - 12:30 PM
In-season Injury And Health-related Quality Of Life Among Collegiate Athletes

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For many athletes, sport-related musculoskeletal (MSK) injuries result in significant time loss from activity and declines in athletic performance. These events may negatively impact health-related quality of life (HRQoL). **PURPOSE:** To determine the effect of MSK injuries sustained during the competitive season on HRQoL among collegiate athletes. **METHODS:** 160 Division I collegiate athletes (mean age=19.6±1.4, 117 males) at a large public university completed the Short Form 12v2.0 Acute Recall (SF-12) prior to the start of the competitive season (PRE) and within 1 month following the end of the competitive season (POST). Participants included athletes not injured in the prior 6 months who competed in football (n=73), soccer (n=43), cross country (n=35), and volleyball (n=9). Data on injuries sustained during the season was collected from a medical database maintained by sports medicine staff. SF-12 raw scores were converted to norm-based scores via a linear z-score transformation. Differences (median (IQR)) in PRE and POST Mental Composite Score (MCS) and Physical Composite Score (PCS) were analyzed using Wilcoxon signed-rank and Mann Whitney U tests. **RESULTS:** Among athletes who suffered an in-season MSK injury (n=55), PCS significantly decreased ($p=0.023$) over the season (PRE=56.71 (54.24, 57.76), POST=55.86 (52.14, 56.71)) while MCS remained unchanged ($p=0.208$). Athletes who underwent surgery during the season (n=10) showed no change in PCS ($p=0.097$) or MCS ($p=0.722$). Among athletes who did not sustain an injury (n=105), MCS significantly decreased ($p=0.003$) pre- to postseason (PRE=57.06 (54.10, 59.43), POST=54.79 (51.73, 57.16)) while PCS did not change ($p=0.289$). Postseason PCS was significantly lower ($p<0.001$) among athletes who underwent surgery (POST=51.63 (48.72, 54.95)) and among athletes who suffered a MSK injury (POST=55.86 (52.14, 56.71)) compared to uninjured athletes (POST=56.71 (55.09, 57.76)). **CONCLUSION:** Among collegiate athletes, in-season MSK injury negatively affected physical aspects of HRQoL. Sports medicine providers should be aware that MSK injury can impact, not only athletic performance, but also self-perceived physical health and function among collegiate athletes.

2514 Board #34 June 2 11:00 AM - 12:30 PM
The Assessment Of Body Composition In Young Athletes

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 (No relationships reported)

Purpose: In this study we have compared the body composition of elite athletes practicing two different sports, we also evaluated bone health in cyclists. **Methods:** we enrolled 64 male athletes (15-21 years old): 52 soccer players and 12 cyclists, belonging to same soccer or cycling team. The athletes were subjected to anthropometric evaluations, measurements of circumferences and skinfolds, DXA and BIA. Specifically, using Durnin & Rahaman formula we evaluated fat mass (FM) and fat free mass (FFM). With DXA we evaluated Whole Body Total Fat (WBTF), Whole Body Total Lean (WBTL), Whole Body Total Mass (WBTM) and Whole Body Total

Percentage of Fat(WBTF). Furthermore BIA allowed us to measure Body Cellular Mass (BCM); Total Body Water (TBW); intracellular water (ICW), extracellular water (ECW) and the index of hydration. Cyclists were also subjected to blood samplings. **Results:** In soccer players we observed (data expressed in Means) BMI 21.75. Waist, hip and bicep circumferences were 73,03; 91,51 and 26,69 cm respectively. Skinfolds sum was 54,57 mm. FM was 16,8% (12,0 kg) and FFM was 59,0 kg. DXA results were: 12,6 kg WBTF, 60,7kg WBTL and 17,2% WBTF. BIA results were: 63,3 kg of FFM. BCM, TBW, ICW, ECW were: 39,03kg; 46,4L; 52% and 48%, respectively. Index of hydration was 6,6. In cyclists we observed: BMI 21,79. Waist, hip and bicep circumferences were 74,08, 94,38 and 29,13 cm. Skinfolds sum was 65,28 mm. FM was 14,5% (9,9 kg) and FFM was 58,1 kg. DXA results were: 12,1 kg WBTF, 57,96 kg WBTL and 17,14% WBTF. BIA results were: 58 kg of FFM. BCM, TBW, ICW, ECW were: 33,63kg; 43,4L; 55,9%; 44,1 %, respectively. Index of hydration was 7,2. Sieric mean value of Vitamine D was 29,87 ng/ml; Z score was -2,9. **Conclusions:** In athletes playing ciclismo we observed, in addition to a minor concentration of FM, a lower percentage of FFM, mostly due to a reduction of bone mineral density (BMD), in line with former studies. Moreover, this study underlines how cycling can induce a significant reduction of BMD. Therefore we should suggest a suspension of this activity for a period of about three or four months per year.

2515 Board #35 June 2 11:00 AM - 12:30 PM
A Wellness Program for Older Female Golfers: Effects on Golf Performance and Range of Motion

Katherine James, Michael Rabel, Lorraine Lacoppola, Erin Ruest. *University of Maryland Eastern Shore, Princess Anne, MD.*
 (No relationships reported)

PURPOSE: To compare the effect of a wellness program on range of motion (ROM) and golf performance in older female golfers. **METHODS:** Twenty-five healthy, right-handed, female golfers were randomly assigned to either an intervention (N=12; mean age ± SD, 60.3 ± 6.8) or control (N=13; mean age ± SD, 65.9 ± 5.4) group. Baseline measures included shoulder, hip, and trunk rotation passive ROM using inclinometers, club head speed (CHS), and self-reported golf performance. The intervention group received a wellness program consisting of flexibility and strengthening exercises. The flexibility component incorporated one exercise for each of the following regions: shoulder, hip, and trunk. The three strengthening exercises focused on abdominal and hip musculature. A daily exercise log was used to monitor compliance with the wellness program. Subjects were reassessed after five weeks. Repeated measures ANOVAs, with age as a covariate, were performed to determine whether pre and post measures differed between groups. **RESULTS:** The intervention group demonstrated a significant increase in all shoulder rotation ROM values ($P\leq 0.03$) with the exception of right internal rotation. For the same group, self-reported golf performance scores ($P=.02$) improved significantly. No significant change in CHS was identified for either group. **CONCLUSION:** The shoulder exercise (cross-body stretch) used in the wellness program has been found to improve shoulder ROM in young adults. This study shows that the exercise may also be effective for older females. While all ROM measures improved for the intervention group, additional time may have been needed to demonstrate significant change. In general, research concerning the female golfer remains limited. This study begins to define a wellness program for female golfers that could easily be incorporated into their daily routine.

2516 Board #36 June 2 11:00 AM - 12:30 PM
Investigating the Acute Effects of Olympic-style Boxing Among Females

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 (No relationships reported)

Although diagnosed concussions affect balance control, dual-task abilities, visual functions, and neurocognitive functions, few prospective investigations have examined how head impacts sustained during an Olympic-style boxing tournament that do not result in a concussion, so-called sub-concussive blows, affect performance. Female boxers, in particular, have received scant attention in the boxing literature to date. **Purpose:** To prospectively examine the neurocognitive, postural control, dual-task, and visual abilities of female Olympic-style boxers before and after participation in a boxing tournament. **Methods:** Sixty-one females completed the modified Balance Error Scoring System (mBESS), King-Devick test, and 3m timed-up-and-go (TUG) test in single-task and dual-task conditions. A subset (n= 31) also completed the CogState computerized neurocognitive test. Initial testing was completed prior to the 2016 Women's World Boxing Championships and each participant repeated the testing protocol within a day of elimination. Pre-tournament and post-tournament performance

variables were compared using paired samples t-tests. **Results:** Participants (mean age = 26.1 ± 4.6 years) completed a mean of 7.5 ± 4.5 rounds of Olympic-style boxing over the course of 2-8 days. Pre-tournament scores were significantly worse than post-tournament scores for total mBESS (5.5±2.9 errors vs. 2.2±1.9 errors, p<.001, d= 1.23) and King-Devick time (18.0±8.3 s vs. 14.2±3.9 s, p= .002, d= 0.53). Processing speed was significantly slower prior to the boxing tournament (maze chase task: 1.17±0.44 correct moves/second vs. 1.39±0.34 correct moves/second, p= .001, d= 0.58). No significant changes between testing sessions were detected for the other obtained outcome variables. **Conclusion:** Female boxers demonstrated either improvement or no significant change after competing in an Olympic-style boxing tournament, relative to pre-tournament performance. As many of the tasks employed in our testing battery are novel, practice effects may have contributed to improved performance. Given the relatively short time frame between assessments, clinicians should be aware of potential practice effects when using ringside tests in the diagnosis and management of concussion.

2517 Board #37 June 2 11:00 AM - 12:30 PM

The Influence Of Oral Contraceptives On Subjective Physical Condition And Athletic Performance In Japanese Female Athletes.

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(No relationships reported)

In Japan, the prevalence of dysmenorrhea and premenstrual syndrome (PMS) in elite female athletes are 25.6 % and 70.3% respectively (Ogura-Nose et al., 2014). However, the use of oral contraceptives (OC) in Japanese female athletes is low (2%)(Ogura-Nose et al., 2014). One of the reasons is because athletes are concerned about the side effects taking OC might have adverse effects on athletic performance. **PURPOSE:** To examine the influence of OC on subjective condition and athletic performance. **METHODS:** Fourteen female athletes were recruited. All subjects were examined during the follicular (F) and luteal (L) phases, OC (days 10-20 of their OC use) and withdrawal-bleeding (W) phase (days 2-5 post OC phase). Each phase of the menstrual cycle was confirmed by serum luteinizing hormone (LH), follicular stimulating hormone (FSH), estradiol, and progesterone levels. After natural menstrual cycle tests, all subjects began taking OC. Monophasic OC with ultra low-dose was used. A post-exercise cardiovascular reactivation test, lactate curve test, oxygen consumption (VO₂max) test, and Wingate test were performed during all phases. In addition, subjective fatigue, mood states and subjectively perceived daily training load were estimated on visual analog scales (100mm). All parameters were analyzed by tow-way analysis of variance for repeated measurements. **RESULTS:** There were no significant changes in subjective physical condition, post-exercise cardiovascular reactivation, VO₂max, and time to exhaustion during all phases. No significant changes in peak power, and mean power of Wingate test were observed. However, at the time of the low-intensity exercise (< 2mmol/L) in lactate curve test, lactic acid values were high during the OC and W phase (OC: 1.6.0 ± 0.4, W: 1.5 ± 0.4 mmol/L) compared with the natural cycle (F: 1.3 ± 0.3, L: 1.3 ± 0.3 mmol/L, P < 0.05). In Wingate test, maximum lactate value after the Wingate test was high during the OC and W phase (OC: 12.0 ± 2.4, W: 12.0 ± 2.6 mmol/L) compared with the natural cycle (F: 11.2 ± 2.2, L: 11.1 ± 1.9 mmol/L, P < 0.05). **CONCLUSION:** These results suggest that ultra low-dose monophasic OC had no influence on athletic performance. Further research is needed regarding the influence of OC on the glycolytic pathway. Supported by Japan Sports Agency's consignment fund.

2518 Board #38 June 2 11:00 AM - 12:30 PM

The Prevalence and Impact of Heavy Menstrual Bleeding Among Exercising Women.

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PURPOSE: Heavy menstrual bleeding (HMB), which includes flooding through clothes, frequent changes of sanitary products, needing extra protection, and/or passing large clots, is prevalent among exercising females in the UK. HMB has negative associations with training and performance and an increased risk of iron deficiency. The aim of this study was to identify the prevalence, associated characteristics, and the impact of HMB within an American exercising female population. **METHODS:** 532 females, ages 15-30 years, who exercise ≥ 4 hours per week and presented to a US-based Sports Medicine clinic, were invited to complete a questionnaire incorporating: a four-part diagnostic series for HMB; menstrual cycle characteristics such as typical duration and frequency; reported impacts on training and performance; cramping and bloating symptoms; and the seeking of medical advice for heavy periods. **RESULTS:** HMB prevalence was 29.7%, while 30.6% reported that their menstrual cycle impacts

their training and performance. These were significantly related, with more than half (52.5%) of those with HMB reporting that their menstrual cycle affects their training and performance (X₂= 50.687; p<0.05). However, only 41.8% with HMB reported seeking medical advice. On average, those with HMB reported longer bleeding days per cycle than those without HMB (5.3 days vs. 4.5 days, t=-5.554; p<0.05), but there was no difference in total number of periods per year (p>0.05). Those with HMB were more likely to report experiencing non-menstrual cycle related cramps (X₂= 19.562; p<0.05) and feelings of gaseous bloating (X₂= 19.072; p<0.05). **CONCLUSIONS:** HMB is linked to negative impacts on training and performance, a longer menstrual cycle, cramping and bloating among American adolescent and young adult exercising females. Further research is required to elucidate the physical and psychological effects of HMB and the clinical implications.

2519 Board #39 June 2 11:00 AM - 12:30 PM

Preliminary Evidence Of Sub-optimal Sleep Durations In Trained Middle Eastern Adolescent Soccer Players

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Sub-optimal sleep durations relative to the National Sleep Foundations (NSF) guidelines of 8-10 h per night are seen in adolescents globally, with the Middle East region having specific lifestyle, environmental and cultural nuances which exacerbate these deficiencies. These deficiencies are due to general and athlete specific negotiable (eg pre-bed screen time, socialising, etc) and non-negotiable (eg schooling, travel, etc) factors. This is concerning given the proposed relationship between sleep and illness/injury risk, athletic performance/recovery and holistic athlete development. **PURPOSE:** Characterise sleep in trained adolescent Middle Eastern soccer players pre- and post-match and the influence of pre-dawn sleep interruption upon these characteristics. **METHODS:** During a 17 day training camp sleep was assessed in 20 male trained adolescent Middle Eastern soccer players prior to (PRE) and night of (POST) three discrete matches (MATCH 1, 2 and 3) on day 5, 9 and 13 of the camp. Quantitative sleep values were obtained by wrist actigraphy, with activity count interpretation determining bedtime (hh:mm), get-up time (hh:mm), time in bed (h), sleep duration (h) and sleep efficiency (%) as well as whether a player did (YES) or did not (NO) experience pre-dawn sleep interruption. In YES sleep was seen in two bouts, BOUT1 - pre-dawn intermission - BOUT2. Linear mixed models were used to analyse data. **RESULTS:** On average these players do not meet NSF endorsed minimum sleep durations PRE and POST match (6.97 ± 1.27 h vs. recommended 8-10 h) with deficits significantly exacerbated (-10% or -0.76 h) in YES compared to NO (6.49 ± 1.05 h vs. 7.43 ± 1.29 h, p<0.01). Sleep efficiencies were less than the recommended 85% on average across all players (82.13 ± 7.04), and in YES, NO, BOUT1 and BOUT2. No differences in any sleep characteristics were observed between BOUT1 and BOUT2 (p>0.05). **CONCLUSION:** Deficiencies in these players of duration and quality of sleep relative to recommendations may jeopardize athletic development/recovery and holistic adolescent maturation. Given the high inter- and intra-individual variances in sleep characteristics seen, these players require from their practitioners individualised sleep education strategies/interventions, without reliance on sleep medications.

2520 Board #40 June 2 11:00 AM - 12:30 PM

Influence of Sports Participation and Bone Stress Injury Anatomical Location on Low Bone Mineral Density in Male Athletes

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PURPOSE: Sports participation can provide health benefits to male athletes, including improvements in bone mineral density (BMD) and strength. However, a subset of male athletes may experience impaired bone health associated with sports participation. The aim of this study was to identify the association of sports type and bone stress injury (BSI) location with low BMD (defined as BMD Z-scores < -1) in male athletes. **METHODS:** A retrospective chart review was performed on male athletes (ages 14 - 35 years) referred to a single tertiary-care center for evaluation of BMD following development of one or more BSI. We excluded non-athletes, fractures from trauma, medical conditions that predispose to low BMD, and athletes taking medication(s) that could negatively influence bone health. Analysis is descriptive and demonstrates proportion of athletes with low BMD by sport type (runner versus other athletes) and location of BSI using Fisher exact test with significance at P<0.05. **RESULTS:** Low BMD was observed in 16 of 37 athletes. Low BMD was more common in runners (11 of 19, 58%) compared to other sports (4 of 18, 22%, P=0.045). Of athletes sustaining BSI in regions of higher trabecular bone content (localized to lumbar spine, pelvis, femoral neck, or calcaneus) 61% (11 of 18) had low BMD. Low BMD was less

common in athletes with BSI in anatomical sites with primarily cortical bone content ($P=0.02$), including tibia (3 of 10), metatarsal (1 of 4), femur (0 of 3), tarsal navicular (0 of 1), and rib (0 of 1). **CONCLUSIONS:** A subset of athletes with history of BSI met criteria for low BMD; runners and athletes who sustain BSI in regions of higher trabecular bone content appear at increased risk. Clinicians should consider screening male athletes for low BMD and consider methods to optimize bone health in this population.

2521 Board #41 June 2 11:00 AM - 12:30 PM
Pediatric and Adult CrossFit Injuries Presenting to a Sports Medicine Clinic
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 (No relationships reported)

PURPOSE: To evaluate and compare both pediatric and adult CrossFit injuries presenting to a sports medicine clinic. **METHODS:** A retrospective chart review was performed of all medical records (age ranges from 8 to 54 years) in an academic tertiary hospital's sports medicine clinic between January 1, 2003 through June 31, 2016. Patients were selected if "CrossFit" was identified in their records ($n=312$) and excluded if injuries were deemed not related to CrossFit ($n=166$), CrossFit participation was questionable ($n=25$), or patient had medical conditions that could influence their risk for injury outside of CrossFit ($n=6$). Data collection included sex, age, injury site, diagnosis, diagnostic imaging, and treatment. Injury site, diagnosis, diagnostic imaging, and treatments were descriptively analyzed. Chi-square (χ^2) analyses were employed to compare CrossFit injuries based on sex and age with a significance level of 0.05. **RESULTS:** A total of 115 medical charts met inclusion criteria (male: $N=55$ female: $N=60$ age: 25.2 ± 10.4). The most common injury sites were: knee (27.0%), spine (24.3%), and shoulder (16.5%). The top five diagnoses were muscle strain (6.1%), back pain (5.2%), patellofemoral stress syndrome (PFSS) (4.3%), labral tears (4.3%) from hip (2.6%) and shoulder (1.7%) joints, shoulder pain (4.3%), and knee pain (4.3%). Diagnostics included MRI (46.0%), plain radiographs (39.2%), CT (7.4%), and ultrasound (7.4%). The most commonly prescribed treatments were PT/OT (32.3%), activity modification (23.1%), NSAIDS (13.6%), crutches/brace/splinting/compression sleeve (10.4%), and injections (7.2%). Males sustained more shoulder injuries than females (68.4% vs. 31.6%, $p=0.049$). All CrossFit athletes diagnosed with PFSS were female (100% vs. 0%, $p=0.029$). Age comparison analysis showed that injuries to the spine were more frequently documented in ≤ 19 years old compared > 20 years old (53.6% vs. 46.4%, $p=0.016$). **CONCLUSIONS:** Injuries from CrossFit appear to differ by sex and age. Males presented with more shoulder injuries than females while females had the greatest incidence of patellofemoral stress syndrome. Pediatric athletes sustained more injuries to the spine. More research is warranted regarding CrossFit injuries, particularly in the pediatric athlete.

2522 Board #42 June 2 11:00 AM - 12:30 PM
Injury Epidemiology at Multi-Day Youth Soccer Tournaments
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 (No relationships reported)

PURPOSE: Sports medicine clinical teams are often employed to provide first-aid, triage, and emergency care at multi-day youth athletic tournaments. This study analyzed data collected from medical tent visits at six multi-day soccer tournaments hosted by competitive clubs in 2015 and 2016 to provide insight into frequency, distribution, injury type, and treatment. This data will enable optimal preparation of sports medicine teams for future tournaments.
METHODS: Sports medicine team members electronically captured clinical data for each medical tent encounter at six multi-day soccer tournaments. These records were assessed for completeness and excluded if date of birth, treatment, or the day of encounter were not documented. Data was sorted by 3-day, 4-day, or 5-day tournaments. Chi-squared testing within tournament types was performed for tent visit frequency, treatment, and body region probability.
RESULTS: Of 3207 encounters, 2896 were included for analysis [5-day: $n = 1655$, 4-day: $n = 1001$, 3-day $n = 240$]. Participant age ranged from 6-19 years [mean = 15.2 years, $SD = 1.8$]. Significant differences were found between tournament day and tent visit frequency. For 3-day events, most tent visits occurred on Day 2 [48.7%, $p < 0.001$]. For 4-day events, most tent visits occurred on Day 3 [41.2%, $p < 0.001$]. For 5-day events, most tent visits occurred on Day 4 [41.0%, $p < 0.001$]. No significant difference was found between treatment delivered and tournament day for 3-day, but existed for 4- and 5-day with Ice, Taping, and Injury Evaluation as the most reported treatments in that order [$p < 0.0001$]. Lower Extremity was most likely to present to the medical tent [$n = 1115$], followed by Upper Extremity [$n = 147$], and Head/Neck [$n = 136$] out of 1454 records with body region recorded [$p < 0.009$].

CONCLUSION: During multi-day youth soccer tournaments, sports medicine teams can optimize staffing and resources by preparing for increased frequency of tent visits during the middle and end of the tournament, scheduling staff capable of expected treatments, and ensuring adequate supplies for predominantly lower extremity injuries and treatments. Future data collection for multi-day tournaments should include injury time of day, games played, and non-injured player data to allow for incidence calculations and control comparisons.

2523 Board #43 June 2 11:00 AM - 12:30 PM
The Impact of Grant Funding on Physical Fitness Levels of School Children
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 (No relationships reported)

Purpose: The purpose of this study was to evaluate the effect of a three year Carol M. White Physical Education Program (PEP) Grant on fitness levels of students in grades K-12. **Methods:** A total of 1251 students (616 female and 635 male), 5-18 years of age (mean 11.07) participated in the FitnessGram series of health related physical fitness assessments (aerobic capacity, muscular strength, and muscular endurance) in each of the 3 years of the grant project. Basic anthropometric measures of height and weight were recorded for each student and used in the calculation of body mass index (BMI). Along with BMI, the assessment scores utilized in this investigation included: the 20 meter PACER test (PACER), Push Up Test (PT), and Curl Up Test (CT). Students performed these assessments as directed by a licensed physical education teacher during the spring semester of each of the 3 years of the grant project. Upon completion of the assessments, students were classified into Fitness Zones based on FitnessGram standards. The classifications for BMI were as follows: Healthy Fitness Zone (HFZ), Needs Improvement (NI), Needs Improvement - Health Risk (NI-HR), or Very Lean (VL). The PACER, PT, and CT only classify students into 2 Fitness Zones: HFZ and NI. **Results:** The data show an increase in number of students in the HFZ for each of the assessments from year 1 to year 2, with an average increase of 8.75%. The PT garnered the greatest percentage of increase at 12%, while the percentage of students in the HFZ for BMI only increased 6%. Conversely, the data from year 2 to year 3 show decreased percentages of student in the HFZ for all assessments, except for the PACER test which remained unchanged (63%). The percent of student in the HFZ decreased 2%, 11%, and 10% for BMI, CT, and PT respectively. Even with the decrease in percent of students in the HFZ for these assessments, the year 3 percentages remained higher than the initial assessment year for both the BMI and PACER with a 4% and 7% increase respectively. **Conclusion:** The increase in overall percent of students classified in a HFZ for multiple physical fitness assessments shows that a 3-year PEP grant had a positive impact on students' physical fitness levels. This improvement coupled with the increased availability of resources and funding make the PEP grant an asset.

E-26 Free Communication/Poster - Behavioral Aspects of Sport

Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2524 Board #44 June 2 11:00 AM - 12:30 PM
Effect of Yoga, Meditation or Body Awareness on Sports Performance and Attention in Futsal Players
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 (No relationships reported)

PURPOSE: To determine the chronic effect of yoga, meditation or body awareness practice produces significant improvements in attention and sports performance in Futsal players. A second aim was to determine the association between attention and sports performance. **METHODS:** Thirty subjects (15 men, 15 women) were randomly assigned to four groups: Meditation (MG) ($n = 8$, mean age = 20.8 ± 2.4 yr.), Yoga (YG) ($n = 8$, mean age = 21.2 ± 1.6 yr.), Body awareness (BA) ($n = 7$, mean age = 20.5 ± 1.4 yr.), and Control Group (CG) ($n = 7$, mean age = 21.0 ± 2.3 yr.). Before (pre) and after (post) nine yoga, meditation or body awareness sessions, the subjects were measured on attention with the Stroop Test, and on sports performance with the Loughborough soccer passing test. **RESULTS:** There was no significant interaction in attention and sport performance ($p > 0.05$). There were significant main effects in measurement (pre- to -post) on attention (Pre = 51.7 ± 5.7 vs. Post = 54.6 ± 4.5 hits, $p < 0.05$), and for sport performance (Pre = 65.2 ± 5.7 vs. Post = 63.6 ± 5.1 -s, $p < 0.05$).

No significant correlations were found between the change in attention scores and sport performance in experimental groups MG ($r = 0.62$), YG ($r = 0.20$), BA ($r = 0.16$), and CG ($r = 0.20$) ($p > 0.05$). **CONCLUSIONS:** Meditation, yoga and body awareness exercises do not influence attention or sport performance in Futsal players.

2525 Board #45 June 2 11:00 AM - 12:30 PM
The Utilization of Different Cues in Visual Anticipation in Skilled Table Tennis Players

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It is reported that expert motor skill performance are superior to less skilled individuals to predict the outcome of an object in striking sport, such as table tennis, due to the ability of using advance information, such as body kinematics cue. Meanwhile, it also revealed that the accuracy would be improved with the visual information (such as the ball trajectory cue). It is unclear the utilization strategies on these two cues in striking sports between expert and novice.

PURPOSE: To investigate the utilization of body cue and ball cue in the visual anticipation and compare the utilization strategies among skilled players, less skilled players and non skilled players.

METHODS: 74 participants were grouped into Elites group (EG, $n=24$), Amateur group (AG, $n=26$) and Novice group (NG, $n=24$) based on the table tennis and skilled level. Participants were presented with short video-clips of serve that were partially occluded (racket-ball contact (T), 50ms after the contact (T+1), 100ms after the contact (T+2)) and probably congruence or incongruence (T'+1; T'+2) within the body cue and ball cue. The task was to judge whether the ball would land on left or right side and the accuracy was analyzed.

RESULTS: The results showed that the EG ($.92 \pm .07$) had a higher accuracy than the other two groups (AG: $.82 \pm .07$, $p < .001$; NG: $.78 \pm .10$, $p < .001$) when the video-clips were occluded before the ball cue showed up, while both the EG (T+1: $.98 \pm .04$; T+2: $.97 \pm .04$) and AG (T+1: $.95 \pm .05$; T+2: $.95 \pm .07$) had a better accuracy than the NG (T+1: $.88 \pm .07$; T+2: $.87 \pm .11$) when the ball cue was offered in the video-clips. Meanwhile the accuracy of EG (T'+1: $.67 \pm .16$; T'+2: $.90 \pm .17$) and AG (T'+1: $.64 \pm .16$; T'+2: $.90 \pm .14$) was sharply decreased in the incongruence video-clips, but their ability to discriminate these two cues was better, comparing with the NG (d -prime: $F(2, 68) = 10.491$, $P < .001$; EG: $-.77 \pm .41$; AG: $-.61 \pm .41$; NG: $-.52 \pm .27$).

CONCLUSIONS: This leads us to argue that experts (both elites and amateur) had the anticipatory advantage than the novice in striking sport. They mainly utilized the body cue to anticipate the outcome, while the novice needed the ball cue to do anticipation. Also, the experience levels of the experts moderated the utilization strategy in visual anticipation. Supported by NSFC (No. 31571151)

2526 Board #46 June 2 11:00 AM - 12:30 PM
Socially Prescribed Perfectionism Might Predict Enhanced Performance When Racing Against an Opponent

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Recent research has shown that racing against an opponent can improve endurance exercise performance (Konings et al, 2016). To what extent athletes can be motivated by racing against an adversary might depend at least partially on personality characteristics such as type of perfectionism.

PURPOSE: We sought to explore the relationship between self-oriented (SO) and socially prescribed perfectionism (SPP) (Hewitt & Flett, 1991) and time-trial performance. We hypothesized that SPP would be related to performance enhancements associated with the presence of an opponent, but that SO would not. **METHODS:** Twelve experienced cyclists (45.8 ± 7.0 years) completed four 4-km time trials (TT) on a VeloTron cycle ergometer. Participants performed three TTs without opponent (TT1no, TT2no, TT3no) and one TT against a virtual opponent (TTopp). Mean performance on the three trials without an opponent was calculated and the difference (Δ TTno-TTopp) between the resulting "meanTTno" and TTopp was assessed for each participant. Participants also answered the 12-item "perfectionism in sport scale" (PPS-P) (Hill et al., 2016) on a 6-point Likert scale before the first race. Spearman correlations of the participants' mean scores on the PPS-P and Δ TTno-TTopp were calculated. **RESULTS:** Overall, there was no significant difference in performances over the 4 trials: T1 = 385.86 ± 18.07 s; T2 = 380.31 ± 20.75 s; TTno = 377.66 ± 17.40 s and TTopp 378.86 ± 19.68 s. Mean score on PPS-P was 4.29 ± 0.96 for SO and 2.83 ± 0.91 for SPP. A significant positive correlation was found between SPP and Δ TTno-TTopp ($\rho = 0.867$, $p < 0.01$), but we found no relationship between SO and Δ TTno-TTopp. **CONCLUSION:** Previous studies have shown that being confronted

with a (virtual) opponent enhances endurance athletes' performance. In the present group of cyclists, overall 4-km performances with and without opponent did not differ significantly. Interestingly, our results show that the performance enhancing effect of a virtual opponent during a 4 km cycling trial is correlated to socially prescribed perfectionism in sport. These findings support current literature and our hypothesis that the positive effect of racing against an opponent might differ according to athletes' psychological characteristics.

2527 Board #47 June 2 11:00 AM - 12:30 PM
Exploring Parental Preferences for Choosing Youth Flag or Tackle Football

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Youth football participation rates have decreased 27.7% over the last six years. One of the primary reasons posited for this decline is parental concerns about concussion. In an attempt to provide an alternative to tackle football, many youth leagues are offering a choice of flag or tackle football. In fact, flag football participation has risen by 8.7 percent from 2014-2015. However, there is a lack of research exploring factors associated with parental preferences for choosing flag over tackle football.

PURPOSE: To explore factors associated with parental preferences for choosing youth flag and tackle football. **METHODS:** Two youth sport leagues offering a choice of both youth tackle and flag football for players aged 5 to 15 years distributed an online survey to 859 parents of youth football participants. The 50-item online survey was administered via Qualtrix and gathered responses on several variables that included parental preference for flag or tackle, history of football participation, injury history, and concussion knowledge. A series of chi-square analyses with odds ratios (OR) and 95% confidence intervals (CI) were used to assess associations and likelihood of select variables and youth football preference. **RESULTS:** A total of 29% (245/859) of parents completed the online survey. Seventy-seven percent (157/203) of parents preferred tackle instead of flag football. Parents that previously played or had a spouse/partner that played football were 2.61 times more likely to prefer flag over tackle ($\chi^2[1, 199] = 4.87$, $p = .03$, 95% CI = 1.09 - 6.25). Parents fearful of their child getting a concussion were 2.41 times more likely to prefer flag instead of tackle football ($\chi^2[1, 199] = 6.31$, $p = .01$, 95% CI = 1.10 - 4.86). Parental history of concussion ($p = .42$), concussion knowledge ($p = .67$), perceived child size ($p = .64$), speed ($p = .51$), and strength ($p = .25$) were not associated with football preference. **CONCLUSIONS:** When given a choice between flag or tackle football for their children, a majority (77%) of parents prefer tackle football. However, parents who played football or are fearful of their child getting a concussion are more likely to prefer flag for their children. Flag football may provide children with a physically active sport that parents view as less risky than tackle football.

2528 Board #48 June 2 11:00 AM - 12:30 PM
Pain Coping Skills of Competitive High School Pole Vaulters

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(No relationships reported)

For competitive pole vaulters, their abilities to cope with painful challenges and subsequent injuries are crucial to overcome obstacles in sport development. In a sport with highly technical and explosive training, the failure to adapt to these competitive challenges could result in suboptimal performance and rehabilitative outcomes. Therefore, the ability to appropriately cope with pain and potential injury is essential for competitive success, especially at this young stage of development. **PURPOSE:** To quantify the coping skills of pain and injury in competitive high school pole vaulters. **METHODS:** Following written informed consent, 59 high school pole vaulters completed the Sports Inventory for Pain (SIP; Meyers et al., 1992): direct coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), body awareness (BOD), and a composite score referred to as total coping resources (TCR). Data were grouped by skill level (novice, intermediate, advanced), gender, and academic classification (upperclassmen, lowerclassmen). **RESULTS:** MANOVAs (Wilks' Lambda) indicated no significant main effects across skill level ($F_{10,104} = 1.511$; $p = 0.146$), gender ($F_{5,53} = 1.128$; $p = 0.357$), or academic classification ($F_{5,53} = 1.440$; $p = 0.225$). Although no significance, there was a trend for upperclassmen to respond higher in COP, COG, CAT, BOD, and TCR. **CONCLUSION:** Although, findings may have been influenced by a limited sample size, pain coping skills among this group reflected above average responses when compared to normative values across other athletic populations. At this early stage of mental and physical development, it is imperative that coaches devote time to the psychological challenges these athletes will face during competition. Further research is warranted assessing challenges from larger populations, as well as to determine the efficacy of pain coping skills interventions.

2529 Board #49 June 2 11:00 AM - 12:30 PM

Influence of Parent and Child Concussion History on Parental Knowledge and Attitudes Regarding Concussion

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Parents' knowledge and attitudes towards concussions are often a vital factor affecting care for injured adolescent athlete. It is important to understand the role previous experiences play in regards to current concussion knowledge and attitudes. **PURPOSE:** To determine the influence of parental and child concussion history on parental attitudes and knowledge towards concussive injury. **METHODS:** Parents of youth sport athletes (n=234; males: n=82; females: n=144; age=44.0±6.3yrs) completed a pre-validated survey for concussion knowledge (max score possible=28) and attitudes (max score possible=49). Higher scores indicated better knowledge and attitudes towards concussive injury. Parents reported the frequency of concussion diagnosis and/or experience of concussion-related symptoms, and whether their child had a diagnosed concussion or experienced concussion symptoms (yes/no). Linear regression models were used to understand the association between concussion history variables and knowledge and attitudes (alpha level 0.05 *a priori*). **RESULTS:** Twenty-seven percent (n=63) of parents had a previously diagnosed concussion while 43% (n=101) had experienced at least one symptom of a possible concussion without reporting a history of diagnosed concussion. Only 8% (n=19) of parents reported their child having a previously diagnosed concussion while 26% (n=61) reported their child had experienced symptoms of a possible concussion. Mean parental knowledge and attitude scores were 23.3±2.5 and 46.3±3.7, respectively. Parents with no previously diagnosed concussions had significantly lower total knowledge scores (mean=23.0±2.5; p<0.001) than those with a previous concussion (mean=23.9±2.3). Those who had never experienced symptoms of a concussion trended towards significance (p=0.05). There were no associations between any of the concussion history variables (parent or child) and attitudes. **CONCLUSIONS:** Parents with no concussion history may benefit from enhanced education. However, given the multifaceted nature of recognizing and responding to concussion, it is important to look further and identify possible driving factors to improve educational efforts within this population. This study was funded in part by the National Operating Committee on Standards for Athletic Equipment.

2530 Board #50 June 2 11:00 AM - 12:30 PM
Prevalence Of Muscle Dysmorphia In Male and Female NCAA Division III Athletes.

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INTRODUCTION: In society today, body image has been, and continues to be, a growing concern for individuals. Muscle dysmorphia (MD) is a preoccupation with the idea that one's body is not sufficiently lean and/or muscular. Many associated disorders and risks of muscle dysmorphia have been identified including exercise dependence and increased anabolic steroid use. To date, few studies have investigated muscle dysmorphia in both male and female college athletes. **PURPOSE:** The purpose of this study was to examine the prevalence of muscle dysmorphia characteristics in NCAA Division III male and female athletes. **METHODS:** 297 athletes (188 males and 109 females) from 16 varsity sports teams (8 men's teams and 8 women's teams) were recruited from a private NCAA Division III school in the eastern United States. Data were collected via the Muscle Dysmorphia Inventory (MDI), which is a 27-item self-report measure designed for the assessment of MD. The 27 questions are divided into 6 sub-sections that examine different areas of behavioral and psychological characteristics associated with MD. These sub-categories are 1. Diet; 2. Supplement usage; 3. Physique protection; 4. Exercise dependency; 5. Size/symmetry; and 6. Pharmacology. The questionnaire was distributed and collected at the end of a sports practice session or team meeting. A one-way ANOVA was used to determine any difference by sport and an independent *t* test was used for differences by gender using IBM SPSS 23. **RESULTS:** The results demonstrated a significant difference by sport in 5 of the 6 sub-categories of the MDI (Diet: $p < .001$; Supplement: $p < .001$; Physique: $p < .001$; Exercise dependency: $p = .049$; Size/symmetry: $p < .001$; and Pharmacology: $p = .214$). The results also demonstrated a significant difference between male and female athletes for all 6 sub-categories of the MDI (Diet: $p < .001$; Supplement: $p < .001$; Physique: $p < .001$; Exercise dependency: $p = .004$; Size/symmetry: $p < .001$; and Pharmacology: $p = .019$). **CONCLUSIONS:** The current results suggests that Division III college athletes are indeed at a risk of developing muscle dysmorphia and its characteristics. This information may be valuable in helping sport coaches, strength and conditioning coaches, athletic trainers to identify warning signs and characteristics of muscle dysmorphia.

ACSM May 30 – June 3, 2017

2531 Board #51 June 2 11:00 AM - 12:30 PM

Coach-identified Barriers To Removing Athletes With Concussion Symptoms From Play: Implications For Concussion Education

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 (No relationships reported)

PURPOSE: Coaches play a critical role in concussion safety. At the high school level, most contact sports teams do not have an athletic trainer on the sidelines of games or practices. This means that coaches are often the adult responsible for identifying if an athlete is experiencing symptoms of a concussion that warrant removal from play for further evaluation from a medical professional. To-date, there has been little research conducted among high school coaches to determine what makes coaches more or less likely to remove an athlete with a suspected concussion from play. The present study sought to describe what coaches considered to be barriers and to determine whether coaches who experienced barriers more strongly were less likely to remove an athlete from play, independently of their concussion knowledge.

METHODS: Participants were 250 Washington state public high school coaches who completed a written survey (92% response rate). Standardized measures assessed concussion knowledge, barriers to removing symptomatic athletes from play, and removal from play intentions. Data were analyzed using structural equation modeling. **RESULTS:** The three most frequently endorsed barriers were "athletes tend to hide their symptoms so it's hard for me to know if they've sustained a concussion" (55% of coaches), "the athlete's parents might be upset if I removed their child from play" (44% of coaches) and concern that they "might make a mistake and remove an athlete who has not sustained a concussion" (36% of coaches). Coaches who more strongly experienced barriers were less likely to intend to remove a symptomatic athlete from play for medical evaluation ($B = -0.22$, $p = 0.006$). There was also a strong positive association between concussion knowledge and removal from play intentions ($B = 0.41$, $p < 0.001$).

CONCLUSION: While sports leagues are increasingly mandating concussion education for coaches, it is important that educational interventions be developed to be most impactful on behavior. The present findings indicate that in addition to addressing gaps in concussion knowledge there is a critical need to address coach-identified barriers related to removing symptomatic athletes from play for medical evaluation. Specific implications for concussion education for coaches will be discussed.

2532 Board #52 June 2 11:00 AM - 12:30 PM

Factors That Predict Grit In Collegiate Athletes During The Competitive Season

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Grit is defined as the drive, passion and persistence that one possesses to reach short- and long-term goals. Yet, few studies have measured grit in athlete populations presenting a gap within sport behavior research. **PURPOSE:** To examine possible predictors of grit among collegiate athletes during the competitive season.

METHODS: Three hundred and thirty-two NCAA Division II athletes ($n_{men} = 185$, $n_{women} = 147$) from twenty-two teams ages 18 to 23 years ($M = 19.50$, $SD = 1.36$) completed five self-report questionnaires: Short Grit Scale (GRIT-S), Short Self-Compassion Scale (SSCS), Sport Motivation Scale II (SMS II), State Self-Esteem Scale (SSES) and a demographics questionnaire. The 12-item GRIT-S was used to measure grit, the 12-item SSCS was used to measure self-compassion (having benevolence for one's self in instances of perceived inadequacy, suffering, or failure), the 18-item SMS II scale was used to measure six sport motivation types and the 20-item SSES was used to assess performance state self-esteem (the degree of fluctuations of positive or negative performance-based attitudes toward oneself). A multiple regression analysis was conducted and an alpha level of 0.05 was set for statistical significance. **RESULTS:** Results demonstrated that the following three factors statistically significantly predicted grit during the athletes' respective in-season, $R^2 = 0.34$, $F(3,329) = 55.45$, $p < 0.001$: performance state self-esteem ($\beta = 0.42$, $p < 0.001$), integrated regulation ($\beta = 0.18$, $p < 0.001$), and self-compassion ($\beta = 0.17$, $p = 0.002$). **CONCLUSIONS:** Results revealed that three predictor variables explained 34% of the variance for grit. The findings of the current study suggest that performance self-state esteem, integrated regulation (an autonomous motivation type where there is congruency between an action and an individual's identified values, goals and needs) and self-compassion are significant predictors for grit. Previous grit research in non-athlete populations has illustrated that high levels of "grittiness" predicts goal outcomes regardless of perceived or actual challenges or adversities. This study's finding on athletes, while novel and promising, warrants further investigation into grit and other psychosocial factors on goal attainment and outcomes during the competitive season.

Denver, Colorado

2533 Board #53 June 2 11:00 AM - 12:30 PM
Sport: Relationship Between Age And Skills Perceived By Children Sport Practitioners
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Psychosocial aspects are factors that influence the psyche of the human being in development. Such aspects infer about the behavioral patterns of the individual, causing physical, cognitive and social changes throughout his life (Myers, 2012). One of the effective ways to experience these practices is the sport (Noble et al., 2014). **PURPOSE:** Identify the relationship between age and skills perceived by children assisted by a sports program. **METHODS:** The sample consisted of 50 children of a municipal sports center of Anápolis, who practiced sport twice a week at the school turn against for more than 6 months (30 boys and 20 girls), aged between 7 and 12 years old. The psychosocial aspects of children were assessed using the Brazilian version of the Self-Perception Profile for Children, validated by Valentini et al. (2010). The Brazilian version called Self Perception Child scale (SPCS) is configured in a questionnaire that assesses six specific areas of competence: cognitive skills, emotional skills, motor skills, physical appearance, behavioral conduct, in addition to the global self-worth. **RESULTS:** The children attending showed moderate levels of self perceived competence in the dimensions evaluated in the present study, by gender and age. Such skills are psychosocial aspects that can be influenced when compared to children who do not participate in sports programs. It was evident that the younger children, the lower the influence of the sports program on the skills perceived except in motor racing, which takes place from 9 years old. The sport seems to exert an influence on the self-perception skills (ie cognitive, social, motor and behavioral), especially when there is a longer practice. **CONCLUSIONS:** The skills perceived by children assisted by a sports program only are perceived as the children mature (i.e 11 and 12 years old). Younger children assisted by sports program have no perception of skills, as they only manifest as the action is performed for longer.

2534 Board #54 June 2 11:00 AM - 12:30 PM
Athletic Coping Skills of the Competitive High School Pole Vaulter
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A competitive pole vaulters' ability to cope with stressful situations during competition is crucial for optimal development. Therefore, the ability to cope under these circumstances is essential for creating a strong mental capacity that leads to competitive success. **PURPOSE:** To quantify athletic coping skills of competitive high school pole vaulters. **METHODS:** Following written informed consent, 59 high school pole vaulters completed the Athletic Coping Skills Inventory (ACSI; Smith et al., 1995): coping with adversity (COPE), peaking under pressure (PEAK), goal setting/mental preparation (GOAL), concentration (CONC), freedom from worry (FREE), confidence and achievement motivation (CONF), coachability (COAC), and a composite score referred to as personal coping resources (PCR). Data were grouped by skill level (novice, intermediate, advanced), gender, and academic classification (upperclassmen, lowerclassmen). **RESULTS:** MANOVAs (Wilks' Lambda) indicated no significant main effects across skill level ($F_{14,106}=1.146$; $p=0.329$), and academic classification ($F_{7,51}=1.524$; $p=0.180$), but indicated a significant main effect by gender ($F_{7,51}=2.575$; $p=0.024$). Univariate analyses (mean±SD) indicated that males responded higher in PEAK (7.81±3.146 vs. 5.82±2.736; $p=0.013$) than female athletes, whereas females responded higher in COAC (9.75±2.703 vs. 8.26±2.683; $p=0.038$) than males. Although no significance, there was a trend for upperclassmen to respond higher in COPE, PEAK, GOAL, CONC, CONF, COACH and PCR. **CONCLUSION:** Although findings may have been influenced by limited sample size, coping skills among this group reflected subnormal response when compared to normative values across other athletic populations. At this early stage of mental and physical development, it is imperative that coaches devote time to the psychological challenges these athletes will face during competition. Further research is warranted assessing challenges from larger populations, as well as to determine the efficacy of athletic coping skills interventions.

2535 Board #55 June 2 11:00 AM - 12:30 PM
Adolescent Behavior Regarding Concussion
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PURPOSE: To assess adolescent male American football players' concussion attitudes and behaviors using a modified Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire. **METHODS:** Two groups (n=19) completed the questionnaire. Group 1 (YRL) included youth recreation league players (n=13; ages 11-13) and group 2 (HS) was high school players (n=7; ages 13-18). Responses were scored as "safe" or "unsafe" based on RoCKAS guidelines. Normative data was established with expected "safe" answers set at 90% and "unsafe" set at 10%. **RESULTS:** For general concussion behavior questions (i.e. I feel that concussions are less important than other injuries, and I feel that an athlete has a responsibility to return to the game even if it means playing while still experiencing symptoms of a concussion), 71.3% of responses were safe and 38.7% unsafe ($X^2=31.25$, $p=0.0001$). There was a difference between group 1 and 2 responses. Safe responses were greater for the HS subjects (Pearson chi = 4.4, $p=0.03$). Responses to the four situational questions were safe 32.5% and unsafe 67.5% ($X^2=293.9$, $p=0.0001$) with no difference between groups (Pearson chi = 0.9, $p=0.34$). When situational questions were analyzed for return to play following an early season concussion with persistent symptoms, 70% demonstrated safe behavior ($X^2=8.9$, $p=0.003$) by not returning the athlete to play with no difference between groups (Fisher $p=0.35$). If the situation posed included returning a symptomatic concussed athlete to play in a playoff game, 75% selected unsafe ($X^2=80.0$, $p=0.0001$) return to play with no difference between groups (Fisher $p=0.61$). **CONCLUSIONS:** As youth football athletes mature, they improve in concussion understanding. However, players' attitudes and behaviors regarding situational return to play decisions did not improve with age, but continue to demonstrate unsafe behavior.

2536 Board #56 June 2 11:00 AM - 12:30 PM
Assessment of Disordered Eating and Orthorexia Nervosa in Endurance Athletes Following Gluten and Wheat-free Diets
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 (No relationships reported)

Endurance athletes recognize that a leaner and lighter body can improve performance outcomes. Currently, there is limited data assessing disordered eating, including orthorexia nervosa, in endurance athletes choosing to adhere to gluten and wheat-free diets (GWDs). **Purpose:** The aim of this study was to assess disordered eating, including orthorexia behaviors, in endurance athletes following GWDs compared to athletes following a normal diet (ND). **Methods:** Endurance athletes (ages 18-55y) were invited to participate in a web-based questionnaire via multiple sporting websites. The survey included demographic information, questions regarding beliefs and attitudes about GWDs, and two validated disordered eating and orthorexia questionnaires: Three Factor Eating Questionnaire (TFEQ-R18) and the ORTO-15. Athletes following GWDs were combined. Descriptive statistics and independent sample t-tests comparing groups using SPSS with significance set at $p<0.05$. **Results:** Of the athletes responding (n=100), only 73 had usable data (63 females; 9 males; 1 transgender). One-third (37%; n=27) reported being on GWDs (clinically diagnosed gluten sensitivity (n=10); celiac (n=1)). ND's were significantly older (44+11 y) than GWD (39+12 y, $p=0.05$). There were no differences between groups for self-reported body mass index (GWD=22+3 vs. ND=24+4 kg/m²), orthorexia scores (GWD=37.1+6.9 vs. ND=39.0+6.3), and TFEQ subscale scores for emotional eating (GWD=8.2+2.1 vs. ND=8.2+2.2), dietary restraint (GWD=14.4+4.1 vs. ND=15.8+3.9) and uncontrolled eating (GWD=24.7+5.3 vs. ND=25.1+4.8). Athletes classified with orthorexia (75.3%; n=55) had significantly lower TFEQ scores in restrained, emotional, and cognitive disordered eating than those not categorized as having orthorexia (24.7%; n=18) ($p<0.001$). **Conclusion:** This sample of endurance athletes displayed high levels of orthorexia and disordered eating behaviors but there were no differences between GWD and ND groups. Further studies are needed to determine the extent of nutritional and behavioral risk in endurance athletes presenting with orthorexia.

2537 Board #57 June 2 11:00 AM - 12:30 PM
Psychological Follow-up of 6 Months Training for a Half Ironman Triathlon
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Preparation for an endurance event amongst amateur athletes requires a major investment in time as well as a proper physical and mental training. Even if there is an increase of participation for endurance events in the country, there are few studies that have reported the psychological effects of such a demanding training for age groups athletes. **PURPOSE:** The aim of this study was to characterise the psychological state of recreational athletes during a six months training prior to a half Ironman triathlon. **METHODS:** Thirty-one amateur athletes were recruited for this observational study. Participants were 40 ± 9.1 years old; and had a body weight of 74 ± 12.7 kg and a height of 172 ± 10.12 cm. All participants underwent a physical fitness assessment in January and two weeks prior to the half ironman event, held in June. They followed a training program supervised by a registered kinesiologist based on the Ironman University™ annual planning. The training volume was 410.4 ± 201.48 min per week. For each month of training, participants received an email with a link to complete a monthly series of questionnaires that included: Facets Mindfulness Questionnaire Short Version (FFMQsv), Profile mood scale (POMS), Positive and Negative Affect Schedule (PANAS) and Sport Motivation Scale 2 Revised (SMS-2R). **RESULTS:** Vigour, anxiety and fatigue, POMS sub scale, significantly changed during training ($p < 0.05$). Positive emotions increased over 3 months to stabilise until the competition. Participants felt different types of motivation regulation: intrinsic (15.9 ± 1.76), integrated (15.9 ± 1.98), identified (15.7 ± 1.87) and a little less ($p < 0.05$) for introjected regulation (13.3 ± 1.62). They were significantly different ($p < 0.01$) from external (4.9 ± 1.08) regulation motivation and non-regulation (3.6 ± 0.73). Mindfulness sub scale, Observation and Describe factors, were the only factors that significantly increased or decreased during the 6-months training ($r^2 = 0.35$ and $r^2 = 0.30$, respectively). **CONCLUSIONS:** Athletes who engages in this type of event have a high intrinsic motivation. We also noted that motivation, mindfulness and mood state follow the macrocycle of training. Thus, specific interventions and mental training could be structured around these important elements.

2538 Board #58 June 2 11:00 AM - 12:30 PM
Vitamin D, Serum Ferritin, and College Athlete Burnout: A Pilot Study
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PURPOSE: To examine the relationship between serum 25 hydroxyvitamin D concentration ([Vit D]), serum ferritin concentration ([Fe]) and athlete burnout (AB) in Division I (D1) collegiate athletes. **METHODS:** Seventy-two (males = 24) DI college athletes (cross-country, swimming, basketball, women's soccer) completed blood draws and psychosocial measurements both pre- and post-competitive season. Serum was analyzed for 25 hydroxyvitamin D and ferritin at a certified hospital laboratory. The athlete burnout questionnaire (ABQ) was completed post-competitive season (Raedeke & Smith, 2001). Subscales of ABQ include devaluation of sport, emotional and physical exhaustion, and reduced sense of accomplishment. **RESULTS:** Linear regression analyses on the entire cohort (male and female athletes combined) revealed no statistically significant relationships between pre-to post-competitive season change (Δ) for either Δ [Vit D] ($p = .78$) or Δ [Fe] ($p = .69$) with regards to any subscale variable within the ABQ. When separated by gender, Δ [Vit D] ($p = .57$) and Δ [Fe] ($p = .57$) did not significantly predict AB in females. However, a significant decrease in pre to post competition Δ [Vit D] ($Mean \pm SD = -8.45 \pm 4.33$) did significantly predict and explain 20.6% of the variance of male athlete perceptions of devaluation of sport ($p < .05$). Another linear regression showed that pre-season [Fe] ($Mean \pm SD = 68.53 \pm 31.49$) predicted and explained 16% of the variance of male athlete perceptions of physical and emotional exhaustion from sport ($p \leq .05$). Additionally, medium to large correlations were noted in male athletes between [Fe], [Vit D], and AB including pre-season [Fe] and AB ($r = .41; p < 0.05$), post-season [Fe] and AB ($r = .36; NS$), and Δ [Vit D] and AB ($r = .41; p < 0.05$). **CONCLUSION:** These preliminary findings support a proposed interplay between mood and chemistry, with respect to Δ [Vit D], Δ [Fe], and AB, particularly in male collegiate athletes who live and train in latitudes above 37 degrees north (Vitamin D winter). Although significant negative relationships were found in male athletes only (the lower [Vit D] and [Fe], the greater chance of AB) we will continue exploration in both genders with randomized (supplement) trials, greater number of subjects, and extended testing time through the winter.

2539 Board #59 June 2 11:00 AM - 12:30 PM
Role Of Stressors In Physiological And Psychological Parameters Associated With Golf Playing
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PURPOSE: A 31-year-old Italian professional golfer shows alteration in putting performance: lack consistency of putting performance; low ability to manage different situation and unexpected events; inability to quiet himself; low awareness about causes and motivation of his emotional states. The aim was to understand how variables related to anxiety affects athletic movements in different stressful situations. **METHODS:** Study consists in: baseline - paper and pencil questionnaire + training (T_0); Experimental Phase - task with goal (T_1), Experimental Phase - task with public (T_2); Post-training (T_3). It was administered STAI-X1 (T_0 and T_3) and STAI-X2 (T_0). The heart rate (bpm) was recoding by a heart rate monitor. The swing analysis was performed by SAM PuttLab. **RESULTS:** Data shown an improvement in the movement consistency at T_1 and T_2 than T_0 and T_3 . The percentage obtained at T_1 (72%) is similar to that obtained by PGA professional golfers (75%) and exceeds at T_2 (81.8%). Also, in this two sessions there was an increase of accuracy due to an acceleration of the forward swing time ($T_1 = 890$ ms; $T_2 = 820$ ms). The score of STAI X2 was 31/80 (anxiety of lower middle level) and the scores of STAI-X1 was 25/80 at baseline and 23/80 to post-test (no state anxiety). These results agree with the presence of a normal bpm at T_0 and T_2

CONCLUSIONS: Putting analysis shown an unexpected improvement of performance in the presence of stressors. These data shown that psychological variables are not sufficient to explain the observed phenomenon. An emotional state is not in the head, but is rather the elementary manifestation of our being situated. Being emotionally situated corresponds to a tension which is born and which is continually renewed in the sphere of social and practical engagement but which, at the same time, reflects and actualizes the story of the individual. There are two affective dispositions: *Inward* and *Outward*. Unlike classic construct of anxiety, this emotional disposition may vary across different periods of life and in accordance with contextual factors that can contribute to determine the interplay between established traits and present experience. This case suggests that you need to incorporate different parameters that take into account the active and continuous interaction with the environment.

2540 Board #60 June 2 11:00 AM - 12:30 PM
Psychophysiological Stress In Women Athletes Elite Tennis Players
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PURPOSE: To analyze psychophysiological stress by saliva cortisol in female tennis athletes, 16 and 18 years-old, during a circuit of an international tournament.

METHODS: Forty-eight female tennis players, enrolled in the Copa Guga-Kuerten. Cortisol samples were collected by saliva, using a Salivette® tube, and analyzed by ELISA method. Samples were collected during the meeting (C-pre) and immediately post-game (C-post). Data are described by mean and standard deviation, and analyze by an ANCOVA (2x2): categories: 16 and 18 years; and, winners and losers), using C-pre measures as covariant ($p < 0.05$).

RESULTS: C-pre (8.0 ± 3.6 nmol/L) differed from C-post (13.0 ± 6.2 nmol/L) when the two categories were analyzed simultaneously ($t = -7.526; p < 0.000$), indicating an elevation of cortisol during the sportive event. There were not differences of cortisol concentrations between winners and losers ($F_{1,98} = 2.686; p = 0.104$). There were not significant associations between athletes' ranking with C-pre ($0.083; p = 0.602$) and C-post ($-0.037; p = 0.818$), which may indicates that athletes' rank position do not influence on cortisol concentration.

CONCLUSIONS: This study showed that female tennis athletes had a higher cortisol concentration after the game. However, only a few studies evaluated the influences of sportive competition on cortisol reporting controversial results. Therefore, it is suggested that further studies quantifying other factors related to stress, purposing a better understanding of its influences on athletes' performance.

2541 Board #61 June 2 11:00 AM - 12:30 PM
Modifications Of Negative Attitudes Toward Obesity In Pre-professionals Of Exercise Sciences.
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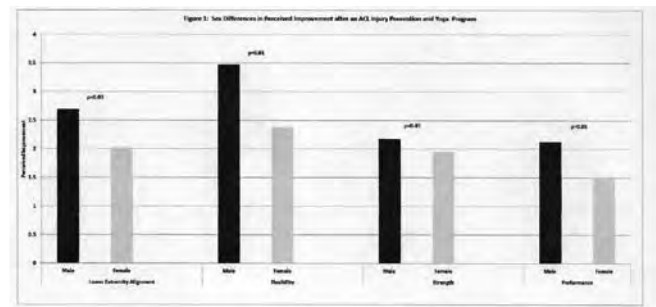
PURPOSE: To investigate the effect of short intervention programs for changing negative attitudes towards obesity through strategies of dynamics intergroup contact in pre-professionals of exercise sciences and determine the most effective strategy. **METHODS:** A total of 56 students of exercise sciences (23.95 ± 4.70-years; 75% male) from Ecuadorian universities participated in this study. The sample was randomly divided into a control group (CG: without intervention, n = 14) and three experimental groups with different dynamics intergroup contact interventions (DC: Direct-Contact, n=14, IC: Imagined Contact, n=13 and CTP: Contact to Take-Perspectives, n=15). Participants were assessed before and after interventions through the AFA (Antifactor Attitudes Questionnaire) for explicit attitudes toward obesity in three dimensions (aversion, fear of gaining weight and unwillingness), and the IAT (Implicit Association questionnaire Antifactor, electronic version) for measuring implicit attitudes. The body mass index was normal (22.5 ± 1.75) for the participants. Statistical comparisons between groups before and after the interventions were analyzed using the Mann-Whitney U test for the AFA, and Chi-square test for the IAT. **RESULTS:** AFA questionnaire revealed that the implementation of short intervention programs decreased attitudes toward obesity with significant differences among all groups in aversion subscale (p=0.06) and unwillingness (p=0.007). In addition, DC group showed the lowest ranges whereas the CG showed the highest ranges for both subscales. The IAT questionnaire showed that DC group significantly decreased the number of participants with implicit negative attitudes towards obesity ($\chi^2 = 0.04$). The CG showed the smallest decrease compared to the rest of study groups. **CONCLUSIONS:** Social psychology programs of short intervention, and in particular by dynamics direct contact programs could modify the implicit and explicit attitudes towards obesity in pre-professionals of exercise sciences.

2542 Board #62 June 2 11:00 AM - 12:30 PM
Perceived Stress has a Negative Impact on Variables Related to Exercise Recovery in Adolescent Athletes
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PURPOSE: Psychological stress has been shown to impair recovery in laboratory settings, but no study has done so in field settings. This study was designed to test the impact of perceived stress on variables related to recovery in an adolescent athlete population who were participating in a 6-wk Summer training program. **METHODS:** Participants included 100 high school athletes (M age = 15.1; 78% Male; 46% African American). Data were collected during 4 consecutive days in the middle of the training program. Recovery was indicated by measures of feeling states and arousal, fatigue, and soreness. These were collected prior to each day's training. The Perceived Stress Scale was used to assess stress. Growth curve analysis was used to examine change in these variables throughout the week. We hypothesized stress to be associated with greater soreness to begin the week, and greater decrements in all variables throughout the week. **RESULTS:** Stress had a significant ($p < .05$) impact on the reference value of the feeling scale ($\beta_{00} = 1.2$) and soreness ($\beta_{00} = 1.4$). As stress increases by 1 SD, there was a .7 decrease in average feeling scale response and a .4 increase in reported soreness. In addition, stress had a significant impact the change in both felt arousal ($\beta_{10} = -.1$) and soreness ($\beta_{10} = .3$) during the week, with each 1 SD increase in stress associated with a daily .14 drop in felt arousal, and a daily increase of .16 in soreness. **CONCLUSION:** Stress appears to be associated with reduced recovery during a week of intense, Summer training in high school athletes. Not only was stress associated with reduced mood and increased soreness overall, it was also associated with a greater increase in soreness and reduction in felt arousal across the week. It may be important to help athletes better cope with stress to enhance their response to training. **Research reported in this publication was supported by Dairy MAX: UTA16-000534.**

2543 Board #63 June 2 11:00 AM - 12:30 PM
Sex Differences in Perceived Achievement after an ACL Injury Prevention and Yoga Program
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Females are more likely to tear their ACL than their male counterparts. A preponderance of ACL injury prevention programs (ACL IPP) have shown that these interventions are effective in decreasing the risk of ACL injuries. Research has shown that girls have a lower general perception of achievement in sports than boys. Little research has investigated sex-specific perceived achievement on lower extremity alignment, flexibility, strength or performance after an ACL IPP. **PURPOSE:** The purpose of this study was to investigate the perceived achievement after 8 weeks of an ACL/yoga IPP between male and female high school soccer players. **METHODS:** 98 high school soccer players (45 girls, 53 boys; 14-19 yrs) participated. Intervention included a 30 minute ACL IPP followed by yoga once a week for 8 weeks. Athletes reported if they injured their ACL and/or had any injuries during the season. An 11 point Likert scale (anchors: -5= worse, 0=no change, 5=better) was used to determine perceived outcomes on lower extremity alignment, flexibility, strength, and performance. An independent t-test ($p=0.05$) was used to determine significant differences between male and female responses. **RESULTS:** There were no ACL injuries in either group. Males reported over twice the number of overall injuries (22) than females (10). Males exhibited significantly greater perceived improvement in lower extremity alignment ($p=0.03$), flexibility ($p=0.01$) and performance ($p=0.05$), however, not for strength ($p=0.45$) (Figure 1). **CONCLUSIONS:** While there were no ACL injuries in either group, and lower overall injuries in the female group, males had a significantly higher perceived improvement than females on lower extremity alignment, flexibility, and performance.



2544 Board #64 June 2 11:00 AM - 12:30 PM
Lived Experiences of College Athletes Misuse of Drinking Alcohol with their Teams: A Phenomenological Study
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This work describes college athletes' shared experiences of the misuse of drinking alcohol with their teams. **PURPOSE:** To explore the essential meaning that college athletes use to characterize their experiences of alcohol misuse when drinking with their teams. **METHODS:** The modified Van Kaam Method of Analysis was used in this psychosocial phenomenological study. Participants (n=15) represented a convenience sample of Division III athletes. The majority of participants (67%) were female. Eight out of 18 (44%) of the campus, intercollegiate teams were represented. Freshmen (27%, n=2), sophomore (20%, n=3), junior (32%, n=5) and senior athletes (20%, n=3) were represented. Over a 7-week period, data was collected during in-depth, semi-structured interviews. Two questions guided the inquiry: What have you experienced when drinking with your team? and What has influenced or affected your experience of drinking with your team? Interviews were recorded and transcribed verbatim. Saturation and validity were confirmed through triangulation of data, bracketing and peer debriefing. **RESULTS:** College athletes characterize the misuse of drinking alcohol with their teams as a primary mechanism for navigating college social life. The four interrelated, interdependent, and embedded themes included acceptance, comradery, safety and protection, and a gateway to college social life. **CONCLUSION:** This examination highlighted the important role that participants' psychosocial development played in their alcohol misuse behaviors. The reported changes in participants' motives throughout college acted as a moderator of alcohol

misuse. The interplay of multiple factors and the malleability of athletes' identities (team identity, student identity) also influenced changes in alcohol misuse behaviors. Participants identified teammates as having the greatest potential to moderate their team's culture of alcohol misuse. Health promoters ought to target transitions in psychosocial development by creating prevention strategies based on the malleability of athletes' social identities.

Supported by a NCAA CHOICES Grant.

2545 Board #65 June 2 11:00 AM - 12:30 PM

The Psychological Parameters of Sports Related Injuries in Female Collegiate Athletes

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PURPOSE: To determine if psychological parameters previous to injury had any impact on injury in female collegiate athletes.

METHODS: Participants were female athletes (n=51) from four various sports teams (basketball, golf, soccer, and softball) at a Division I college. Five questionnaires were completed, an injury report, The Life Events Coping Scale for Collegiate Athletes (LESCA), The Sport Anxiety Scale (SAS), The Sport Competition Anxiety Test (SCAT), and The Athletic Coping Skills Inventory-28 (ASCI-28). Data collection and analysis were completed to calculate mean, median, mode, range, standard deviation, and a t-test for injury and non-injury by each team and overall.

RESULTS: Seventy-one percent of respondents suffered at least one injury in the previous 18 months. There was a statistically significant correlation found between life events and injury ($P < .05$, $P = .03$) and no significant correlation between the SAS and injury ($P > .05$, $P = .12$), the SCAT and injury ($P > .05$, $P = .12$), and coping skills and injury ($P > .05$, $P = .47$). In basketball, a correlation between injury and non-injury for life events, anxiety, and coping could not be found due to the fact that there was only one non-injured athlete. In golf, there was no significant correlation found between life events and injury ($P > .05$, $P = .35$), anxiety and injury ($P > .05$, $P = .32$, $P = .22$), and a somewhat significant correlation found between coping skills and injury ($P > .05$, $P = .08$). For soccer, there was a definite significant correlation found between life events and injury ($P < .05$, $P = .01$), and no significant correlation found between anxiety and injury ($P > .05$, $P = .20$, $P = .27$), and coping skills and injury ($P > .05$, $P = .32$). For softball, there was a somewhat significant correlation found between life events and injury ($P > .05$, $P = .09$), and no significant correlation found between anxiety and injury ($P > .05$, $P = .43$, $P = .29$), and coping skills and injury ($P > .05$, $P = .20$). **CONCLUSIONS:** The findings show that almost all athletes, non-injury or injury have a history of negative life events and a large amount of sport anxiety, but a increased amount of coping skills. The findings suggest that certain psychosocial variables moderated the relationship between life stress and injury, supporting the components of Williams and Andersen's model for stress and athletic injury.

2546 Board #66 June 2 11:00 AM - 12:30 PM

Health and Well-being Mindset and Behavior Patterns: A Qualitative Analysis of Swim Coaches

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Full-time sports coaches face a unique, challenging, and constantly changing work environment. Understanding the experiences and perceptions of individual coaches is paramount to appreciating the implications of the profession on a coach's behavior and ultimately their health and well-being.

PURPOSE: The purpose of this interpretative phenomenological analysis is to understand in-depth the individual perceptions and experiences of health and well-being for swim coaches. **METHODS:** Six focus groups were conducted at an annual worldwide swim coaching clinic. Twenty-three participants, aged 23-70, were asked a series of open-ended questions to gain a better understanding of participants' experiences, perceptions, and beliefs related to health and well-being in their profession. Questions aimed to address three research questions: (1) How do swim coaches perceive their health and well-being? (2) What are the lived experiences of swim coaches pertaining to health and well-being? (3) If a coach is a former athlete, how are health and well-being experienced in coaching? All audio files were transcribed verbatim and coded separately by 3 coders. The 3 coders thoroughly discussed each transcript before coming to consensus on finalized codes and developing major and minor themes. **RESULTS:** A number of major themes emerged including the notion that (1) coaches experience some of the same challenges of maintaining a healthy lifestyle that the general adult population also faces (lack of motivation and limited supporting infrastructure from employer), but also that (2) the profession of coaching is distinctive in the way the job becomes a lifestyle which presents unique challenges to maintaining work/life balance, regular physical activity,

and healthy nutrition. **CONCLUSION:** Swim coaches have a complex occupation that directly influences their health and well-being. Many coaches express interest in learning how to improve their health and well-being suggesting that targeted programming on the topic could be quite popular. The findings presented here can be instrumental in the development of such programs and motivating professional organizations to support such endeavors.

2547 Board #67 June 2 11:00 AM - 12:30 PM

Underserved Boys' Self-efficacy, Pacer Performance and Ethnicity In A Summer Sports Camp

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Underserved boys' Self-Efficacy, PACER Performance and Ethnicity in a Summer Sports Camp

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Childhood obesity is prevalent in the United States. It occurs with a higher rate among minority children and particularly during the summer time. Physical activity (PA) participation is vital in curbing obesity epidemic. To promote PA, it is crucial to understand its underlying psychological factors such as self-efficacy (SE). Research indicates SE is related to children's fitness performance. However, few studies have examined the association among minority children.

PURPOSE: This study investigated the relationship between underserved boys' SE and PACER performance and whether these variables differed by ethnicity in a summer sports camp. **METHOD:** Participants included 94 boys (13.1 ± 2.1 yrs) enrolled in summer sports camp in 2015. The boys came from low-income families and were 20.2% African American, 20.2% Caucasian, and 59.6% Hispanic American. Their social self-efficacy (SSE) and physical activity self-efficacy (PASE) were measured using a previously validated questionnaire on a 5-point Likert scale during the first week of the camp, and fitness performance was assessed by PACER in the third week of the camp. **RESULTS:** SSE was significantly correlated with PASE ($r = 0.52$, $p < 0.01$), while PASE was significantly correlated with PACER performance ($r = 0.26$, $p < 0.01$). A MANOVA yielded a significant main effect for ethnicity ($\lambda = .81$, $F(6, 178) = 3.32$, $p < .01$, $\eta^2 = .10$). Follow-up tests revealed significant ethnicity differences in the mean scores of PASE only ($F(2, 94) = 6.86$, $p < .01$, $\eta^2 = .13$), with African American boys scoring the highest ($M = 4.16$), followed by Hispanic American boys ($M = 3.82$) and Caucasian boys ($M = 3.51$). **CONCLUSION:** Similar to previous research, boys in this study believing in their physical activity ability had better PACER performance than boys who did not. This finding provides additional evidence for the importance of physical activity self-efficacy in physical activity settings. Observed ethnicity differences support the notion that ethnicity is related to children's self-efficacy.

This study was funded by the Sydney and J.L. Huffines Institute for Sports Medicine and Human Performance at Texas A&M University.

E-27 Free Communication/Poster - Blood Flow Restriction

Friday, June 2, 2017, 7:30 AM - 12:30 PM

Room: Hall F

2548 Board #68 June 2 9:30 AM - 11:00 AM

Are Higher Blood Flow Restriction Pressures More Beneficial When Lower Loads Are Used?

Jeremy P. Loenneke, Scott J. Dankel, Matthew B. Jessee, Samuel L. Buckner, J Grant Mouser, Kevin T. Mattocks. *The University of Mississippi, University, MS.*

(No relationships reported)

Low load (~20% one repetition maximum (1RM)) exercise in combination with blood flow restriction (BFR) produces robust increases in muscle size and strength. However, little is known about relative loads less than 20% 1RM.

PURPOSE: To determine the effect of BFR in combination with very low loads on acute changes in electromyography (EMG) amplitude, muscle thickness (Mth), and torque; all variables associated with long term muscle growth.

METHODS: Fourteen participants completed four visits. The 1RM was determined during visit 1. Visits 2-4 involved the same procedures but differed based on the load (10%, 15%, or 20% of their 1RM) lifted and level of restriction (40% or 80% of arterial occlusion). Each condition (i.e. load (% 1RM)/pressure (% arterial occlusion)) began with a measure of arterial occlusion. Measurements of Mth and torque were taken before and after exercise. EMG amplitude of the last 3 reps was analyzed and expressed relative to the value obtained during a maximal isometric contraction

(%MVC). Both arms were exercised each visit. A repeated measures ANOVA was used to identify differences in the dependent variables. Data represented as means (95% CI) and mean (SD) for EMG.

RESULTS: There was an interaction with torque and Mth ($p < 0.001$). There were no differences across Pre ($p = 0.312$) but there were for Post ($p < 0.001$) with torque. Increasing load [e.g. 10/40: -5.2 (-7.2, -3.2) Nm vs. 20/40: -24.4 (-32.9, -15.8) Nm] and pressure [e.g. 15/40: -15.1 (-22.3, -7.9) Nm vs. 15/80: -20.7 (-29.2, -12.2) Nm] resulted in a gradient pre-post decrease in torque ($p < 0.001$). Increasing load [e.g. 10/40: 0.18 (0.1, 0.25) cm vs. 20/40: 0.38 (0.29, 0.47) cm] and pressure [e.g. 15/40: 0.31 (0.23, 0.4) cm vs. 15/80: 0.43 (0.37, 0.48) cm] resulted in a gradient pre-post increase in Mth ($p < 0.001$). For EMG amplitude there was a condition ($p = 0.002$) and time ($p = 0.019$) effect. EMG amplitude increased across time [e.g. 1st set: 40 (12.6) %MVC vs. 4th set: 45 (14.4) %MVC, $p = 0.033$] and was augmented by increasing the load to 20% 1RM [15/80: 40 (9) %MVC vs. 20/40: 55 (15) %MVC, $p = 0.003$] with no effect of pressure [20/80: 54 (20) %MVC].

CONCLUSIONS: These acute findings provide important information for implementing BFR with very low loads. We wish to suggest that higher pressures may be useful when implementing BFR with loads less than 20% 1RM.

2549 Board #69 June 2 9:30 AM - 11:00 AM

The Acute Muscular Responses to Blood Flow Restricted Exercise Using Low and High Relative Pressures

Matthew B. Jessee¹, Kevin T. Mattocks¹, Brittany R. Counts², Samuel L. Buckner¹, J Grant Mouser¹, Scott J. Dankel¹, Gilberto C. Laurentino³, Jeremy P. Loenneke¹. ¹The University of Mississippi, University, MS. ²University of South Carolina, Columbia, SC. ³University of Sao Paulo, Sao Paulo, Brazil.

(No relationships reported)

The efficacy of an exercise modality to increase muscle size has been linked to increased muscle activation, fatigue, and muscle swelling. With low load exercise in combination with blood flow restriction (BFR), a range of moderate (40%) to high (90%) pressures made relative to arterial occlusion pressure (AOP) have been investigated, but no studies have examined the acute muscular responses to even lower relative BFR pressures.

PURPOSE: To determine how a muscle responds to low relative BFR pressures. **METHODS:** Participants ($n = 26$) performed elbow flexion with 30% of one repetition maximum (1RM) while undergoing BFR with one of six BFR pressures: 0%, 10%, 20%, 30%, 50%, 90% of AOP. Muscle thickness and maximal voluntary isometric contraction (MVC) of the elbow flexors were assessed prior to exercise as well as 0, 15, and 30 minutes after exercise. Electromyography amplitude (EMG) was assessed during each set of exercise and normalized to the first 3 repetitions of set 1.

RESULTS: Data presented as mean (95% confidence intervals). There was a main effect of time for muscle thickness ($p < 0.001$), which increased from pre to 0 minutes post-exercise [+0.47 (0.40, 0.54) cm] and trended back toward baseline. Decrements in MVC from pre to 0 minutes post-exercise were greater in higher pressure conditions compared to lower pressures ($p = 0.015$) [e.g. 10% AOP: -20.7 (-15.5, -25.8) Nm vs. 90% AOP: -24 (-19.1, -28.9) Nm]. For each set of exercise EMG amplitude relative to the first 3 reps of set 1 was greater for the last 3 repetitions compared to the first 3 repetitions of sets 2-4 ($p \leq 0.003$) [First 3 reps of Set 2-4: 130 (122, 138) % vs. Last 3 reps of Set 2-4: 151 (137, 165) %]. Repetitions decreased across sets ($p < 0.001$), with most participants unable to complete all repetitions, indicating volitional failure. Repetitions were lower with increasing pressures ($p < 0.05$) [e.g. 10% AOP sets 2-4: 13 (12, 14), 11 (10, 13), and 11 (9, 12) reps vs 90% AOP: 9 (7, 11), 6 (4, 7), and 5 (3, 7) reps].

CONCLUSIONS: When exercising to volitional failure with 30% of 1RM the application of BFR does not seem to augment the acute muscular responses indicative of a hypertrophic stimulus. However, increasing BFR pressure reduced the number of repetitions required to reach failure which may be beneficial for certain populations contraindicated to higher volumes of exercise.

2550 Board #70 June 2 9:30 AM - 11:00 AM

Effects of Different Levels of Blood Flow Restriction on Arterial Occlusion Pressure and Perceptual Responses

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(No relationships reported)

Low load exercise with blood flow restriction (BFR) increases muscle size similar to high load exercise. Studies have investigated relative restriction pressures ranging from 40% - 90% of resting arterial occlusion pressure (AOP) during BFR exercise, however, no studies have investigated relative restriction pressures below 40% AOP.

PURPOSE: To characterize the cardiovascular and perceptual responses to pressures below 40% AOP and compare them to a moderate (50% AOP) and higher (90% AOP) relative pressure.

METHODS: Twenty-six participants performed four sets of unilateral elbow flexion using 30% of their one-repetition maximum (1RM) while a 5cm wide nylon cuff was placed at the proximal portion of their upper arm. The cuff was inflated to one of six relative restriction pressures (0%, 10%, 20%, 30%, 50%, 90% AOP). AOP was measured before (pre) and immediately after four sets (post) of exercise at the radial artery. Ratings of perceived exertion (RPE) and discomfort were taken prior to (pre) and following each set of exercise. A repeated measures ANOVA determined differences in AOP. A Friedman test was used to determine differences for perceptual responses. Data presented as mean (95% CI) except for perceptual responses represented as the 25th, 50th, 75th percentiles. Statistical significance was set at $p \leq 0.05$.

RESULTS: AOP increased from pre to post ($p < 0.001$) in all conditions but was augmented further with higher pressures [e.g. 0%: 36 (30 - 42) mmHg vs. 10%: 39 (34 - 44) mmHg vs. 90% 46 (41 - 52) mmHg]. For RPE and discomfort, there were significant differences across conditions for all sets of exercise ($p < 0.01$) with RPE [e.g. 0%: (13, 14.5, 17) vs. 10%: (12, 13.5, 17) vs. 90%: (14.7, 17.0, 19.0) during last set] and discomfort [e.g. 0%: (1.5, 3.5, 6.2) vs. 10%: (1, 3, 6) vs. 90%: (4.5, 7.0, 9.0) during last set] generally being greater at higher restriction pressures.

CONCLUSIONS: The results provide additional information to the BFR literature by categorizing the cardiovascular and perceptual response to pressures $< 40\%$ AOP. The cardiovascular response is different depending on the relative restriction pressure applied. These findings may guide future studies to provide a safer and more tolerable stimulus for the individual who still wants to increase muscle size while concomitantly minimizing the cardiovascular response.

2551 Board #71 June 2 9:30 AM - 11:00 AM

Cardiovascular And Perceptual Responses To Various Blood Flow Restriction Pressures And Exercise Loads

Scott J. Dankel, Matthew B. Jessee, Samuel L. Buckner, J Grant Mouser, Kevin T. Mattocks, Jeremy P. Loenneke. *The University of Mississippi, University, MS.*

(No relationships reported)

Blood flow restriction (BFR) allows individuals to exercise with lower loads while producing similar increases in muscle size as high load training. Most studies implement moderate to high pressures with loads corresponding to 20-30% of their one-repetition maximum (1RM). No study has examined perceptual or cardiovascular responses using loads lower than 20% 1RM, which may provide a more widely inclusive and palatable stimulus.

PURPOSE: To determine the cardiovascular and perceptual response to very low load BFR exercise using both moderate (40%) and high (80%) relative arterial occlusion pressures (AOP).

METHODS: 14 participants came to the lab on four separate days to complete six exercise protocols (2 per visit on visits 2-4) consisting of 4 sets (1 set of 30 followed by 3 sets of 15) of BFR elbow flexion exercise with either a 10%, 15% or 20% 1RM load, each of which was performed with a moderate (40% AOP) and high (80% AOP) relative pressure. A repeated measures ANOVA was used to determine differences in AOP pre and post exercise and a Friedman test was used to determine differences in discomfort and ratings of perceived exertion (RPE) following each set. AOP is expressed as [mean (95% confidence interval)] with RPE and discomfort expressed as [median (25th, 75th percentile)].

RESULTS: There was an interaction for AOP ($p = 0.002$) with higher pressures and loads producing a gradient increase. The pre to post changes ranged from 21 (95% CI: 10-32) mmHg in the 10% 1RM/40% AOP condition to 62 (95% CI: 45-78) mmHg in the 20% 1RM/80% AOP condition.

Ratings of discomfort were primarily dependent on the level of restriction pressure applied, with higher pressures resulting in greater discomfort ($p < 0.001$) ranging from 2.5 (1, 5) in the 15% 1RM/40% AOP condition to 6.5 (5.5, 7.25) in the 15% 1RM/80% AOP condition. Additionally, a gradient increase in RPE accompanied higher pressures and loads which ranged from 8.5 (7, 12) at the conclusion of the 10% 1RM/40% AOP condition to 15.5 (12.75, 17.25) at the conclusion of the 20% 1RM/80% AOP condition.

CONCLUSIONS: Increases in load and restrictive pressure resulted in elevated AOP and RPE, but higher pressures were primarily responsible for increased discomfort. Individuals experiencing discomfort during low load BFR exercise may wish to decrease the applied pressure and increase the exercise load.

E-28 Free Communication/Poster - Cardiac Physiology

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2552 Board #72 June 2 9:30 AM - 11:00 AM

Global And Regional Cardiac Function In Lifelong Endurance Athletes With And Without Myocardial Fibrosis

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PURPOSE: The aim of the present study was to compare cardiac structure as well as global and regional cardiac function in athletes with and without MF.
METHODS: Cardiac magnetic resonance imaging with late gadolinium enhancement was used to detect MF and global cardiac structure in 9 lifelong veteran endurance athletes (58±5 years, 43±5 years of training). Transthoracic echocardiography using tissue-Doppler and myocardial strain imaging assessed global and regional (18 segments) longitudinal left ventricular function.
RESULTS: MF was present in 4 athletes (range 1-8 g) and not present in 5 athletes. MF was located near the insertion points of the right ventricular free wall on the left ventricle in 3 athletes and in the epicardial lateral wall in 1 athlete. Athletes with MF demonstrated a larger end diastolic volume (205±24 vs 173±18 ml, p=0.06) and posterior wall thickness (11±1 vs 9±1 mm, p=0.03) compared to those without MF. The presence of MF did not mediate global tissue velocities or global longitudinal strain (-22.0±4.3 vs -21.7±1.8) and strain rate (S': -0.97±0.19 vs -1.02±0.11; E': 0.95±0.20 vs 0.90±0.15; A': 0.61±0.16 vs 0.66±0.17), however, regional analysis of longitudinal strain demonstrated reduced function in 5 out of 8 wall segments associated with the presence of MF in 3 athletes (Figure).
CONCLUSIONS: MF is associated with larger cardiac dimensions, normal global cardiac function but evidence of co-localised regional cardiac dysfunction in lifelong veteran endurance athletes. Given the heterogeneous phenotype of MF, we propose that follow-up studies and a case-by-case approach are needed for appropriate risk assessment in athletes with MF.

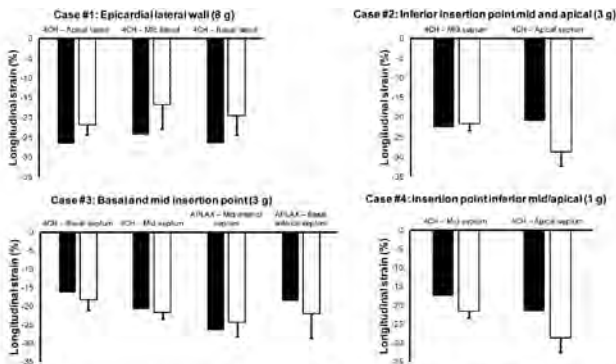


Figure: Regional left ventricular longitudinal strain data from co-localised MRI derived myocardial fibrosis segment. Data is presented per case (black bars) and compared to the average strain value in the same segment of athletes without myocardial fibrosis (white bars). Data is presented as mean ± SD. 4CH1, apical 4 chamber view, APLAX, apical parasagittal long axis view.

2553 Board #73 June 2 9:30 AM - 11:00 AM

Accuracy Of Mobile HRV Devices For Measuring RMSSD: A Systematic Review And Meta-analysis

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(No relationships reported)

There are a number of commercially available heart rate variability (HRV) mobile devices that provide a measure of root mean square of successive R-R differences (RMSSD). However, their accuracy compared to electrocardiography (ECG) remains questionable. **PURPOSE:** To compare a range of mobile devices to ECG for measuring RMSSD under a variety of conditions. **METHODS:** This review was

conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement guidelines. Articles published before July 22, 2016 were located using searches of the Physical Education Index (n=1,007), PubMed (n=1,145), Scopus (n=1,562), and SPORTDiscus (n=2,137) online databases using combinations of the terms: *heart rate variability, HRV, valid, and validity*. Duplicate publications were removed, yielding 4,686 original records for review. In addition, three publications were identified through a manual reference search. All studies included in the meta-analysis were peer reviewed and published in English. Each study effect size (ES) was calculated as the difference between the RMSSD measures recorded from the mobile device compared to ECG, divided by the pooled standard deviation and adjusted for small sample bias. Random-effects models were used to aggregate a mean ES and 95% confidence intervals (CI). In addition, a multi-level model was used to account for the nesting of multiple effects within a single study. **RESULTS:** The cumulative results from 35 effects extracted from 14 articles published between 2005 and 2016 indicate no difference between the mobile devices and ECG for RMSSD measures (ES = -0.0040, 95% CI = -0.0687, 0.0608, p = 0.9039). The multi-level model yielded similar results (ES=-0.0040, 95% = -0.0687, 0.0608, p=0.9059). The number of effects obtained from each studied ranged from 1 to 12 (mean=2.92, standard deviation=3.00). We observed minimal heterogeneity among our effects (Q = 4.516, p=0.99; I²=0%), with 100% of the observed heterogeneity explained by sampling error. **CONCLUSIONS:** These results suggest that mobile HRV devices provide similar measures of RMSSD compared to ECG.

2554 Board #74 June 2 9:30 AM - 11:00 AM

Tumor Necrosis Factor-alpha Adversely Influences Myocardial Oxygen Demand and Exercise Tolerance in Postmenopausal Women

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(No relationships reported)

Oxidative stress-mediated arterial stiffening is related to the pathophysiological progression of vascular dysfunction with advancing age. However, the functional implications concerning the involvement of tumor necrosis factor-alpha (TNF-α), a marker of oxidative stress, on hemodynamic responses at rest and during physical exertion are unclear. **PURPOSE:** The aims of this investigation were to examine the independent effects of TNF-α on myocardial oxygen demand at rest and during submaximal exercise, while also evaluating the influence of TNF-α on exercise tolerance. **METHODS:** Forty, postmenopausal (65 ± 3 years) women, provided blood samples and completed a modified-Balke protocol to measure maximal oxygen uptake. Local pulse contour analyses were used to assess large artery compliance while rate-pressure product (RPP), a reliable index of myocardial oxygen demand, was measured at rest and during two submaximal workloads. RPP was calculated by dividing the product of heart rate and systolic blood pressure (via auscultation) by 100. Exercise tolerance corresponded with the cessation of the graded exercise test. P-values ≤ 0.05 were considered statistically significant for all analyses. **RESULTS:** Multiple linear regression revealed a positive association between TNF-α and RPP during submaximal exercise (partial r = 0.43; p = 0.015) adjusted for maximal heart rate, maximal oxygen uptake, large artery compliance, and percent body fat. Path analyses revealed a significant indirect effect of large artery compliance on exercise tolerance through TNF-α, β = 0.13, CI [0.03, 0.35] such that heightened levels of TNF-α translated to poorer exercise tolerance. **CONCLUSIONS:** These data indicate that TNF-α is independently associated with myocardial oxygen demand during submaximal exercise equating to 5 METs but not at rest and TNF-α mediates the indirect effects of large artery compliance on exercise tolerance. Future studies should explore differential responses to standardized exercise tasks among older adults and consider the influence of exercise training on myocardial oxygen demand and activity-related energy expenditure.

2555 Board #75 June 2 9:30 AM - 11:00 AM

Absence of Cardiac Drift during a Prolonged, Submaximal Swim Bout

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PURPOSE: Cardiovascular (CV) factors undergo progressive time-dependent changes beginning approximately 10 min into a bout of prolonged, submaximal exercise. One expected response is a gradual rise in heart rate (HR) throughout a prolonged sustained exercise bout. The purpose of this study was to examine whether or not CV drift occurs in trained swimmers during a typical early season repetition training session. **METHODS:** Thirteen swimmers (n=2 women; n=11 men) were asked to perform 60 repetitions of 91.4 m of freestyle swimming in 26.6 C water with a 5-10

sec rest interval between each repetition. HR was collected in 15 second epochs using a commercially available cardio-tachometer (Actiheart) for the entire bout. During the 60 min and after each swimmer achieved "steady state" (10 min after the beginning of the bout), the HR data were averaged each minute. A series of 6 one-tailed paired t-tests were used to compare the group mean HR at 10 min to each of the subsequent 10 min time interval of group mean HR. Standard deviations, and the subsequent average of those standard deviations, were calculated for each subject's HR data. **RESULTS:** Significant differences were found between the group mean HR at 10 min (165.2 ± 8.2 bpm; baseline) and minutes 11-20, 21-30, 31-40, and 41-50 (166.1 ± 9.0 bpm, 169.1 ± 7.9 bpm, 169.8 ± 8.2 bpm, 169.4 ± 7.0 bpm, respectively; $p < 0.05$). No significant differences were found between the group mean HR at 10 min and minutes 51-60 and 61-70 (167.8 ± 6.3 bpm, 166.4 ± 6.1 bpm, respectively). The range of standard deviations for each subject's HR was 2.7-9.5 bpm (mean = 5.9 ± 1.8 bpm). **CONCLUSIONS:** The swimmers in this study experienced a small increase in HR from their first 10 minute value through minute 50 of the prolonged bout. However, HR then returned to baseline suggesting either CV drift did not occur or the results were related more to athlete pacing than any CV response per se.

2556 Board #76 June 2 9:30 AM - 11:00 AM

Cardiovascular Structure and Function in Lifelong Competitive Swimmers

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It is known that intense aerobic exercise elicits physiological adaptations of the cardiovascular system. However, it is unclear whether these adaptations exist over a lifetime of training. Little published data exists quantifying such adaptations in older competitive athletes, & even less data exists on populations engaged in long-term interval training, such as swimmers.

Purpose: To assess & compare the cardiovascular remodeling status of chronically trained Master's swimmers to age-matched, inactive reference values. **Methods:** Chronically trained (20.0 ± 14.5 yrs), competitive men (M, n=7) & women (F, n=21) Master's swimmers (age 55.2 ± 6.0 yrs) were studied just prior to competing in the 2009 US Masters Swimming Long Course Nationals. Demographics, anthropometrics, training history & resting hemodynamics were recorded. Subjects then underwent 2D transthoracic echocardiography with Doppler. Septal wall thickness (IVS), posterior wall thickness (PWT), left ventricular internal diastolic & systolic dimensions (LVIDd/s), end diastolic & systolic volumes (EDV/ESV), relative wall thickness (RWT), LV mass measured via truncated ellipsoid method (LVM), & left atrial volume (LAV) were assessed & indexed to body surface area where appropriate. RWT & LVMi were used to characterize remodeling status per American Society of Echocardiography (ASE) guidelines. Sex-specific means as well as individual values were compared to ASE published normal values (mean + 2SD = ULN, upper limit of normal). A one-sample T-test was used to compare published ASE values to subject sex-specific means ($p < 0.05$). **Results:** 64% of all athletes demonstrated normal geometry (M 57%, F 67%), 21% concentric remodeling (M 14%, F 24%), 14% eccentric hypertrophy (M 29%, F 10%), & 0% concentric hypertrophy. No statistical difference was shown between sex-specific means for LVIDd, LVIDs, EDV, EDVi, ESV, ESVi, LAVi & ASE reference values. However, 29% of men displayed LVEDVi above age-specific ASE ULN, compared to only 5% of women. **Conclusions:** Compared to inactive reference values nearly a third of the active men showed signs of exercise-induced cardiac remodeling. This trend was not observed in women suggesting a difference in physiological response to training, or a difference in long-term training parameters.

2557 Board #77 June 2 9:30 AM - 11:00 AM

Heart Rate Variability During Acute Recovery from Maximal Exercise; Utility of a Nonlinear Dynamics Approach

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The non-stationary trend of the heart rate (HR), response immediately following the cessation of exercise mathematically biases traditional measures of heart rate variability (HRV), during acute recovery. Fitness-induced alterations in resting HR, HRV and heart rate recovery (HRR) are observed in response to changes in cardiac autonomic nervous system modulations. **PURPOSE:** To pilot the utility of nonlinear

dynamics to characterize the patterns of fluctuation and complexity surrounding the non-stationary drift in HRV during acute recovery from exercise. **METHODS:** HR data was collected throughout exercise and into recovery following an incremental treadmill test to exhaustion in young adults [age range=19-21 yrs (male: n=14, Ht=173±7cm, Wt=71.7±11.4kg, BF=16.8±6.7%, VO_{2max} =48.0±6.0ml/kg/min, HR_{max} =200±11; female: n=18, Ht=162±5cm, Wt=67.8±15.9kg, BF=32.9±9.4%, VO_{2max} =33.3±9.5 ml/kg/min, HR_{max} =195±12)]. Nonlinear regression techniques were used to fit the first 5-min of R-R interval data following the cessation of exercise. Residuals were calculated from individual-specific regressions and used to create a secondary time-series. Detrended fluctuation analysis (DFA_a) and sample entropy (SampEn) were used to characterize self-similar patterns and the complexity of fluctuation in HRV-R, respectively. **RESULTS:** We successfully removed the non-stationary trend associated with post-exercise HRV data. Preliminary analyses show a significant interaction between VO_{2max} and HR_{max} as predictors of complexity (SampEn) surrounding the post-exercise HR response ($p=0.03$). A significant interaction between gender and HR_{max} predicted DFA_a ($p=0.02$); after controlling for HR_{max} , DFA was greater in women than men during acute recovery. **CONCLUSIONS:** Nonlinear dynamics provide an additional perspective on HRV during acute exercise recovery. The complexity surrounding the nonlinear trend of HRV during recovery may provide additional context for the role of fitness on cardiac autonomic nervous system modulation which has been previously described during resting HRV data. Future analyses should investigate the utility of this residual approach to examine the relationships across pre-, during-, and post-exercise HRV measures.

2558 Board #78 June 2 9:30 AM - 11:00 AM

Repeatability Of Impedance Cardiography In The Measurement Of Cardiovascular Hemodynamics During Exercise.

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Impedance cardiography (IC) is a non-invasive method for measuring cardiovascular hemodynamics during exercise. However, the consistency of measurements obtained via IC across different exercise modes has not been investigated.

PURPOSE: To investigate whether hemodynamic measures assessed via IC are consistent between treadmill (TM) and cycle (C) exercise at a given intensity. **METHODS:** Ten men (age = 21.2 ± 2.2 y; BMI = 24.8 ± 3.3) completed three exercise tests, two TM and one C. Within each test, a five minute, steady-state stage was completed with a target intensity of 5 METs. Oxygen consumption (VO_2) was measured by indirect calorimetry. Hemodynamic measures were obtained via IC (PhysioFlow, PF07 Enduro) and included stroke volume (SV), heart rate (HR), cardiac output (CO), cardiac index (CI), end diastolic volume (EDV), end diastolic filling ratio (EDFR), ejection fraction (EF), ventricular ejection time (VET), and systemic vascular resistance (SVR).

RESULTS: There were no significant differences in VO_2 and hemodynamic measures between repeated TM tests ($P > 0.05$). Steady-state VO_2 (19.2 ± 1.1 vs 19.1 ± 1.2 ml·kg⁻¹·min⁻¹) and HR (112 ± 14 vs 113 ± 16 beats·min⁻¹) did not differ between exercise modes (TM vs C). There were no significant differences between TM and C in SV, CO, CI, EDV, EF, and SVR, but EDFR and VET differed between trials. Significant intraclass correlation coefficients ($r = 0.70 - 0.90$, $p < 0.05$) were observed between modes for SV, HR, CO, EDV, EF, and SVR, but not for CI, VET, and EDFR. Bland-Altman analyses indicated good agreement between TM and C for in SV, HR, CO, CI, EDV, EF, and SVR.

CONCLUSION: The majority of hemodynamic measurements obtained via IC during moderate exercise showed moderate-strong consistency between TM and C modes. Future research utilizing IC during exercise should be conducted across a greater range of exercise intensities. In addition, hemodynamic variables obtained with IC should be compared with invasive methods to confirm their validity.

2559 Board #79 June 2 9:30 AM - 11:00 AM

Comparison of Heart Rate Variability in Intercollegiate Explosive Power vs. Sustained Power and Endurance Athletes

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Heart rate variability (HRV) provides valuable feedback about heart function by measuring the RR interval change over time (Poincaré SD1 and SD2, RMSSD, PNN50), sympathetic activity with low frequency (LF) Power, and parasympathetic activity with high frequency (HF) Power. **PURPOSE:** To investigate HRV and autonomic activity in intercollegiate explosive power (EXP) vs. sustained power and endurance athletes (SEN). **METHODS:** A standard operating procedure was created

to assess resting HRV and autonomic activity over 10-15 minutes in 27 Intercollegiate athletes (EXP n=17, SEN n=10). Data were sorted and analyzed by sport type using t-tests. **RESULTS:** Despite a 43% variation, EXP athletes' LF Power did not differ significantly from SEN athletes ($p=0.08$); however, EXP had a significantly higher HF Power (56%) than SEN ($p=0.03$). EXP did not differ significantly in HRV via Poincaré SD1 compared with SEN athletes ($p=0.09$). LF:HF ratio was similar in all athletic types.

HRV in Explosive Power Vs. Sustained Power and Endurance Athletes		
HRV Measure	Explosive Power (n=17)	Sustained Power and Endurance (n=10)
LF Power ($\text{ms}^2 \pm \text{SEM}$)	3863 \pm 847	2191 \pm 352
HF Power ($\text{ms}^2 \pm \text{SEM}$)	3107 \pm 725	1366 \pm 192
Mean LF:HF \pm SEM	1.64 \pm 0.25	1.69 \pm 0.21
Poincaré SD1 (ms) \pm SEM	61.6 \pm 7.7	46.9 \pm 3.6
Poincaré SD2 (ms) \pm SEM	114.6 \pm 11.5	115.5 \pm 10.1
RMSSD (ms) \pm SEM	87.1 \pm 10.9	66.3 \pm 5.1
PNN50 (%) \pm SEM	26.8 \pm 5.4	20.1 \pm 5.0

CONCLUSION: Differences in HRV were observed between EXP and SEN athletes, with the major significance in HF Power indicating EXP athletes demonstrated greater parasympathetic activity at rest compared with SEN athletes. Most HRV studies have focused on endurance trained athletes. This finding is of interest as cardiovascular variability studies in explosive athletes have potential to elucidate autonomic and cardiovascular regulation.

Supported by Miami University Student Tech Grant

2560 Board #80 June 2 9:30 AM - 11:00 AM

Effect of the Muscle Metaboreflex on Heart Rate Kinetics during the Exercise Transient Spanning the Entire Moderate Intensity Domain

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Recent data from our laboratory has shown that increasing sympathetic activity to the heart via muscle metaboreflex activation speeds heart rate kinetics during transitions in the lower moderate intensity domain (from 20W to ~60% of the ventilatory threshold, VT). Whether the magnitude of the exercise transient and heart rate change influences the effects of elevated sympathetic activity on heart rate kinetics is not known.

PURPOSE: We tested the hypothesis that increasing sympathetic activity to the heart via muscle metaboreflex activation would speed heart rate kinetics throughout the entire moderate intensity exercise transient. **METHODS:** Five healthy and active, but not trained, adults ($m/f = 3/2$; age = 22 ± 2 yrs; peak $\text{VO}_2 = 46 \pm 8$ ml/kg/min) performed square-wave moderate intensity exercise transitions from 20W to 90% VT. Each subject was tested in 2 conditions. Condition 1 was a control (CTL) condition. In condition 2, the muscle metaboreflex activation was induced by 2 min of handgrip at 40% maximal voluntary contraction during the pre-transition 20W baseline followed by 5 min of circulatory occlusion (OCCL) during the transition to 90% VT. Trials were randomized and three repetitions of each condition were completed, time-aligned, and averaged by condition. Heart rate kinetics were determined using mono-exponential curve fitting and data was analysed with non-parametric tests. $P < 0.05$ was significant.

RESULTS: The pre-transition baseline heart rate was not different between CTL (93 ± 8 beats/min) and OCCL (90 ± 10 beats/min), $P = 0.138$. Heart rate amplitude was not different between CTL (29 ± 6 beats/min) and OCCL (29 ± 5 beats/min), $P = 0.500$. Finally, the heart rate time constant, tau, was not different between CTL (34 ± 10 s) and OCCL (36 ± 16 s), $P = 0.686$. **CONCLUSIONS:** Heart rate kinetics are not altered by sympathetic activation via the muscle metaboreflex during the exercise transition from 20W to 90% VT. These findings suggest that the magnitude of step-change in exercise intensity and/or the magnitude of change in heart rate plays an important role in heart rate kinetics under a sympathetically elevated condition.

2561 Board #81 June 2 9:30 AM - 11:00 AM

Cardiac Autonomic and Blood Pressure Responses to an Acute Bout of Kettlebell Exercise

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Increased blood pressure (BP) and autonomic dysfunction are independent risk factors for cardiovascular disease. Heart rate variability (HRV) is used as a measure of cardiac autonomic function in many research settings, including the evaluation of the autonomic control during and after physical activity. A prolonged sympathetic predominance and a slow parasympathetic reactivation contribute to a delayed BP and heart rate (HR) recovery after exercise which is thought to be associated with increased risk of acute cardiac events. Therefore, understanding the impact of various exercise modalities on the post-exercise autonomic modulation and BP would allow for appropriate exercise prescription in susceptible populations. Kettlebell (KB) training has become an extremely popular training modality for improving both muscle strength and aerobic fitness. However, the HRV and BP responses induced by an acute KB exercise session are currently unknown. **PURPOSE:** To evaluate the effects of an acute session of KB exercise on HRV and BP responses in healthy young adults. **METHODS:** 17 young healthy adults ($M=10, F=7$) completed a KB exercise or a no-exercise control trial in a randomized order. During the KB trial, participants completed twelve-30s sets of KB swings followed by 30 seconds of rest. Men and women used a 16kg and 8kg KB, respectively. Low-frequency power (LF), high-frequency power (HF), the LF to HF ratio (LF/HF), HR and BP were collected in the supine position at baseline, 3, 10 and 30 min after each trial. LF and HF were normalized to total power resulting in nLF, nHF and nLF/nHF. **RESULTS:** There were significant group-by-time interactions ($P < 0.05$) for nLF (sympathetic activity), nHF (vagal tone), nLF/nHF (sympathovagal balance), HR, systolic and diastolic BP. There were significant increases ($P < 0.01$) in nLF, nLF/nHF and HR as well as significant decreases ($P < 0.01$) in nHF, systolic (~4mmHg) and diastolic (~3mmHg) BP for 30 min after KB compared to no changes after control. **CONCLUSIONS:** Our findings indicate that KB exercise increases sympathovagal balance 30 min post-exercise which is concurrent with a sustained hypotensive effect in young healthy adults. Further research is warranted to evaluate the potential clinical application of KB in populations that might benefit from post-exercise hypotension.

2562 Board #82 June 2 9:30 AM - 11:00 AM

Acute Resistance Exercise Effects on Autonomic Modulation Between Resistance-Trained Men and Women

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While it has been reported that women have greater vagal withdrawal during aerobic exercise and supramaximal exercise compared to men, the sex-specific responses to an acute bout of resistance exercise are unknown. **PURPOSE:** To determine the effects of an acute bout of free-weight resistance exercise consisting of the squat, bench press, and deadlift on heart rate variability (HRV) and heart rate complexity (HRC) between the sexes. **METHODS:** Twenty-three resistance-trained (aged 23 ± 3 yrs; mean \pm SD) men ($n=13$) and women ($n=10$) with a minimum of 1 year of resistance training volunteered for the study. Autonomic modulation was assessed at rest as well as 15-20 minutes (Rec1) and 25-30 minutes (Rec2) after an acute bout of resistance exercise utilizing 3 sets of 10 repetitions at 75% 1-repetition maximum on the squat, bench press and deadlift. Two minutes of rest was given between sets and exercises. A quiet control condition of the same duration was also utilized for each participant. Measures of HRV were analyzed in the frequency domain and included measures of vagal modulation (normalized high frequency (HFnu)), sympathetic modulation (normalized low frequency (LFnu)), and sympathovagal balance (LF/HF ratio). Sample Entropy (SampEn), indicative of vagal modulation, was used as a measure of HRC. A repeated measures ANOVA was used to compare the effects of sex (men and women) across the two conditions (resistance exercise and control) and time (rest, Rec1 and Rec2). T-tests were used for post-hoc testing if the ANOVA was significant with a Benjamini-Hochberg correction factor. **RESULTS:** There were no significant sex differences at rest for any of the variables. Furthermore, there were no significant sex \times condition \times time interactions for any variable. Compared with Rest LFnu (Rest: $35.5 \pm 15.3\%$; Rec1: 73.0 ± 18.0 ; Rec2: $66.0 \pm 25.1\%$, $p=0.0001$), LnLF/HF (Rest: $4.0 \pm 0.9\%$; Rec1: $5.1 \pm 1.1\%$; Rec2: $5.2 \pm 1.1\%$, $p=0.002$) were augmented at Rec1 and Rec2. HFnu (Rest: $61.2 \pm 17.1\%$; Rec1: $40.3 \pm 22.3\%$; Rec2: $38.4 \pm 21.8\%$, $p=0.0001$) and SampEn (Rest: 1.5 ± 0.3 units; Rec1: 1.2 ± 0.3 units; Rec2: 1.3 ± 0.5 units, $p=0.0001$)

were decreased at Rec1 and Rec2 compared to Rest after the acute resistance exercise. **CONCLUSIONS:** These data suggest that acute RE using free-weights has a profound impact on autonomic modulation that is similar between the sexes.

2563 Board #83 June 2 9:30 AM - 11:00 AM
The Effects Of Ultra-endurance Event Participation On Biomarkers Of Cardiac Damage - A Systematic Review And Meta-analysis

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Meta-analysis has not yet collectively evaluated biomarkers of cardiac damage following ultra-endurance races or factors which modulate these biomarkers.

PURPOSE:

To quantify the response of creatine kinase MB (CK-MB) and cardiac troponin (cTn) isoforms following a single ultra-endurance event and determine whether patient and ultra-endurance race characteristics modulated changes in these markers of cardiac damage.

METHODS:

A systematic review was conducted and reported according to PRISMA guidelines. A generic search strategy using PubMed, CINAHL, and SportsDiscus was employed to comprehensively identify all peer-reviewed publications which evaluated health-related effects of participating in an ultra-endurance event. Data from observational studies which reported pre- and post-race measurements of CK-MB (k=16 studies), cTnI (k=8), and cTnT (k=6) were analyzed following random-effects assumptions.

RESULTS:

On average, ultra-endurance participants were middle-aged males who competed in running, cycling, or triathlon race distances ~156-235 km and ~20 h duration. Overall, ultra-endurance events significantly increased CK-MB ($d = 11.29$; 95% CIs: 7.90, 14.69) and cTn levels ($d = 2.18$; 95% CIs: 1.39, 2.97) post- compared to pre-race. Collectively, these effect sizes lacked homogeneity (I^2 [95% CI]: CK-MB=94.4% [92.2, 95.9]; cTn=90.9% [86.4, 93.8]). Bivariate moderator analyses revealed that older versus younger samples experienced greater increases in CK-MB following a single ultra-endurance event ($\beta = 0.543$, $p = 0.030$). Ultra-endurance running events elicited greater increases in CK-MB compared to cycling and triathlon events ($\beta = 0.583$, $p = 0.018$). In contrast, greater increases in cTn levels were observed among younger compared to older samples following a single ultra-endurance event ($\beta = 0.659$, $p = 0.020$). Furthermore, cycling and triathlon events elicited greater increases in cTn compared to running events ($\beta = 0.472$, $p = 0.036$). Effects were similar whether cTn isoforms were analyzed separately or combined.

CONCLUSIONS: Cardiac biomarkers were consistently elevated following ultra-endurance events and dependent on age and race type. Further research is necessary to determine the long-term clinical significance of repeated ultra-endurance races.

2564 Board #84 June 2 9:30 AM - 11:00 AM
Influence of Exercise Mode on Post-Exercise Indices Reflecting Cardiac Parasympathetic Reactivation and Sympathetic Withdrawal

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PURPOSE: This study investigated indirect measures of post-exercise parasympathetic reactivation (using heart rate variability, HRV) and sympathetic withdrawal (using systolic time intervals, STI) following upper- and lower-body dynamic exercise. **METHODS:** 13 males (age 26.4±4.7 y) performed maximal incremental arm-crank and leg cycling exercise tests (MAX-ARM and MAX-LEG, respectively). Subsequently, participants performed separate 8-min bouts of submaximal HR-matched exercise of each mode (SUBMAX-ARM and SUBMAX-LEG). HRV (including the natural-logarithm of root mean square of successive differences, Ln-RMSSD) and STI (including the pre ejection period, PEP) were assessed throughout 10-min seated recovery. **RESULTS:** Peak HR was higher ($p = 0.001$) during MAX-LEG (182±7 b.min⁻¹) compared with MAX-ARM (171±12 b.min⁻¹), while HR ($p < 0.001$) and Ln-RMSSD ($p = 0.010$) recovered more rapidly following MAX-ARM. PEP recovery was similar between maximal exercise bouts ($p = 0.106$). HR during submaximal exercise was 146±7 and 144±8 b.min⁻¹ for SUBMAX-LEG and SUBMAX-ARM, respectively ($p = 0.139$). The recovery of HR and Ln-RMSSD was also similar between submaximal modes ($p = 0.219$ and 0.110, respectively), although these variables did not return to resting levels ($p < 0.001$). PEP was similar at end-exercise (SUBMAX-LEG 70±6 ms; SUBMAX-ARM 72±9 ms;

$p = 0.471$), however PEP recovery was slower following SUBMAX-ARM ($p = 0.021$), with differences between modes apparent over 1 to 10-min recovery ($p \leq 0.036$). By 10-min post-exercise, PEP had recovered to near-resting levels (132±21 ms) following SUBMAX-LEG (130±21 ms; $p = 0.143$) but not after SUBMAX-ARM (121±17 ms; $p = 0.001$). **CONCLUSION:** Compared with submaximal HR-matched lower-body exercise, upper-body dynamic exercise elicited a similar recovery of HR and HRV indices of parasympathetic reactivation, but a delayed recovery of PEP (index of sympathetic withdrawal). These data indicate that exercise mode influences post-exercise parasympathetic reactivation and sympathetic withdrawal in a manner that is moderated by exercise intensity. These results may be of practical relevance to multi-discipline athletes, as well as for clinical monitoring applications where the mode of exercise testing may vary.

2565 Board #85 June 2 9:30 AM - 11:00 AM
Early Life Nutrition Alters the Electrocardiogram of Adult Mice with Dobutamine Stimulation

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PURPOSE: Under nutrition in early life has been shown to increase the risk of cardiovascular disease (CVD) in adult life. Thus, the purpose of this study was to determine if early life undernutrition at various windows of development (Postnatal days [PN] 1-21) produced cardiac arrhythmias at rest and when pharmacologically stressed (PST) with dobutamine. **METHODS:** Mouse FVB/N dams were fed a semi-purified diet (CON: 20% protein), or a low-protein (LP: 8%) diet beginning 1 week prior to mating. In order to evaluate the phases (N=16/group) of early life undernutrition (early-EUN; PN1-10, late-LUN; PN11-21, E+L-PUN, PN1-21) a cross fostering model was used where pups suckled to dams fed a LP diet received a global reduction in caloric intake (~18% as compared to CON) during the designated window prior to weaning. After weaning all mice were fed the control diet until PN80. At PN80 body composition (BC) was measured by MRI, and then evaluated for cardiac function via electrocardiogram (ECG) under 1% isoflurane anesthesia. After baseline measure, the mouse was administered an intraperitoneal injection of dobutamine (1.5 µg/g BW) and measurements repeated. Quantitative ECG analysis was performed using EMKA Tech. software. **RESULTS:** At PN80 Undernutrition significantly ($P < 0.05$) reduced weight in the LUN (22.68±0.88g) and PUN (19.96±0.32g) but there was no difference between CON (25.05±0.96g) and EUN (25.28±0.92g). Similarly fat mass was reduced ($P < 0.05$) in all groups compared to controls (CON: 8.00±1.2g, EUN: 6.32±0.65g, LUN: 5.11±1.1g, PUN: 3.90±0.25g), however lean mass was only significantly reduced ($P < 0.05$) in the PUN group (CON: 17.99±0.26g, EUN: 17.78±0.39g, LUN: 17.34±0.33g, PUN: 15.85±0.28g). Heart weight when standardized to body surface area was only significantly ($P < 0.05$) reduced in the EUN group (.001288±.000031 kg/cm²) as compared CON group (.001405±.000089 kg/cm²), with LUN (.00135±.00004 kg/cm²) and PUN (.001342±.000031 kg/cm²) not different from CON. ECG analysis showed that with dobutamine, EUN group had a 6.25% increase in 1st degree AV block and PUN group had a 43.75% increase in wide QRS complex. **CONCLUSION:** Thus, EUN reduces heart size with a predisposition for conduction delays to left ventricle but ischemia is primarily associated with prolonged undernourishment in postnatal life (PUN).

2566 Board #86 June 2 9:30 AM - 11:00 AM
Cardiac Autonomic Response to Handgrip Exercise Performed with and without Blood Flow Restriction

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Recent studies examining blood flow restriction (BFR) training, utilizing low-intensity leg exercise, demonstrate that the cardiac autonomic stress is lower in comparison to high-intensity leg exercise without BFR. Whether or not this response occurs for upper-body exercise performed with and without BFR is unclear. **PURPOSE:** To examine the heart rate variability (HRV) response to low- and high-intensity unilateral handgrip exercise performed with and without BFR. **METHODS:** Six college-aged males (Age=23±1 yrs; BMI=31±3 kg/m², handgrip max voluntary contraction-MVC=53±4 kg) underwent three 5-min bouts (10 mins rest between, counterbalanced design) of exercise consisting of rhythmic handgrip (20 contractions/min, 1-2 sec duty cycle) performed at a low- (40% MVC) and high-intensity (60% MVC) with and without a proximally placed occlusion cuff (80-100mmHg, 50-80% arterial occlusion assessed via radial artery Doppler-ultrasound). Using Lead-II surface electrocardiography, heart rate (HR) and HRV data [time and frequency domain (power-spectral analysis)] were analyzed at baseline, and also during the last 2 mins of each exercise bout. **RESULTS:** High-intensity handgrip performed with and without BFR produced a greater HR increase from baseline as compared to the low-intensity handgrip with BFR (60% with BFR=+8±2, vs. 60% without BFR=+9±2, vs. 40%

with BFR=+6±2 bpm; $P=0.001$). Compared to baseline, the standard deviation of R-R intervals was lower during high-intensity handgrip without BFR (baseline=58±8, vs. 60% without BFR=37±3 ms; $P=0.035$), but similar to baseline for low- and high-intensity BFR (40% with BFR=40±4, $P=0.071$; 60% with BFR=44±6 ms, $P=0.3$). A similar finding was noted for root mean square of R-R standard deviations ($P=0.01$). The low and high frequency HRV components (markers of sympathetic and parasympathetic activity, respectively) were lower during exercise ($P<0.05$), but comparable across all handgrip bouts ($P>0.05$). **CONCLUSIONS:** These preliminary findings suggests that both low- and high-intensity handgrip exercise performed with BFR produce a comparable cardiac autonomic stress (i.e., parasympathetic withdrawal) as high-intensity handgrip exercise without BFR.

2567 Board #89 June 2 9:30 AM - 11:00 AM
Multi-layer Myocardial Mechanics In The Athlete's Heart

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Introduction: Endurance exercise training provokes numerous adaptive changes to the morphology, structure and function of the human heart that are chamber and region specific. Accordingly, regional non-uniformity of the human heart may play an important role in ventricular contraction and relaxation, and contribute to myocardial efficiency during exercise. **Purpose:** This study examined regional and transmural myocardial tissue deformation (strain) in a cohort of endurance trained (active >10h/week) and untrained (active <2h/week) men to characterize multi-layer myocardial tissue mechanics in the athlete's heart. **Methods:** Echocardiography was used to measure biventricular strain in 12 endurance trained men (ET; Age: 27.4±1.6yr, BMI: 23.2±0.7m², $VO_{2\text{peak}}$: 4.4±0.3L·min⁻¹) and 12 healthy untrained men (UT; Age: 26.5±1.0yr, BMI: 22.6±0.8m², $VO_{2\text{peak}}$: 3.1±0.2L·min⁻¹). **Results:** Left ventricular global longitudinal strain (ET: -18.8±0.8% vs UT: -18.5±0.5%) was similar in trained and untrained men, while right ventricular global longitudinal strain (ET: -18.3±0.8% vs UT: -23.5±1.8%, $p<0.01$) was lower in trained men. Left ventricular transmural strain increased from the epicardium to the endocardium in trained (Epi: -16.6±0.4%; Mid: -18.4±0.5%; Endo: -21.1±0.5%, $p<0.01$) and untrained (Epi: -16.0±0.6%; Mid: -18.7±0.7%; Endo: -21.2±0.8%, $p<0.01$) men. Right ventricular transmural strain was similar across myocardial layers in untrained men (Epi: -23.2±1.7%; Mid: -23.4±1.8%; Endo: -23.9±1.8%), while right ventricular transmural strain increased from the epicardium to the endocardium (Epi: -16.9±0.8%; Mid: -18.3±0.7%; Endo: -19.7±0.6%, $p<0.01$) in trained men. **Conclusion:** Functional non-uniformity is more pronounced in the left ventricle than the right ventricular free wall; however, right ventricular functional changes develop following endurance training. Differences in myocardial architecture and exercise-induced wall stress in the left and right ventricles are possible explanations for the marked functional non-uniformity throughout the myocardium, and in response to exercise training.

2568 Board #88 June 2 9:30 AM - 11:00 AM
Cardiac Autonomic Modulation and High Intensity Interval Training in Physically Inactive Men

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Purpose: Cardiac autonomic dysfunction and physical inactivity are associated with increased risk of cardiovascular disease. Short duration high intensity interval training (HIIT) has been shown to improve aerobic capacity; however, adaptations of the cardiac autonomic nervous system are less clear. Therefore, the aim of the present study was to assess cardiac autonomic adaptations to HIIT.

Methods: In a randomised crossover controlled trial, 40 physically inactive males (21 ± 1.7 years; 179.9 ± 5.4 cm; 82.6 ± 11.5 kg; mean ±SD) completed 2-weeks of HIIT and a matched duration control period. The HIIT protocol consisted of 3 x 30-second maximal cycle ergometer sprints against a resistance of 7.5% body weight, interspersed with 1-minute of active recovery (50 rev·min⁻¹ with no resistance). In total 6-sessions were performed. Cardiac autonomic function was measured pre and post-training and control period using a plethysmographic device (Task Force® Monitor). Total power spectral density (PSD) and associated low-frequency (LF) and high-frequency (HF) power spectral components were recorded in absolute (ms²) and normalised units (nu).

Results: Each participant completed 18-maximal cycle ergometer sprints over a 2-week period. The HIIT intervention produced an improvement in cardiac autonomic function with significant increases in total PSD (361.8 ± 200.1 vs. 19.8 ± 141, $p<0.001$), HF (ms²) (210.6±159.3 vs. 15.6±86.9, $p<0.001$) and HF (nu) (3.6 ± 2.5 vs. 0.23 ± 1.7,

$p<0.001$), coupled with a significant decrease in LF (nu) (-3.6 ± 2.5 vs. -0.23 ± 1.7, $p<0.001$) and LF/HF ratio (-0.3 ± 0.3 vs. 0.01 ± 0.2, $p<0.001$) compared to the control period. There was no significant change in the LF (ms²) power spectral component. **Conclusion:** A short-term programme of HIIT was associated with a significant increase in cardiac autonomic modulation, demonstrated by a residual increase in cardiac vagal activity. Further research is required to establish whether these adaptations are sustained with regular HIIT training and any impact this may have on long-term cardiovascular disease risk.

2569 Board #89 June 2 9:30 AM - 11:00 AM

Post-exercise Heart-rate Recovery Correlates To Resting Parasympathetic Modulation In Apparently Healthy Men

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(No relationships reported)

Post-exercise heart rate (HR) recovery (HRR) has recently been considered to be a powerful and independent predictor of risk for cardiovascular disease and mortality. The short-term post-exercise cardiovascular adaptation is associated to simultaneous rapid increase in parasympathetic and a progressive decrease in sympathetic activity. However, the relationship between HRR and rest parasympathetic modulation is not yet fully understood. **PURPOSE:** We aimed to correlate HRR with resting parasympathetic status. **METHODS:** We evaluated 70 apparently healthy men, aged 27.5 ± 6.3 years showing BMI 24.4 ± 2.3 kg/m². All participants underwent a sub-maximal exercise testing (SET). At 85% of the maximal predicted HR, the recovery protocol started. The HRR was calculated as the absolute difference from the peak HR to the HR at the 1st min to 5th min during 5-min period of active recovery at 2.4km/h and 2.5% grade. HRR at the 1st min to 5th min following SET were correlated with 5 min time domain (pNN50 and rMSSD), frequency domain (HF_{nu}) and Poincaré Plot (SD1) indices of heart rate variability (HRV) at rest in supine position. Due to non-normal distribution of variables (*Shapiro-Wilk test*) we used the Spearman correlation at the 5% level of significance. **RESULTS:** We observed positive correlation of HRR from the 1st to 5th min with parasympathetic indices in the supine position, as shown in Table 1.

Table 01- Spearman correlation coefficients and p value (in parenthesis) of the correlation of heart rate recovery (HRR), at different post exercise times, with the parasympathetic indices in resting supine position, in 70 healthy men

Variables	1 st min	2 nd min	3 rd min	4 th min	5 th min
pNN50 (%)	0.18 (0.05)	0.29 (<0.01)	0.25 (<0.01)	0.35 (<0.01)	0.36 (<0.01)
rMSSD (ms)		0.25 (0.01)	0.23 (0.02)	0.35 (<0.01)	0.35 (<0.01)
HF _{nu} (%)		0.29 (<0.01)	0.37 (<0.01)	0.43 (<0.01)	0.42 (<0.01)
SD ₁	0.18 (0.05)	0.24 (0.02)	0.18 (0.05)	0.27 (0.01)	0.25 (0.01)

CONCLUSIONS: HRR from the 1st to 5th min post-exercise positive correlated with parasympathetic indices in resting supine position. Our results demonstrate that the highest is the tonic (resting supine) parasympathetic modulation, the greater is the decrease of HRR after SET in apparently healthy men.

2570 Board #90 June 2 9:30 AM - 11:00 AM

Long-term Intensive Exercise Induced Atrial Fibrillation Is Associated With Tgf-β1-Mir-21 Signaling Pathway

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PURPOSE: To explore the long-term intensive exercise induced atrial fibrillation relates to cardiac injury and TGF-β1/miR-21 Signaling Pathway and provides experimental evidence for determine the mechanism of exercise-induced atrial fibrillation.

METHODS: 72 SD rats were grouped to control group(C), moderate intensity group (M) and high intensity group (H) with 24 animals in each group. M and H group were conditioned to run for 4, 8, and 16 weeks, 5 days/weeks, 1h/day. Rats were euthanized to obtain hearts within 24h after exercise. Right atrial were collected. Plasm cTnI was detected, hydroxyproline was measured by lkali hydrolysis method. TGF-β1 and miR-21 gene expression were evaluated by real-time PCR. TGF-β1 protein was quantified by Western Blot.

RESULTS: Compared with control and M group, rats serum cTnI increased at 8 weeks/12 weeks/16 weeks($P<0.01$). Compared with C and M group, hydroxyproline content of H group showed significant increase at 12 weeks and 16 weeks($P<0.01$).

Hydroxyproline of H group confirmed a gradual increase with training time, with significant increase from 8 weeks to 16weeks($P<0.05$). TGF- β 1 gene and protein expression of H group increased compared their control group at 8/12/16 weeks. Compared with their controls, miR-21 expression of H group showed a significant increase($P<0.05$). miR-21 of H group significantly decrease from 8 weeks to 16weeks($P<0.05$).

CONCLUSIONS: Long-term Intensive exercise induced sustained myocardial damage, resulted in sustained collagen increase which induced myocardial fibrosis. TGF- β 1/miR-21 signaling pathway, upregulated by long-term intensive exercise, may involve in the pathology of intense exercise -induced myocardial damage and atrial fibrillation.

2571 Board #91 June 2 9:30 AM - 11:00 AM
Muscle Metaboreflex Modulation of Heart Rate Kinetics During the Transition to Low-Moderate and High-Moderate Exercise Intensities

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Our classical understanding of heart rate kinetics is that a sympathovagal balance favouring parasympathetic tone at rest or during low level exercise contributes to a rapid heart rate adaptation (i.e. fast kinetics) during low level exercise transitions. Conversely, higher-level exercise transitions elicit slower heart rate kinetics, due in part to a sympathovagal shift to greater sympathetic tone. **PURPOSE:** To test the hypothesis that increasing sympathetic activity to the heart via muscle metaboreflex activation would slow heart rate kinetics during lower vs higher level exercise transitions. **METHODS:** Twelve healthy, active, and untrained adults (m/f = 6/6; age = 23 ± 3 yrs; peak $\dot{V}O_2 = 40 \pm 3$ ml/kg/min) performed square-wave moderate intensity exercise transitions in two equal step changes between 20W to 90% ventilatory threshold (VT). The first transition was in the low moderate domain (LMD: 20W to 55 \pm 13 W) and the second transition in the high moderate domain (HMD: 55 \pm 13 W to 90 \pm 27 W). These transitions were performed without (control; LMD-CTL and HMD-CTL) and with muscle metaboreflex activation induced by 2 min of handgrip at 40% maximal voluntary contraction during the pre-transition baseline followed by 5 min of brachial occlusion (OCC) during either the LMD (LMD-OCC) or HMD (HMD-OCC) transition. Trials were randomized and three repetitions of each condition were completed, time-aligned, and averaged by condition. Heart rate kinetics were determined using mono-exponential curve fitting. Data was analysed with non-parametric tests. $P < 0.05$ was significant. **RESULTS:** Heart rate amplitude was lower during LMD-OCC vs LMD-CTL (15 ± 5 vs 17 ± 6 beats/min; $P = 0.012$) and the heart rate time constant, tau, was faster during LMD-OCC vs LMD-CTL (18 ± 9 vs 26 ± 11 s; $P = 0.01$). Heart rate amplitude was not different between HMD-OCC vs HMD-CTL (18 ± 6 vs 19 ± 8 beats/min) and heart rate tau was not different between HMD-OCC vs HMD-CTL (49 ± 28 vs 45 ± 24 s; all $P > 0.05$). **CONCLUSIONS:** Contrary to our hypothesis, an increase in sympathetic activity induced by the muscle metaboreflex speeded heart rate kinetics during LMD but not HMD exercise transitions. Our data suggests that elevating sympathetic activity can speed heart rate kinetics to a certain point, beyond which heart rate kinetics via sympathetic activity may already be maximized.

2572 Board #92 June 2 9:30 AM - 11:00 AM
Test-retest Reliability of Female Heart Rate Variability
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PURPOSE: The study purpose was to evaluate the test-retest reliability of our heart rate variability (HRV) assessment method in: cancer survivors; and healthy-active and healthy-inactive females. The study also determined the impact on reliability of the body position and of the time compared to frequency domains. **METHODS:** Subjects were 25 females, 18 years or older. Testing was on two different days 2-7 days apart. Each day had exactly the same protocol. Participant started in the sitting or supine position (order randomized) and breathed in rhythm with a metronome (12 br/min). Following 10 minutes of rest, ECG data were collected for 10 minutes. Blood pressure and then cardiac output (Q, by CO_2 rebreathing) were then measured. Finally, the participant switched positions and repeated the protocol. A time domain [Standard Deviation of Normal beat to beat (SDNN)] and a frequency domain [Low to High Frequency ratio(LF/HF)] were analyzed for five minute intervals. Intra Class Correlation Coefficients (ICC) were calculated between each consecutive five minute interval. Also, data for a given position were pooled for ICC determinations. Stroke volume (SV) was calculated from heart rate (HR) and Q. **RESULTS:** For the LF/HF ratio two outliers (values 5 x or more than others) were not used. Repeated Measures ANOVAs found no significant day effect or interaction for HR ($p = .424, p = .230$) and SV ($p = .899, p = .108$) but significant ($p < .001$) position effect for HR and SV.

	Sit			Supine		
	Pooled	Day 1	Day 2	Pooled	Day 1	Day 2
SDNN	0.92	0.91	0.96	0.96	0.97	0.98
LF/HF	0.74	0.65	0.86	0.88	0.74	0.91
HR min ⁻¹	Mean + SD	73.5 + 14.5	75.6 + 18.1		64.0 + 12.8	64.1 + 14.2
SV mL* ^b -1	Mean + SD	53.2 + 15.1	51.5 + 16.6		65.5 + 19.2	66.7 + 20.2

CONCLUSION: It appears that the time domain and supine position are more reliable than the frequency domain and sitting position, respectively. Frequency domain itself may be more reliable on the second day of testing.

2573 Board #93 June 2 9:30 AM - 11:00 AM
Left Atrial Enlargement is Related to Diastolic Dysfunction in Obese Individuals

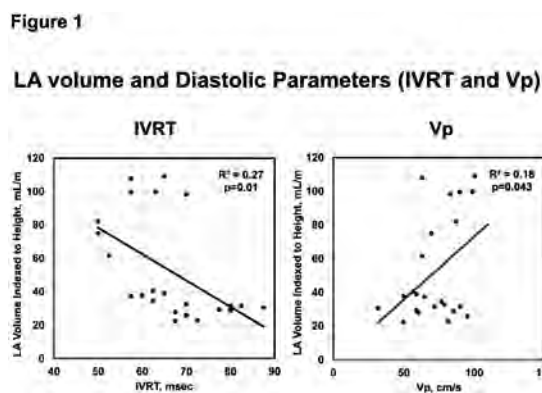
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Purpose: Obesity is linked to diastolic dysfunction and left atrial enlargement (LAE). The mechanisms responsible for LAE in obesity are unknown. We hypothesize that diastolic dysfunction, which is common in obesity, is the mechanism through which LAE occurs.

Methods: 37 middle-aged, obese patients (8M: 29F, 49 \pm 6years) with an average body mass index (BMI) of 38 ± 5 kg/m² were compared to age and sex matched non-obese healthy controls. Diastolic function (IVRT; isovolumic relaxation time, Vp: propagation velocity) was assessed using echocardiography. Left atrium (LA) size was measured using 3D echocardiogram, and normalized to height to account for the effects of body size.

Results: Obese individuals had a significantly enlarged atrial volume when compared to healthy individuals (52.5 ± 31.2 vs. 23.1 ± 10.5 mL/m; $p<0.01$). Obese patients had a significantly faster IVRT when compared to non-obese patients (68 ± 11 vs 100 ± 16 msec; $p<0.01$). Obese patients also had a significantly faster Vp when compared to non-obese patients (75 ± 19 vs 56 ± 13 cm/sec; $p<0.01$). In obese subjects, there was a significant negative-relationship between LA volume index and IVRT ($R^2=0.27$; $p<0.05$) as well as a significant positive-relationship between LA volume index and Vp ($R^2=0.18$; $p<0.05$). (Figure 1)

Conclusions: Obese patients had larger LA and markers of elevated LA filling pressures (faster IVRT and Vp) compared to age matched controls. LAE in obesity may be a driven by sub-clinical elevations in left atrial filling pressures.



2574 Board #94 June 2 9:30 AM - 11:00 AM
Doppler Measurement of Parasternal Aortic Blood Flow Velocity: A Pilot Study

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Echocardiographic Doppler is capable of continuously measuring blood velocity, and stroke volume at rest and during exercise. Doppler measurements require a near parallel angle between the flow of blood and the ultrasound signal necessitating apical cardiac views to obtain accurate absolute values. However, apical cardiac views are technically challenging during long serial recordings. Parasternal views

are less challenging, but do not provide a parallel angle to the aorta. If a relationship exists between the aortic Doppler measurements from these two cardiac windows, a correction calculation can be established to estimate stroke volume from the parasternal view. **PURPOSE:** To determine if a relationship exists between Doppler measurements made at the aorta in the parasternal long axis and apical three chamber echocardiographic views. **METHODS:** Healthy college age participants underwent Doppler ultrasound measurements at the aorta in the parasternal long axis and apical three chamber view. Linear cross sectional analysis was performed to assess aortic annulus area and Teichholz stroke volume estimates in the parasternal long axis. Only participants with complete data sets are included in this analysis. Bivariate correlations and t-test were used as appropriate to analyze the data. **RESULTS:** Of the 18 participants studied, only 12 (66.7%; 6 males, 6 females, age 25.5±1.1yrs, height 156±14.2cm, weight 69.8±4.5kg, body fat 20.6±2%) had adequate Doppler signal strength in the parasternal long axis view for software automated signal tracing. No relationship was found between the time averaged mean blood flow velocity measurements obtained in the parasternal long axis and apical three chamber views ($r=-0.216$, $p=0.498$). Parasternal long axis Doppler based stroke volume (25.9±4.9mL/beat) measurements were lower than parasternal long axis Teichholz estimated stroke volume (57.8±4.9mL/beat) measurements ($p<0.001$), with no correlation between the two ($r=0.402$, $p=0.190$). **CONCLUSIONS:** While this data is preliminary, it suggests that aortic Doppler measurements in the parasternal long axis view suffer from low Doppler signal strength, and are inaccurate when compared to more conventional measurements.

2575 Board #95 June 2 9:30 AM - 11:00 AM
Cardioprotective Benefits Associated With Routine Physical Activity In Middle Aged Population
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Purpose: It is well known that routine intensive physical activity (PA) will result in positive cardiovascular adaptations. Similarly, it is known that aging will cause decrements in similar common measures of cardiovascular health. However, there is only limited data on the cardiovascular performance of an older, presumably healthy, physically active population who have remained active for decades. **Methods:** Thirteen masters level swimmers (MS) and eight controls (IC) (54.3 ± 12.7yrs and 57.5 ± 7.9yrs; respectively) were asked to wear an ambulatory heart rate monitor (Actiheart) for seven consecutive days. Subjects were partitioned based upon self-reported long-term physical activity and asked to maintain their normal daily activities for the entirety of the data collection period. Heart rate was collected during waking hours (14.8 ± 3.2 hrs). All HR data was verified via accelerometer. To measure HR_{peak} and estimate cardiovascular fitness level, subjects completed a 1-mile timed walk. Independent two-sample t-tests were used for all comparisons, significance set at $p<0.05$. **Results:** Mean daily HR_{min} and HR_{avg} was lower in MS than IC (54 ± 5 vs 67 ± 8bpm, 72 ± 8bpm vs. 83 ± 9bpm; $p<0.05$, respectively) while mean daily HR_{max} was higher in MS (139 ± 18bpm vs. 131 ± 19bpm; $p<0.05$). Mean daily HR_{max} was higher than HR_{peak} during the 1-mile test for MS (139 ± 19 vs. 123 ± 20bpm; $p<0.05$) but not for IC (131 ± 18 vs. 135 ± 18; $p = 0.69$). **Conclusions:** Persistent participation in routine physical activity at any age appears to result in training induced changes consistent with improved cardiovascular health. Results from the present study, however, suggest that a 1 mile walk may not be an appropriate test for the physically active as it tends to underestimate maximum values for heart rate.

2576 Board #96 June 2 9:30 AM - 11:00 AM
Measurement of Myocardial Microvascular PO₂: Impact of Sumatriptan
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Triptan drugs (e.g., sumatriptan) are 5-HT_{1B/1D} receptor agonists that are prescribed for treatment of migraine. However, triptans may cause coronary vasoconstriction and increase the risk of adverse cardiac events. The balance between oxygen delivery (QO₂) and oxygen consumption (VO₂) at the tissue level is reflected in the microvascular partial pressure of oxygen (PO_{2,mv}). **PURPOSE:** To determine whether sumatriptan decreases coronary QO₂ and decreases PO_{2,mv} in a beating rat heart preparation. **METHODS:** Female Sprague-Dawley rats (n=22, 262 ± 4 g) were anesthetized with pentobarbital sodium (50 mg/kg ip). A tracheal cannula was inserted and the carotid artery and jugular vein were cannulated. A left lateral thoracotomy exposed the heart and mechanical ventilation was initiated (4-6 ml at 60 bpm; PaO₂ 74 ± 2, PaCO₂ 43 ± 2). PO_{2,mv} was measured by phosphorescence quenching. The fiber

optic probe of the phosphorometer was positioned over the left ventricular free wall to measure PO_{2,mv} during steady-state conditions and after the following interventions; 1) bolus infusion of sumatriptan (1 mg, n=7), 2) infusion of dobutamine (9 and 18 µg/min, n=5), 3) infusion of sumatriptan (37.5 and 75 µg/min, n=5), and 4) infusion of both dobutamine and sumatriptan (n=5). **RESULTS:** Left ventricular PO_{2,mv} averaged 75 ± 2 mmHg and mean arterial pressure (MAP) averaged 93 ± 5 mmHg. With a bolus infusion of sumatriptan, PO_{2,mv} fell 5 ± 1 mmHg and MAP fell 25 ± 4 mmHg, whereas infusion of an equivalent volume of saline vehicle had no effect. Dobutamine infusion caused PO_{2,mv} to fall 25 ± 3 mmHg and MAP to fall 39 ± 8 mmHg. Sumatriptan infusion did not impact PO_{2,mv} (0 ± 1 mmHg) or MAP (2 ± 2 mmHg). Simultaneous infusion of dobutamine and sumatriptan caused PO_{2,mv} to fall 19 ± 1 mmHg and MAP to fall 14 ± 5 mmHg. Isoproterenol was infused as a positive control (10 µg) at the end of each experiment to ensure responsiveness of the system. **CONCLUSION:** Bolus infusion of sumatriptan caused a small transient fall in left ventricular PO_{2,mv} suggesting a decrease in QO₂. In contrast, slow infusion of a low dose of sumatriptan did not impact PO_{2,mv} and did not exacerbate the effect of dobutamine. These findings do not support the notion that sumatriptan may elicit a profound vasoconstriction that would compromise cardiac function. Supported by a grant from the Graduate Program, KCOM-ATSU.

2577 Board #97 June 2 9:30 AM - 11:00 AM
Exercise Improves Diastolic Function In HFpEF By Reducing Intrinsic Cardiomyocyte Stiffness And Fibrosis
 Cristine Schmidt¹, João Coelho², Rita Ferreira³, Nuno Paiva³, Inês Falcão-Pires², André Lourenço², Adelino Leite-Moreira², José Oliveira¹, Daniel Moreira-Gonçalves¹. ¹CIAFEL, Faculty of Sports, University of Porto, Porto, Portugal. ²Faculty of Medicine, University of Porto, Porto, Portugal. ³University of Aveiro, Aveiro, Portugal.
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INTRODUCTION In heart failure with preserved ejection fraction (HFpEF), the underlying systemic inflammatory state is related to myocardial stiffening. However, optimal treatment remains largely undefined. **PURPOSE:** To investigate the effect of exercise training (ExT) on left ventricle (LV) stiffness in a rat model of HFpEF. **METHODS:** The study was performed with nine-week old ZSF1 obese rats (Ob n=20). At the 16th week, they were randomly divided in sedentary (ObSED, n=10) and exercised (ObEX, n=10; treadmill ExT during 4 weeks, 5 days/week, 60 min/day, at a speed of 20m/min). In the 18th week, all animals underwent echocardiographic evaluation. In the 20th week, animals were sacrificed and samples from heart and LV were collated for: i) histological analysis (cross-sectional area (CSA), collagen content; ii) passive tension analysis in skinned cardiomyocytes; iii) assessment of expression on matrix metalloproteinases (MMP-2,-9) and its tissue inhibitors (TIMP-1 and 2) by western blot analysis and iv) zimography assessment of proteolytic activity. **RESULTS:** Both groups presented preserved ejection fraction (>70%). ExT improved diastolic function evidenced by E/E' ratio (14.81±2.27 vs 16.53±1.47 $p<0.05$). Moreover, in skinned cardiomyocytes, the ObEX showed decreased passive tension, which suggests a reduction in myocardial stiffness ($p<0.05$). No significant differences were observed between the groups in body mass, heart and LV weight, CSA, and MMPs and TIMPs expression and activity ($p>0.05$). However, the ratio collagen/muscle was significantly reduced in ObEX, compared to ObSED (0.08 vs. 0.12 $p<0.05$). **CONCLUSION:** ExT improves diastolic function mainly due to the decrease on collagen deposition and diminished cardiomyocyte stiffness. **FUNDING:** Grant from the European Commission FP7-Health-2010; MEDIA-261,409. CIAFEL is funded by European Regional Development Fund through the Operational Competitiveness Programme, and by FCT (UID/DTP/00617/2013). Schmidt, C.: CAPES (BEX 0554/14-6). Moreira-Gonçalves, D.: FCT (SFRH/BPD/90010/2012).

2578 Board #98 June 2 9:30 AM - 11:00 AM
Global Longitudinal Strain And Left Ventricular Remodelling In Young Black Athletes
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 (No relationships reported)

Purpose: Cardiac adaptation to intense physical training is determined by many factors including age, gender, body size, load training and ethnicity. ECG analysis investigating the impact of ethnicity has shown a higher presence of marked repolarization changes and left ventricular (LV) hypertrophy in black compared to

white athletes. Despite the wide availability of ECG analysis, echocardiographic studies on young black and white athletes are lacking in literature. We aimed to assess the secondary LV remodelling to load training in young black players compared to matched white players. **Methods:** 77 young black soccer players (BP) and 53 white matched soccer players (WP) (mean age = 17.35±0.50 and 18.25±0.77 yo in BP and WP, respectively) were enrolled. The athletes, training with the same load and having the same lifestyle, were evaluated with echocardiography. 30 BP and 27 WP were followed up for 4 years (mean age at the first evaluation: 12.47±0.60 and 13.90±0.50 yo in BP and WP, respectively). Contractile function was determined using speckle-tracking echographic global longitudinal strain (GLS). **Results:** No significant differences in basal anthropometric parameters were found in both groups. BP showed higher level of LV remodelling, consisting in higher interventricular septum (IVS) and posterior wall (PW) thickness (IVS: 10.04±0.14 and 9.35±0.10mm, p<0.001; PW: 9.70±0.20 and 9.19±0.10mm, p<0.05; in BP and WP respectively). Strain data showed no significant differences between the two groups (-22.35±0.48 and -23.38±0.69% in BP and WP, respectively). At the beginning of the follow up period, BP showed a significantly higher LV remodelling (IVS= 9.29±0.3 and 8.53±0.12mm, p<0.002; PW= 9.01±0.2 and 8.40 ±0.20, p=0.1; in BP and WP respectively). A regular parallel increase in LV wall thickness and diameters, proportionally with body-size and LV mass, was observed in both groups during the follow-up period (IVS=10.52±0.17 and 9.03±0.22mm, p<0.001; PW: 10.06±0.17 and 8.26±0.19mm, p<0.001; in BP and WP respectively). **Conclusion:** LV remodelling in BP seems to be a specific and normal phenotype already present in pre-adolescent period, suggesting the central role that ethnicity plays in it since the first years of life in elite athletes and the need for echocardiographic specific ethnic criteria.

2579 Board #99 June 2 9:30 AM - 11:00 AM
Effects Of Endurance Exercise Training On Doxorubicin-induced Changes In Cardiac Insulin-like Growth Factor-1 Expression
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 (No relationships reported)

Doxorubicin (DOX) is a highly effective chemotherapeutic agent used in the treatment of cancer; however, its clinical use is limited due to a dose-dependent cardiotoxic side-effect. Insulin-like growth factor-1 (IGF-1) signaling regulates contractility, metabolism, hypertrophy, apoptosis, and many other process related to optimal cardiac function. DOX treatment has been shown to decrease IGF-1 expression and down-regulate other markers in the IGF-1 signaling pathway. Although exercise training has been shown to mitigate the cardiotoxic side-effects of DOX, it is unclear whether exercise may mediate its effects via IGF-1 expression. **PURPOSE:** The purpose of this study was to examine the effects of endurance exercise on DOX-induced changes in cardiac IGF-1 expression. **METHODS:** Male Sprague-Dawley rats (n = 12) were randomly assigned to either sedentary (SED) or treadmill (TM) exercise groups. The TM protocol included 10 weeks of running, 5 days/week, with progressive increases in intensity and duration on a motorized treadmill, while SED animals were limited to normal cage activity for 10 weeks. Following the 10-week treatment period, animals were further randomized to receive saline (SAL) or a 12.5 mg/kg bolus dose of DOX. Cardiac IGF-1 was quantified in all hearts three days following injection. **RESULTS:** Cardiac IGF-1 expression decreased 22% in the SED/DOX group when compared to SED/SAL (Cohen's d = 0.774). Results also indicate a 22% increase in IGF-1 expression in the TM/SAL group when compared to the SED/SAL group (Cohen's d = 0.843) and a 16% increase in IGF-1 expression in the TM/DOX group when compared to SED/DOX (Cohen's d = 1.131). **CONCLUSIONS:** These pilot studies show that the cardioprotective effects of exercise may be mediated, at least in part, through preservation of IGF-1 expression. Initial data from these studies show a large effect size across all comparisons and warrants further exploration with larger sample sizes. While several mechanisms may explain exercise-induced protection against chemotherapy cardiotoxicity, IGF-1 and IGF-1 signaling pathways may be involved.

2580 Board #100 June 2 9:30 AM - 11:00 AM
Effect of Cardiac Resynchronization Therapy on Arterial-Ventricular Coupling during Exercise in Heart Failure with Reduced Ejection Fraction
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Exercise intolerance in heart failure with reduced ejection fraction (HFrEF) is mediated, in part, by an impairment in arterial-ventricular coupling. Cardiac resynchronization therapy (CRT) improves resting and paced arterial-ventricular coupling. The effect of chronic CRT on arterial-ventricular coupling during exercise

in HFrEF has not been studied. **PURPOSE:** To study the effects of 6 months of CRT on arterial-ventricular coupling during exercise in patients with HFrEF. **METHODS:** Seven patients with HFrEF (59 ± 9 yrs; m/f: 5/2; NYHA III/IV = 6/1; EF = 18 ± 3%; peak VO₂ = 12.5 ± 3.6 ml/kg/min) were studied pre-CRT and 6 months following (post-CRT). After resting measurements, subjects performed cycle ergometry at 22 ± 8 W (70 ± 13% of peak VO₂) for 4 min. Left ventricular volumes were determined using contrast enhanced echocardiography. Blood pressure was measured manually at the brachium. End-systolic pressure (ESP) was approximated as 0.9 × systolic blood pressure. Effective arterial elastance (Ea) was calculated as ESP/stroke volume and end-systolic elastance (Ees) was calculated as ESP/end-systolic volume. Arterial-ventricular coupling was calculated as Ea/Ees. Comparisons were made with a 2 (rest, exercise) × 2 (pre-CRT, post-CRT) repeated measures factorial ANOVA and *t*-tests. Data are mean ± SD and P < 0.05 was significant. **RESULTS:** There was a main effect of CRT on Ea, where the pre-CRT Ea increased 0.28 ± 0.45 mmHg/mL during exercise and the post-CRT Ea decreased 0.12 ± 0.25 mmHg/mL (P < 0.05). There was no main effect of CRT on Ees, as both the pre-CRT (0.04 ± 0.03 mmHg/mL) and post-CRT (0.08 ± 0.04 mmHg/mL) increase in Ees from rest to exercise was not significant (P > 0.05). However, resting and exercise Ees tended to be higher post-CRT. Lastly, there was a main effect of CRT on Ea/Ees, where Ea/Ees increased 0.40 ± 1.35 mmHg/mL from rest to exercise pre-CRT and Ea/Ees decreased 0.69 ± 0.35 mmHg/mL from rest to exercise post-CRT (P < 0.05). **CONCLUSION:** The improvement in arterial-ventricular coupling during exercise following chronic CRT in HFrEF can be attributed to improvements in arterial loading on the left ventricle, as contractility changes related to CRT were modest.

E-29 Free Communication/Poster - Children-Exercise Responses
 Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2581 Board #101 June 2 11:00 AM - 12:30 PM
Predictive Formulas To Improve The Interpretation Of Cardiorespiratory Fitness In Children
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 (No relationships reported)

Adequate reference values for cardiopulmonary exercise testing (CPET) is crucial for accurate interpretation and prognostic purposes for children with a chronic disease. Current reference values in healthy children have been developed using heterogeneous exercise protocols and often incomplete adjustment for body size. **PURPOSE:** To update current reference values from CPET and provide new reference values for several parameters previously unstudied in children using a prospectively recruited cohort of healthy children. **METHODS:** In this cross-sectional multicenter study, we prospectively recruited 269 healthy children (♂=107; ♀=162) between the ages of 12-17 years old (14.8 ± 1.5) in local schools. We measured height, weight, waist circumference, pubertal development and fat free mass (FFM) and performed a symptom-limited CPET (Vmax Encore Metabolic Cart, SensorMedic, San Diego, CA) on an electronically-braked ergocycle using a progressive ramp protocol. Reference values and Z score were computed by testing several regressions models for each CPET measurement. Variation around the predicted mean was modeled to account for heteroscedasticity and residual association with growth-related parameters was assessed. **RESULTS:** Using currently published reference values, up to 31.2% of children were classified as having abnormal CPET results despite being free of chronic disease. Our weighted non-linear parametric modeling allowed more precise and well-adjusted Z scores and percentiles limits. The table shows a selection of our predicting equations as well as the percentage of children below the 3rd percentile. Selection of prediction equations for males

Parameters	Z score equation (Measured parameter - Predicted mean) / Predicted SD	% of children below the 3 rd percentile
Peak VO ₂	$Z \text{ score} = \frac{\text{Peak VO}_2 - [(-0.52 \times \text{FFM}^2) + (100.2 \times \text{FFM}) + (-970.38)]}{(3.95 \times \text{FFM}) + 152.6}$	5.6%
Peak O ₂ pulse	$Z \text{ score} = \frac{\text{Peak O}_2 \text{ pulse} - [(0.002 \times \text{FFM}^2) + (0.47 \times \text{FFM}) + (-3.91)]}{(0.03 \times \text{FFM}) + 0.64}$	6.7%
OUES	$Z \text{ score} = \frac{\text{OUES} - [(-0.17 \times \text{FFM}^2) + (62.4 \times \text{FFM}) + (162.11)]}{(6.37 \times \text{FFM}) + 91.67}$	2.8%
VE/VO ₂ slope	$Z \text{ score} = \frac{\text{VE} / \text{VO}_2 - [(0.005 \times \text{FFM}^2) + (-0.56 \times \text{FFM}) + (43.79)]}{(-0.03 \times \text{FFM}) + 4.86}$	0.9%

CONCLUSION: The use of weighted non-linear regression model resulted in a decreased false-positive rate. These updated and new reference values provide an accurate lower limit of normal thus improving their value for prognostic and risk-stratification in children with chronic diseases.

Abstracts were prepared by the authors and printed as submitted.

2582 Board #102 June 2 11:00 AM - 12:30 PM

The Muscle Metaboreflex Improves Post Exercise Blood Pressure Responses in Children after the Fontan Operation

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Children after the Fontan operation have reduced heart rate variability (HRV) and altered blood pressure control, consistent with autonomic dysfunction. We tested the hypothesis that increasing sympathetic nerve activity via the muscle metaboreflex may improve post exercise blood pressure responses in children after the Fontan operation. **PURPOSE:** To determine resting HRV and the mean arterial pressure (MAP) response to post-handgrip exercise muscle metaboreflex activation in children after the Fontan operation compared to age- and sex-matched healthy controls. **METHODS:** Five children after the Fontan operation and 10 controls (12 ± 2 yrs) underwent resting electrocardiography and continuous finger arterial plethysmography. Children then completed 2 min of isometric handgrip exercise at 30% of maximal voluntary contraction, followed in random order by either (1) 3 min of rest with no occlusion or (2) 3 min of brachial cuff occlusion to produce post exercise ischemia and increased sympathetic nerve activity via the muscle metaboreflex. Post-handgrip MAP changes were calculated as the 1 min average value after 3 min of recovery minus the pre-handgrip resting 1 min average value. Comparisons were made using unpaired *t*-tests. *P* < 0.05 was significant. **RESULTS:** Resting heart rate was higher in children after the Fontan operation vs. controls (78 ± 14 vs. 67 ± 5 beats/min; *P* = 0.041). HRV spectral analyses were similar in the low frequency domain (24 ± 10 vs. 22 ± 13%; *P* = 0.720), but increased in the high frequency domain (23 ± 15 vs. 52 ± 16%; *P* = 0.005) and low/high frequency domain ratio (1.5 ± 1.3 vs. 0.6 ± 0.4; *P* = 0.046) for children after the Fontan operation vs. controls, indicating autonomic dysfunction. Following isometric handgrip exercise with no occlusion, the change in heart rate (-2 ± 5 vs. -3 ± 5 beats/min; *P* = 0.646) was similar, but children after the Fontan operation had greater lowering in MAP (-5 ± 1 vs. 0 ± 5 mmHg; *P* = 0.024) vs. controls. With brachial occlusion, changes in heart rate (0 ± 5 vs. -1 ± 6 beats/min; *P* = 0.701) and MAP (6 ± 7 vs. 6 ± 7 mmHg; *P* = 0.980) were similar between children after the Fontan operation vs. controls. **CONCLUSION:** Our findings suggest that increasing sympathetic nerve activity via the muscle metaboreflex helps to improve post exercise blood pressure responses in children after the Fontan operation.

2583 Board #103 June 2 11:00 AM - 12:30 PM

Race Effect On Improved Aerobic Efficiency In Pediatric Obese Patients After A Weight Management Program

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(No relationships reported)

BACKGROUND: Studies have shown that obesity may be influenced by measurable racial differences in metabolism. The current study aims to establish the effect of race on aerobic efficiency in obese patients participating in a weight management program. **METHODS:** We evaluated 60 African American (AA) and 135 Caucasian (C) pediatric patients using a Modified Balke protocol before (Pre) and after (Post) a 16-week weight management program. Oxygen consumption (VO₂), indexed maximal oxygen consumption (IMVO₂), carbon dioxide production (VCO₂), expiratory volume (VE), respiratory quotient (RQ) and heart rate (HR) were obtained at all submaximal and maximal stages. The VE/VO₂ slope (SLOPE) was calculated across all stages for each subject. VE/VO₂ and VE/VCO₂ equivalents (AT VE/VO₂ and AT VE/VCO₂) were calculated at anaerobic threshold for each subject. Maximal oxygen pulse (O2Pulse) was calculated by dividing maximal oxygen consumption (MVO₂) by maximal HR (MHR) and used as an indicator of maximal stroke volume.

	AA Pre	AA Post	C Pre	C Post
Weight (kg)	98 ± 30	99 ± 30	85 ± 29	82 ± 28**
IMVO ₂ (cc/kg/min)	23 ± 3	26 ± 4**	26 ± 5	31 ± 6**
ET (minutes)	10.9 ± 3.0	13.2 ± 3.4**	13.3 ± 3.7	16.5 ± 4.0**
MHR (BPM)	190 ± 13	190 ± 12	192 ± 9	194 ± 9*
SLOPE	26 ± 9	24 ± 5	24 ± 3	23 ± 4*
O2Pulse	11.6 ± 3.4	13.0 ± 3.4**	11.4 ± 3.4	12.7 ± 3.8**
MRQ	1.02 ± 0.06	1.05 ± 0.08**	1.06 ± 0.08	1.06 ± 0.07
AT VE/VO ₂	22.8 ± 3.6	22.0 ± 3.2	22.2 ± 4.1	20.9 ± 3.5**
AT VE/VCO ₂	25.4 ± 3.5	25.2 ± 3.3	24.7 ± 3.8	24.6 ± 3.9

Pre versus Post: * *p* < 0.05, ** *p* < 0.01

RESULTS: There was no significant difference in mean age between AA and C groups (12.4 ± 2.8, 11.8 ± 2.9 years pre-program). The C group had a significant decrease in weight (84.9 ± 28.8 vs 81.7 ± 27.7 kilograms (kg)) pre and post program. IMVO₂, exercise time (ET), and O2Pulse was significantly increased post program in both groups with a significant increase in MHR in the C group. Aerobic efficiency improved in the C group only, noted by a decrease in SLOPE and VE/VO₂ equivalent. **CONCLUSION:** These data suggest that a 16-week weight management program increases aerobic capacity in both AA and C obese pediatric patients. Improved aerobic efficiency, however, was only seen in the C group. Further investigation into racial disparity effecting weight loss and aerobic efficiency is warranted.

2584 Board #104 June 2 11:00 AM - 12:30 PM

Relationship between Self-Reported Physical Activity Levels and Exercise Capacity in Pediatric Fontan Patients

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(No relationships reported)

Cardiopulmonary exercise testing is routine in the care of children with cardiac disease. Those with single ventricle physiology after Fontan completion have limitations in cardiac function and exercise tolerance. Hemodynamic adaptations may be affected following surgery, and it is unclear if this alters the relationship between leisure time physical activity (PA) and peak oxygen consumption (VO₂). **PURPOSE:** To examine the relationship between self-reported leisure time PA and peak VO₂ in pediatric Fontan patients. **METHODS:** Twenty-six youth with Fontan physiology (age 14.2 ± 2.1 yrs, male 57%) underwent routine cardiopulmonary exercise testing. Peak VO₂ (ml/kg/min), respiratory exchange ratio (RER), VE/VCO₂ slope, oxygen pulse (ml/beat), and maximal heart rate (bpm) were measured. Subjects exercised to volitional fatigue on a cycle ergometer using the Modified James protocol. Subjects were excluded if RER at peak VO₂ was < 1.0. Self-reported leisure time PA was assessed using the interviewer administered Modifiable Activity Questionnaire for Adolescents (MAQ-A). Relationships were assessed using Pearson partial correlations and nonparametric Kruskal-Wallis tests. **RESULTS:** Significant positive relationships were found between VO₂ peak (24.44 ± 5.8 ml/kg/min) and self-reported hours per week of PA (1.36 ± 1.15 hrs) (*r* = 0.534, *p* < 0.05) and MET hours per week of PA (7.71 ± 6.66 MET hrs) (*r* = 0.483, *p* < 0.05). Significant negative relationships were found between VE/VCO₂ slope (35.78 ± 7.08) and hours per week of PA (1.36 ± 1.15 hrs) (*r* = -0.481, *p* < 0.05) and MET hours per week of PA (7.71 ± 6.66 MET hrs) (*r* = -0.483, *p* < 0.05). Days per week of light exercise was associated with VE/VCO₂ slope (*X*² = 9.57, *p* < 0.05) and O₂ pulse (*X*² = 12.9, *p* < 0.05). **CONCLUSIONS:** Greater self-reported hours per week and MET hours per week of leisure time PA were associated with higher peak VO₂ and lower VE/VCO₂ slopes. Despite the hemodynamic compromises in single ventricle Fontan physiology, routine leisure-time PA appears to have a beneficial effect on both aerobic capacity and ventilatory efficiency, thus improving their prognosis in cardiac mortality risk.

2585 Board #105 June 2 11:00 AM - 12:30 PM

Adolescent Children Born Preterm Have An Inhibited Stroke Volume And Cardiac Output Response To Exercise

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(No relationships reported)

Purpose: Young adults born preterm exhibit lower ejection fractions and higher right ventricular mass but little is known about the consequences of premature birth on cardiac performance during exercise, particularly in children. The aim of the present

study was to compare the cardiac response to maximal exercise between adolescent children born preterm and age-matched controls. **Methods:** Seven children born preterm (PT) (age 12-13, birthweight <1500 g, gestational age 24-31 weeks) and 6 age-matched children born full term (CT) (gestational age 38-40 weeks) underwent progressive maximal exercise testing on a cycle ergometer, with continuous measurement of O_2 consumption (ml/kg/min), and cardiac output (Q), stroke volume (SV) and heart rate (HR) using thoracic bioimpedance. SV and Q were indexed to body surface area (BSA (m^2)), SVi and Qi, respectively). HR was recorded for two minutes following exercise, and HR recovery (HRR_{2min}) was calculated as decrease in HR at 2 minutes after maximal exercise. Statistical analysis was done using multiple t-tests. **Results:** PT had lower relative maximal oxygen consumption (VO_{2max}) compared to CT (38.3 ± 9.3 v 51.5 ± 7.3 ml/kg/min, $p=0.03$). SV did not increase in PT from rest to maximal exercise (51.7 ± 9.0 v 53.3 ± 8.3 ml/ m^2 , $p=0.77$), while SV significantly increased in CT (47.4 ± 4.0 v 67.7 ± 14.4 ml/ m^2 , $p=0.01$). The change in SV from rest to maximal exercise was significantly smaller in PT compared to CT (1.6 ± 6.5 v 20.3 ± 17.0 ml/ m^2 , $p=0.04$). The increase in Qi from rest to exercise was also significantly smaller in PT than CT (5.6 ± 1.1 v 9.0 ± 2.6 L/min/ m^2 , $p=0.02$). There was no difference in resting or maximal HR between the groups ($p>0.05$ for all). HRR_{2min} was lower in PT than CT (54 v 64 beats, $p=0.01$). Maximal arterio-venous O_2 difference was not different in PT compared to CT (13.2 ± 6.5 v 13.2 ± 2.3 ml/dL, $p=0.98$). **Conclusion:** Adolescent children born preterm exhibit lower maximal aerobic capacity and significantly smaller maximal SVi and Qi than age-matched controls. PTs also demonstrated slower HRR after maximal exercise. This data suggests that PTs may not be able to increase SV in response to increasing metabolic demand, and this may reduce their ability to exercise at higher intensities. National Institutes of Health: 1R01 HL086897 (ME) and R01 HL38149 (MP), and UW CVRC T32- HL 07936 (KH).

2586 Board #108 June 2 11:00 AM - 12:30 PM
Activity Levels and Caloric Expenditure in Obese Youth Before, During and After Weight Management Camp.
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 (No relationships reported)

PURPOSE: To compare the physical activity levels and caloric expenditure of participants before, during and after a weight management camp for youth with obesity. **METHODS:** Fifteen obese youth, ages 9 to 13 years, were recruited at an open house for an overnight weight management camp. Informed consent/assent was obtained. Subjects wore GENEActiv accelerometers 24 hours/day for approximately one week before, during, and after camp. Data were analyzed to determine the amount of time each participant spent in sedentary (SED), moderate (MPA) and vigorous (VPA) activity, as well as calories expended (EE). The participants' activity levels and caloric expenditure and other subject characteristics were compared during the week of camp and weeks at home. **RESULTS:** Complete usable data was obtained from 10 (67%) participants (6 boys, 4 girls). Mean age (\pm SD) was 11.7 ± 1.2 years. Mean BMI was 32.25 ± 5.1 kg/ m^2 . Overall, there were no significant differences between the weeks at home for SED, MPA, VPA or EE. During camp, participants averaged less daily SED than at home (428.38 ± 63.20 minutes, $p=0.0003$) and more MPA (363.4 ± 38.63 , $p=0.0001$) and VPA (55.05 ± 33.96 , $p=0.0055$). Average EE was also higher during camp (3.00 ± 0.57 kcal/min, $p=0.0004$). A higher BMI was strongly associated with more SED and less MPA and VPA before ($r=0.87$, $r=-0.83$ and $r=-0.71$) and during ($r=0.75$, $r=-0.69$ and $r=-0.78$) camp. **CONCLUSION:** Obese youth exercise at higher intensities and expend significantly more energy while participating in a summer weight management camp versus on their own at home. BMI of the participants also plays a key role in determining caloric expenditure and intensity of activities they participate in at home and while attending camp. Campers were no more or less active in the week following camp as the week prior to camp, indicating camp did not have an impact on motivation or self-selected exercise at home.

2587 Board #107 June 2 11:00 AM - 12:30 PM
Accuracy of Cardiorespiratory Fitness and Adiposity to Discriminate Elevated Cardiometabolic Risk Among Prepubertal Children
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 (No relationships reported)

The measures of cardiorespiratory fitness scaled by lean mass (LM) have physiological rationale for assessing aerobic capacity as the scaling by body weight introduces confounding by adiposity.

PURPOSE: To investigate differences in the accuracy to discriminate elevated cardiometabolic risk between the measures of adiposity and cardiorespiratory fitness when using alternative methods to perform body size related scaling of maximal workload (Wmax).

METHODS: Altogether 448 children (214 girls) aged 6-8 years participated in the study. We assessed fat mass (FM), percent body fat (%BF) and LM by dual-energy X-ray absorptiometry, and Wmax by incremental bicycle ergometer exercise test. Absolute and by body weight, FM and LM scaled Wmax were used in the analysis. We used age and sex-specific criteria (Ahrens et al. *Int J Obes*, 2014;38:S4-S14) to define dyslipidemia (elevated triglycerides or high density lipoprotein cholesterol), elevated blood pressure and elevated insulin resistance (HOMA-IR), and 90th percentile for cardiometabolic risk score (CMS) to define elevated cardiometabolic risk. We used area under the curve (AUC) by receiver operating characteristics to investigate the accuracy of the measures of cardiorespiratory fitness and adiposity to discriminate elevated cardiometabolic risk, and the Youden index to assess the thresholds discriminating elevated CMS.

RESULTS: In boys, %BF and Wmax/FM were able to discriminate CMS (AUC 0.86, $P<0.001$), HOMA-IR (AUC 0.79-0.80, $P<0.001$), elevated blood pressure (AUC 0.73-0.74, $P<0.001$) and dyslipidemia (AUC 0.64, $P<0.05$). While Wmax/body weight had AUC 0.82 ($P<0.001$) for CMS, and AUC 0.71 ($P=0.001$) for HOMA-IR and AUC 0.64 ($P<0.05$) for elevated blood pressure, Wmax/LM had AUC 0.65 ($P<0.05$) for CMS and the absolute Wmax had AUCs <0.6 . In girls, %BF, Wmax/FM and Wmax/body weight were able to discriminate CMS (AUC 0.75-0.78, $P<0.001$) and HOMA-IR (AUC 0.69-0.71, $P<0.01$). Proposed thresholds in girls and in boys were 2.3 and 2.6 W/kg of body weight (sensitivity 67 and 64%; specificity 80 and 85%) and 3.9 W/kg of LM in boys (sensitivity 82%; specificity 45%).

CONCLUSIONS: Measures representing adiposity (%BF; Wmax/FM; Wmax/body weight) were the best discriminators for cardiometabolic risk, and Wmax/LM showed ability to discriminate elevated CMS only in boys.

2588 Board #108 June 2 11:00 AM - 12:30 PM
High-intensity Interval Training in Children With A Chronic Disease Or Condition
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High-intensity interval training (HIT) is superior compared to moderate-intensity continuous training for improving anaerobic fitness, agility and aerobic fitness. However, for children and adolescents with a chronic disease or condition the effects of HIT as a training modality is relatively unknown. **PURPOSE:** To investigate the effect of eight weeks of HIT on physical fitness in children and adolescents with a chronic disease or condition who 1) are able to run, 2) walk independently but are not able to run, and 3) propel a manual wheelchair. **METHODS:** A total of 68 children and adolescents were recruited from schools for special education in the Netherlands (mean age 13.5 ± 2.8 , range 8-19 years, 56% boys). They had various chronic diseases: cerebral palsy (41%), spina bifida (8%), other neuromuscular diseases (34%), musculoskeletal (4%), cardiovascular (4%) and metabolic diseases (9%). The sample consisted of 35 runners, 24 independent walkers, and 9 wheelchair users. All subjects performed HIT twice a week for 45 minutes. Every session consisted of 8-12 intervals containing a 30 seconds all-out exercise followed by 90 or 120 seconds of active recovery. Anaerobic fitness was measured by the Muscle Power Sprint Test (MPST), agility with the 10x5 meter sprint test and a shuttle run/ride test (SRT) was performed to determine aerobic performance (shuttles) and aerobic capacity (VO_{2peak}). **RESULTS:** Exercise attendance was 85%. A significant improvement in respectively mean and peak power on the MPST was only found for children and adolescents who are able to run ($p=.043$; $p=.028$). Both agility and aerobic performance on the SRT showed a significant training effect in all groups; runners ($p=.001$; $p<.001$), independent walkers ($p=.024$; $p=.006$) and wheelchair users ($p=.024$; $p=.012$). However, VO_{2peak} (ml/kg/min) did not change significantly in all groups of functional mobility. **CONCLUSION:** HIT is feasible in children and adolescents independent of mode of mobility. Agility and aerobic performance, both parameters containing motor-skills, improved. However, since anaerobic fitness improved only in children and adolescents who are able to run, the 30s all-out HIT principle is probably not applicable for independent walkers and wheelchair users. Future studies about HIT protocols to improve VO_{2peak} as well are warranted.

2589 Board #109 June 2 11:00 AM - 12:30 PM
An Assessment of Cardiovascular Health in Southern Maine Children and Comparison to National Normative Values
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 (No relationships reported)

Childhood obesity has been on the rise, with an increase in obesity from 7% to 18% from 1980 to 2012. Along with the rise in obesity, the onset of coronary artery disease

(CAD) risk factors has become more prominent in children. **PURPOSE:** The purpose of this study was to assess current CAD risk factors in Southern Maine (SM) children and compare to National norms. **METHODS:** A total of 691 children participated in the Cardiovascular Health Intervention Program (368 females, 323 males, 9.2 ± .41 years old). Assessment included a fasting blood lipid/glucose profile, height, weight, and blood pressure (BP). Surveys were used to assess physical activity (PA) level. **RESULTS:** Females had higher values for total cholesterol (TC) ($p < .00$) and triglycerides ($p < .00$), while males had higher values for HDL-C ($p < .05$) and glucose ($p < .00$). In respect to the number of risk factors, 12.3%, 36.03%, 28.36%, 18.67%, 3.91%, and 0.72% had 0, 1, 2, 3, 4, or 5 risk factors, respectively for females and males combined. In comparison to National norms, 8% of children 6-11 years old nationally had high total cholesterol (> 170 mg/dl), versus 35% for SM children. Nationally and in SM, 14% of children had low levels of HDL-C (< 45 mg/dl). In SM, 51.23% of children reported they were physically inactive (< 60 min/day), in comparison to 58% nationally. Nationally, 16.5% and 17.7% of children were overweight ($> 85^{\text{th}}$) or obese ($> 95^{\text{th}}$), versus 20.47% and 22.8% of children in SM, respectively. Only 1.6% of children nationally had high blood pressure ($> 95^{\text{th}}$), versus 5.93% of children in SM. In SM, 26.34% of children reported a family history of heart disease, versus 33% nationally. **CONCLUSION:** The observed CAD risk factors at this age differ between sex and may be related to one's maturation status. The number of CAD risk factors at this age is somewhat alarming, in that more than 25% of the subjects had at least two CAD risk factors. Lastly, in comparison to National norms, SM children had higher BMIs, which may reflect the observed higher lipid and blood pressure values, whereas PA appears to be greater. Funding provided by Clark Charitable Foundation (Subcontract from Children's National Medical Center, Washington, DC)

2590 Board #110 June 2 11:00 AM - 12:30 PM
Exploring the Relationships of Body Composition, Aerobic Fitness and Physical Activity Levels with Arterial Stiffness in Healthy Children with Children with Congenital Heart Disease

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 (No relationships reported)

Physical activity is a key modulator for arterial health and greater arterial stiffness increases mortality risk. Children with congenital heart disease (CHD) are often less physically active compared to healthy children and this may predispose them to greater arterial stiffness. **PURPOSE:** To explore the relationships of body composition, aerobic fitness and physical activity levels with arterial stiffness in children with CHD and healthy age- and sex-matched controls. **METHODS:** Nineteen children with CHD (m/f: 9/10; mean ± SD; age 11 ± 3 years) and 22 age-matched healthy controls (m/f: 12/10; age 11 ± 3 years) were studied. Carotid-radial pulse-wave velocity (PWV) was assessed with applanation tonometry (foot-to-foot method) to determine arterial stiffness. Average daily minutes of moderate-to-vigorous physical activity (MVPA) was assessed by 7-days of accelerometry. Total lean body mass (LBM) was measured via dual-energy x-ray absorptiometry. Aerobic fitness was determined by 6-minute walk test (6MWT). Data were analyzed with linear correlations and stepwise multiple regressions, with significance accepted at $P < 0.05$. Analyses were performed across all participants pooled, split into CHD and control groups only, and split into high MVPA ($N = 21$; 64 ± 19 minutes/day) and low MVPA ($N = 20$; 23 ± 11 minutes/day) groups. **RESULTS:** There was a significant correlation of LBM with PWV in all participants pooled ($R = 0.536$, $P < 0.001$) and in controls only ($R = 0.668$, $P < 0.001$), but not in CHD only. There was no significant correlation of 6MWT or MVPA with PWV in pooled analyses or when split into CHD and control groups. When split by physical activity level, in the high MVPA group, LBM significantly predicted PWV ($R^2 = 0.224$, $P = 0.03$), and in the low MVPA group, LBM and 6MWT distance significantly predicted PWV ($R^2 = 0.571$, $P = 0.001$). **CONCLUSIONS:** In children with CHD and healthy controls, body composition predicts arterial stiffness independent of physical activity levels. Aerobic fitness further predicts arterial stiffness only in children with low physical activity levels. Our findings suggest that interventions to improve body composition and aerobic fitness may be especially important for arterial health in less physically active children, independent of health status.

2591 Board #111 June 2 11:00 AM - 12:30 PM
Muscle Strength and Power Deficits in Children with Type SS Sickle Cell Disease

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 (No relationships reported)

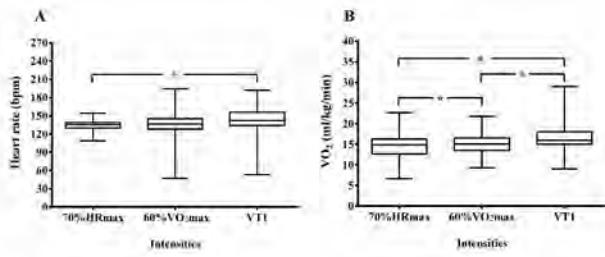
We previously showed (Dougherty et al., 2011) that muscle strength and power adjusted for body size and composition deficits, were attenuated in children with type SS sickle cell disease (SCD-SS) compared to healthy African-American children. However, in today's SCD clinical care environment, hydroxyurea is considered a "standard of care" treatment and is introduced at a young age. It is unclear if this change in treatment may have corrected these body size and muscle performance deficits. **PURPOSE:** To compare muscle strength and power, adjusted for body size and composition, in a contemporary group of 5- to-20-yr-old African-American children with and without SCD-SS. **METHODS:** Anthropometry and DXA for body composition were measured and associated Z-scores generated. Maximum muscle strength with a handgrip dynamometer and peak power via 3 squat jumps on a force plate were assessed. **RESULTS:** Twenty-one children with SCD-SS and 23 healthy control children did not differ by age (11 ± 1 vs. 10 ± 1 yrs), sex (male, female: 9, 12 vs. 13, 10) or maturation stage (Tanner 1, 2, 3, 4, 5: 10, 4, 3, 4, 0 vs. 11, 2, 5, 3, 2), respectively. Children with SCD-SS compared to healthy controls had significantly lower (all $P < 0.05$) height Z (-0.5 ± 0.3 vs. 0.4 ± 0.2), weight Z (-0.7 ± 0.3 vs. 0.8 ± 0.2), BMI Z (-0.6 ± 0.2 vs. 0.7 ± 0.2), arm circumference Z (-0.9 ± 0.3 vs. 0.8 ± 0.3), upper arm muscle area Z (-0.6 ± 0.3 vs. 1.0 ± 0.4), and whole body lean mass-for-height Z (-1.9 ± 0.2 vs. -0.9 ± 0.3). Unadjusted dominant hand maximum handgrip strength (16 ± 2 vs. 23 ± 2 kg, $P < 0.01$) and peak power (1054 ± 107 vs. 1488 ± 169 W, $P < 0.04$) were significantly reduced in children with SCD-SS compared to healthy controls. Performance decrements persisted when handgrip strength was adjusted for lean body mass and fat mass explaining 66% of the variance and power was adjusted for age, lean body mass, fat mass, height explaining 91% of the variance. **CONCLUSIONS:** Body habitus adjusted muscle strength and power are reduced in children with SCD-SS compared with healthy children beyond expectation for growth and body composition deficits suggesting that additional factors contribute to attenuation in anaerobic performance. Supported by K12 (KL2RR024132), K23 (K23HL114637), (UL1TR000003), CHOP RAG Pilot Grant, GI Research and Education Fund, and Nutrition Center.

2592 Board #112 June 2 11:00 AM - 12:30 PM
Is The Acsm Recommendations For Exercise Prescription For Obese Adolescents In Accordance With Ventilatory Threshold?

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Purpose: To compare heart rate (HR) and oxygen uptake ($\dot{V}O_2$) among ACSM recommended intensities for obese adolescents (70% of maximum heart rate - HR_{max}, 60% of maximum oxygen uptake - $\dot{V}O_{2max}$) and ventilatory threshold 1 (VT_1). **Methods:** One-hundred and twenty-seven obese adolescents (age=15.2±1.5yrs.; BMI=34.6±3.9 kg/m²; Fat mass=48.8±5.3%) performed an incremental treadmill test. The initial load was set at 3 km/h (3 minutes) and increased 1km/h each minute until exhaustion, while the grade was kept constant at 1%. $\dot{V}O_2$ was measured directly in an open circuit respiratory metabolic system (Quark, PFT, Cosmed, Italy). VT_1 was determined by visual inspection using Wasserman's criteria by two independent researchers. ANCOVA adjusted for gender, age and fat percentage was used to compare HR and $\dot{V}O_2$ among the three intensities (70%HR_{max}, 60% $\dot{V}O_{2max}$ and VT_1), with Tukey test for post-hoc comparisons. **Results:** VT_1 was achieved at 67 ± 9% of $\dot{V}O_{2max}$ (ranging from 45 to 93%). HR at VT_1 was higher than HR at 60% $\dot{V}O_{2max}$ and 70%HR_{max} ($p < 0.05$). HR at 60% $\dot{V}O_{2max}$ was higher than at 70%HR_{max} ($p < 0.05$). $\dot{V}O_2$ was also higher at VT_1 compared to 70%HR_{max} ($p < 0.05$), with no differences in further comparisons ($p < 0.05$) (Figure 1). **Conclusion:** In obese adolescents, an aerobic exercise prescription based on ACSM recommendations requires lower cardiorespiratory effort than VT_1 intensity. The exercise prescription at 60% $\dot{V}O_{2max}$ induces higher cardiorespiratory stimulus than at 70%HR_{max}.

Supported by CNPq (grant 477955/2009-6) and FACEPE (grant 0928-4.9/08)
 Figure 1. Heart rate and oxygen uptake responses at different recommendations for aerobic exercise prescription for obese adolescents



The GPS data were used to determine the total distance and velocities performed, and to examine for pacing affects. Summary statistics of mean ± SD are provided. **RESULTS:** High total running speeds for the initial 150 s ($S_{150s} = 5.79 \pm 0.59$ m/s) and total distance (3 MT distance = 871.5 ± 71.9 m) were observed. A total of 13 of 30 subjects surpassed the 300 m D' value (mean $D' = 288.2 \pm 49.1$ m). The CS of the total group was 3.87 ± 0.55 m/s. Skewing of CS and D' was observed between forwards and backs, therefore between-group differences in neither CS nor D' were observed ($p > 0.05$). **CONCLUSION:** Comparisons with previous literature indicate male rugby players have higher CS values than female rugby players. Using referent data on male Olympic distance runners, male rugby players have markedly higher D' values and markedly lower CS values. Feature utility of the CS concept is anticipated as we begin to understand norms for CS and D' of different athletes and different running conditions (e.g., load carriage, shuttle running).

E-30 Free Communication/Poster - Elite Athletes

Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2593 Board #113 June 2 11:00 AM - 12:30 PM

Physiological & Anthropometric Profiles Of Elite Collegiate Rugby Union Players

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PURPOSE: To Investigate physiological and anthropometric characteristics of Elite US College Rugby Union Players (ECP).
METHODS: Thirty-six elite US college rugby union players (20 forwards, 16 backs) was measured for height (cm), body mass (kg), percentage of body fat (3 sites), muscular power (vertical jump, power Clean), speed (10m and 40m sprint), strength (back squat, bench press) and maximal aerobic power (Yo-Yo test).
RESULTS: Forwards were significantly taller (183.8±6.0cm vs. 176.8 ±4.9cm) ($p < 0.01$), more massive (110±13.9kg vs. 86.4 ±8.1kg), had higher percent body fat than the backs (17.0 ± 5.9 vs. 11.7 ± 4.3) ($p < 0.01$). Scores for vertical jump (27.4±4.3 cm vs. 29.5±2.4cm), power clean 1RM (112.0±10.4kg vs. 93.4±24.5kg), back squat 1RM (177.4±29.9kg vs. 150.1±21.8kg), bench press 1RM (132.0 ±19.5kg vs. 110.7 ±16.3kg) and pull-up (10±7 reps vs. 14 ±4reps) were all found significantly different between forwards and backs ($p < 0.01$). However, there was no significant difference for power clean, back squat and bench press when scaled to body weight. Scores for 10m (1.9±0.13sec vs. 1.78 ±0.1sec) and 40m sprint (5.55±0.30 vs. 5.21±0.22), Yo-Yo test (865 ±312m vs. 1240±360m) performance and estimated VO_{2max} (43.7±2.6 ml/kg/min vs. 46.8±2.6 ml/kg/min) were significantly different between forwards and backs ($p < 0.01$).
CONCLUSION: Certain physiological characteristics (muscular strength & power) of ECP are of the same level when compared to other competitive rugby union players. These finding suggest that position specific training is effective in ECP. A greater importance should be placed on developing ECP's aerobic power and enhancing anthropometric characteristics to aid success in the future at higher competitive levels of rugby union.

2594 Board #114 June 2 11:00 AM - 12:30 PM

Positional Norms For Critical Speed And D' Of High-level Male Rugby Athletes

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The critical speed (CS) concept helps characterize the aerobic and anaerobic fitness of an athlete. Rugby players should hypothetically have modest CS values but extremely high curvature constant (D') values, yet, normative data are unavailable. **PURPOSE:** To gather normative data of CS and D' on high-level male rugby athletes. **METHODS:** A total of 30 male rugby players, were recruited from the Eastern Cape of South Africa. All subjects performed the running 3-min all-out exercise test (3 MT) using global positioning system (GPS) technology to determine CS and D' .

2595 Board #115 June 2 11:00 AM - 12:30 PM

An Interdisciplinary Athlete Development Program Aimed at Improving Skills and Physical Attributes in Elite Athletes

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While strength and conditioning training can improve athlete skills and physical attributes, little is known on how effective an interdisciplinary approach can be when focused on additional factors (medical, psychological, nutrition) shown to influence such variables. **PURPOSE:** to evaluate the effectiveness of an interdisciplinary athlete development program for improving skills and physical attributes related to the NFL combine. **METHODS:** Retrospective review (2008-2016) of 108 elite level football athletes that completed the St. Vincent Sports Performance NFL Pre-Draft Program. Sports health and fitness professionals created 6-week individualized training programs based on 4 disciplines: 1) Physical Training (strength, speed, position skills), 2) Medical (diagnostic, treatment, corrective exercises), 3) Nutrition (dietary analysis, meals), and 4) Psychological (mental preparation, composure). Anthropometric and skill measurements for strength, power, speed, and agility were obtained pre- and post-program. Paired t-test ($p < 0.05$) was used to assess pre to post differences for all athletes and for subgroups of position demands (speed, hybrid, power). Independent t-test was used to compare both pre- and post-program to NFL combine averages. **RESULTS:** All variables significantly improved pre- to post-program (Table 1), which moved our athletes from worse than combine averages at pre-program, to the same or better at post. Subgroup outcomes showed the same general pattern of improvements, except for fat weight where hybrid (tight end, quarterback, linebacker) showed significant change (38.4 to 36.8 lbs, $p = 0.03$). **CONCLUSION:** While our athletes were of elite status pre-program, thus little room for gains, all outcomes improved post-program and were the same or better than the NFL combine averages. This was likely due to the interdisciplinary approach focused on the total athlete. Future studies should assess how such gains translate to performance.

Table 1. Pre- and post-program outcomes and NFL Combine averages for anthropometrics (percent body fat, fat weight, lean weight) and skill tests for bench press (maximum repetitions of 225 lbs), vertical and broad jumps, and linear and multidirectional speed.

	Weight (lb)**	% Body Fat*	Fat Weight (lb)	% Lean*	Lean Weight (lb)**
Pre	236.3† (45.5)	16.1% (7.9%)	40.8 (26.5)	83.9% (7.9%)	194.6 (23.1)
Post	241.0 (43.3)	15.5% (7.4%)	39.9 (25.3)	84.5% (7.4%)	200.6 (22.4)
Combine	243.8 (45.4)				

	225 Bench (reps)**	Vertical Jump (in)**	Broad Jump (in)**	20 Yard Shuttle (s)**	60 Yard Long Shuttle (s)**
Pre	15.4†† (6.7)	29.1†† (4.3)	106.8†† (9.1)	4.56†† (0.26)	12.23†† (0.58)
Post	20.9 (7.0)	32.3 (4.4)	112.1† (9.1)	4.31†† (0.24)	11.91†† (0.58)
Combine	21.1 (6.5)	32.5 (4.3)	114.3 (9.1)	4.40 (0.30)	11.58 (0.37)

	40 Yard Dash (s)**	20 Yard Dash (s)**	10 Yard Dash (s)**	3 Cone Drill (s)**
Pre	5.07†† (0.30)	2.98 (0.17)	1.82 (0.12)	7.47†† (0.45)
Post	4.81 (0.30)	2.78 (0.18)	1.63 (0.13)	7.09†† (0.38)
Combine	4.78 (0.30)			7.24 (0.41)

Paired t-test (pre to post): * $p < 0.01$; ** $p < 0.001$.
 Independent t-test (pre to combine, post to combine): † $p < 0.05$; †† $p < 0.001$.

2596 Board #116 June 2 11:00 AM - 12:30 PM
A Comparative Study of Shoulder ROM, Proprioception and Balance Ability between General People and Pro Golfers

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PURPOSE:

The purpose of this study is to identify the differences of shoulder range of motion, proprioception and balance ability between general peoples (28±3 yrs, n=9) and pro golfers (members of Korea Professional Golfers' Association, 26±4 yrs, n=9).

METHODS:

Data of the results was analyzed by using the SPSS/PC Window version 21.0 statistics program. To verify differences between the groups, Independent T-test was conducted. All the statistical significance level was set at $\alpha=0.05$.

RESULTS:

1. In shoulder range of motion (ROM), pro golfers group showed higher shoulder range of motion in flexion, abduction, internal rotation than the general people, but there was no significant difference. Pro golfers group showed significant higher range of motion than general people in external rotation ($p<0.05$).
2. In shoulder passive joint position sense (PJPS) test, there was no significant difference between the groups, but in shoulder active joint position sense (AJPS) test, pro golfers group showed significant low error angle than general people ($p<0.05$).

CONCLUSION:

As a result of this study, pro golfers were identified that they have higher shoulder ROM in external rotation and they were showed a low error angle of AJPS than general people. This results might come from the superior motor ability of the pro golfers, however to improve athletic performance and prevent injury & rehabilitation, exercises to improve shoulder range of motion and proprioceptive sense should be included.

For balance ability, there was no significant difference between the groups, but pro golfers group showed the tendency of higher scores than general people, exercise to increase balance ability also considered to be included. However, this study has the limitations of range of motion and proprioception ability measurement for single joint, balance ability test was conducted by the movement of supported plate not by the active movement of the subjects. Therefore, further study is a assessment through a more various and segmentation study are needed.

2597 Board #117 June 2 11:00 AM - 12:30 PM
Comparison of Agility and Approach Jump in Elite Sand and Indoor Collegiate Volleyball Athletes

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The differences between sand and indoor volleyball courts can affect an athlete's performance, most notably jumping and agility performance. Maximal jumps have been reported to be lower when performed on sand compared to rigid surfaces similar to a wood-flooring court. **PURPOSE:** To examine the performance of elite female sand and indoor collegiate volleyball players in agility and approach jump testing in sand and on an indoor surface; including heart rates and ratings of perceived exertion. **METHODS:** Participants (n=21, age 19.8±1.1yrs, height 1.78±0.08m, body mass 73.62±9.63kg) were members of NCAA Division I women's indoor and sand volleyball teams who finished their seasons ranked in the top 8 nationally. Two thirty minute sessions (one sand, one indoor) were completed, consisting of the approach jump test and the 4 Cone Star Drill with a five minute rest between tests. At least three trials were completed for each test and the outcome measures were the participant's approach jump (cm) and agility time (sec), as well as their ratings of perceived exertion (RPE) and heart rate recovery (HRR) following agility testing. **RESULTS:** There was a significant difference between surfaces for both approach jump (57.57±6.28cm indoor vs. 51.03±5.47cm sand, mean difference 6.5±4.3cm, $p<0.001$) and agility trials (6.66±0.52sec indoor vs. 6.96±0.60sec sand, mean difference 0.30±0.46sec, $p=0.021$), but not in HRR (36.4±10.2bpm indoor vs. 36.3±9.9bpm sand, $p>0.05$), peak HR (139.5±12.1bpm indoor vs. 142.3±11.9bpm sand, $p>0.05$), and RPE (9.6±2.1 indoor vs. 9.4±2.2 sand, $p>0.05$). There were no significant differences in approach jump or agility time for athletes who competed in sand, indoor, or both ($p>0.05$ for all), although the difference in RPE trended towards significance ($p=0.082$). Although not significant, sand athletes and hybrid (compete in sand and indoor) athletes consistently performed better than indoor athletes on both surfaces (mean difference 0.593±0.238 sec and 0.553±0.79 sec, respectively). **CONCLUSIONS:** Significant differences exist between sand and indoor surfaces when performing approach jump and agility drills, but not between sand and indoor volleyball athletes.

2598 Board #118 June 2 11:00 AM - 12:30 PM
Salivary Cortisol Responses After A Women's Basketball Match In Elite Athletes

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Cortisol can negatively affect athletic performance, potentially causing fatigue and inflammation, and high levels of this hormone have been associated with impaired performance in elite athletes. Monitoring hormones in saliva has distinct advantages over doing it in other biological fluids. However, little is known about the salivary cortisol responses in female athlete and particularly after a basketball match.

PURPOSE: The purpose of this study was to examine the salivary cortisol responses in elite female athletes after a women's basketball final match. **METHODS:** Fifteen elite female basketball players participated in the study. Unstimulated mixed saliva samples were collected in salivate swabs before and immediately after the basketball match. Specifically, the swab was placed in the mouth for one minute, then it was transferred into plastic tubes, centrifuged and the resulted saliva sample was analyzed. Saliva samples were assayed in duplicate using a commercially available ELISA kit for cortisol. Differences between the cortisol levels before and after the match were analyzed using student's T-test, while Pearson correlation coefficient (r) was used to reveal potential relationship between post-match cortisol levels and participation time in the match. **RESULTS:** Salivary cortisol levels were significantly higher after the completion of the basketball match compared to the baseline levels (2425.6±1927.6 pg/ml vs. 1014.5 ± 548.8 pg/ml; $p=0.003$). No significant correlation was revealed between the participation time (in minutes) of the elite basketball players and their salivary cortisol levels ($r=0.22$; $p>0.05$). **CONCLUSIONS:** The findings of the present study suggest that monitoring cortisol in saliva can be a useful, non-invasive and sensitive method to assess this hormonal response in female athletes after a basketball match. The increased cortisol levels appear not to be associated with the total participation time of the elite basketball players. However, the possible negative effects of these cortisol responses on the female elite athlete's performance needs to be further investigated.

2599 Board #119 June 2 11:00 AM - 12:30 PM
Profiling Inflammatory Markers During The Competitive Season And Post Season In Collegiate Wrestlers

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 (No relationships reported)

PURPOSE: Collegiate wrestling is a highly demanding sport, requiring hours of training, intense competition, combined with periods of poor nutrition and weight loss. The purpose of this study was to profile inflammation in collegiate wrestlers during a competitive season and post season. **METHODS:** Subjects were recruited from the Central Michigan University Division I collegiate wrestling team (N=7). Subjects reported in a fasted state on six separate occasions throughout the competitive season and post season; each time point was separated by 2-weeks up to 2-months. The following measurements were made each time: body fat, hydration, blood profiles (Hct, Hgb, %ΔPV), fatigue (questionnaire), and inflammatory plasma proteins (creatinine kinase, IL-6, TNF α , IL-1 β , IL-10). **RESULTS:** The wrestlers trained 3-4 hours per day during the season. The self-reported level of muscle soreness and fatigue was significantly higher from pre-season through mid-season, but leveled off late into the season ($p<0.05$). Creatine Kinase levels peaked early into the season at time point 2 versus pre-season (391.32 ± 48.46 vs. 220.75 ± 54.18, $p<0.05$), but decreased at the end of season versus pre-season (158.11 ± 44.23 vs. 287.79 ± 44.34, $p<0.05$). Plasma TNF α levels increased late into season (time point 4) compared to pre-season (5.26 ± 0.38 vs. 3.34 ± 0.36, $p<0.05$). Plasma IL-8 followed a similar trend and peaked at time point 4, however this value was not significant ($p=0.08$). Sleep quality correlated with plasma levels of IL-8 ($r^2=0.120$, $p<0.05$). No other plasma cytokine data was statistically significant ($p>0.05$). **CONCLUSIONS:** Muscle soreness and fatigue values peaked early in the competitive season and decreased as the season progressed, without a reduction in training volume; suggesting an adaptive response to training load. Low grade systemic inflammation increased late into the season (measured by plasma cytokines), and correlated with poor sleep quality. Sleep quality may be a simple marker to track inflammation among wrestlers. Based on these data, wrestlers may benefit by additional recovery time early into the season to prevent fatigue and muscle damage. As the season progresses, low-grade inflammation may be prevented by tracking the quality of sleep. Combined these measures may prevent injury and improve performance.

2600 Board #120 June 2 11:00 AM - 12:30 PM
The Retention Potential of the 2016 U.S. Olympic Track and Field Team
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In 2016, USA Track & Field (USATF) fielded a team of 129 athletes to compete at the Olympic Games in Rio de Janeiro. Trends in the retention rates of athletes on past USATF national teams may help to better direct future USATF funding and support. **PURPOSE:** To assess the retention potential of the 2016 U.S. Olympic Track and Field team for future World Championships and Olympic Games teams. **METHODS:** USATF rosters from 13 World Championships and Olympic national teams dating back to 2000 were analyzed in terms of athlete retention rates at subsequent national team events. The relationship between the mean retention rates of national teams and subsequent national team events was modeled using non-linear regression. Data from this model were used to make inferences regarding the future retention rates of the 2016 Olympic team and its athletes with the significance level set at $P < 0.05$. **RESULTS:** The retention rate of a given national team falls logarithmically ($y = -0.0203 \ln(x) + 0.5443$) with time as athletes attempt to make subsequent teams ($R = 0.98$). Furthermore, individual athlete retention rates decayed exponentially ($y = 1.354e^{-0.424x}$) with time as athletes attempted to make subsequent teams ($R^2 = 0.99$). Using these models to assess the 2016 Olympic team, the model predicts that only 65 of the 129 members will make the 2017 World Championships team (95% CI, [58-73]). Additionally, the model suggests that only 39 athletes from the 2016 Olympic team will make the 2020 Olympic team (95% CI, [32-46]). Finally, when applied to the 48 first time national team athletes in 2016, the model projects that 19 (41.2%) will never make another national team (95% CI, [17-22]). **CONCLUSIONS:** The large amount of turnover from one national team to another is likely a reflection of the highly competitive and objective nature of national track & field team selection in the United States. From an athlete funding standpoint, national governing organizations with limited resources may be able to optimize their return on investment by funding athletes on a year to year basis as opposed to making long term commitments.

2601 Board #121 June 2 11:00 AM - 12:30 PM
Metabolic Approach in Canoeing Olympic Medalist Athletes in Rio 2016 Summer Olympic Games
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(No relationships reported)

Olympic athletes are overexposed to training and daily routine, and the training log should be matched with multifactorial issues, such as nutrition, physiotherapy, psychologic, and health, focusing on improvement of performance. Evaluate how the athletes is responding to each period of preparation is challenging, specially on a 4 year Olympic cycle. Interdisciplinary approach is mandatory and any mismatch may lead to injury or decrement of performance. Canoeing has specific demands and methods for evaluation, and multifactorial analysis such as biomechanical, metabolic and clinical aspects should be encouraged. **PURPOSE:** The aim of this study was to evaluate athletes participating in Rio 2016 Summer Olympics Games on a multidisciplinary and multifactorial aspect. **METHODS:** 2 male athletes (Bronze Medalists) were evaluate during a 1.000m sprint on an ergometer, analyzing aerobic capacity (VO_2), Heart Rate (HR) and Power (W) on every 250m. Blood samples were collected for muscle-damage biomarkers: Creatine-Kinase (CK) and Lactate Dehydrogenase (LDH); Electrolytes: Sodium (Na) and Potassium (K) levels. **RESULTS:** Descriptive data demonstrate that VO_2 (mL/kg/min), HR (bpm), W (watts) were, during 250m: 39.3/172/113 x 39.2/159/107, 500m: 31.2/176/105 x 37.1/160/109, 750m: 36.7/178/110 x 34.9/168/100, and 1.000m: 43.5/184/182 x 45.1/178/118, respectively. CK levels (mg/dL) and LDH (U/L) were, pre vs post protocol, 835 vs 1081 and 548 vs 682 for the first athlete, and 255 vs 340 and 488 vs 492 for his teammate. Electrolytes, Na (mEq/L) and K (mEq/L) were 143 vs 151 and 5.8 vs 5.6; and 141 vs 151 and 5.4 vs 5.9. The time for completing the 1.000m protocol were 5m12s06ms vs 5m02s92ms. **CONCLUSIONS:** The protocol described evidences multidisciplinary variables that should be focused when detailing improvement in performance, on cardiorespiratory and metabolic approach.

2602 Board #122 June 2 11:00 AM - 12:30 PM
Differences Among Kinetics, Kinematics, Performance, and Elbow Varus Torque in Professional Versus High School Pitchers
 Micheal J. Luera¹, Mitchel A. Magrini¹, Tyler W.D. Muddle¹, Ryan J. Colquhoun¹, Jason M. DeFreitas¹, Brittany Dowling², Nathaniel D.M. Jenkins¹. ¹Oklahoma State University, Stillwater, OK. ²Motus Global, Massapequa, NY.
(No relationships reported)

PURPOSE: The purpose of this study was to compare ball velocity (BV) and elbow varus torque (EVT), as well as kinematic and kinetic differences between high school (HS) and professional (PRO) baseball pitchers. **METHODS:** Seventy-eight HS ($n = 39$; 16 ± 1 yrs; 74 ± 10 kg; 178 ± 7 cm) and PRO ($n = 40$; 21 ± 2 yrs; 94 ± 9 kg; 189 ± 4 cm) baseball pitchers were analyzed while throwing fastball pitches using an eight-camera 3D motion capture system. Following a warm-up, participants threw ~8 maximal effort fastballs. The 6 pitches with the greatest BV were used for analysis. Independent samples t-test were used to examine differences between the HS and PRO pitchers. Pearson correlation coefficients were used to assess potential relationships between BV, EVT and several kinetic and kinematic variables during phases of the throwing motion. **RESULTS:** BV (86.3 ± 2.2 vs 70.4 ± 6.5 mph; $p < 0.001$) and EVT (79.2 ± 14.9 vs 44.4 ± 16.0 Nm; $p < 0.001$) were greater in PRO than HS. In HS, BV was related to EVT ($r = 0.77$) and BV and EVT were related to elbow flexion torque, elbow flexion and extension velocity, shoulder anterior and elbow medial shear force at arm acceleration, shoulder rotation torque at arm cocking, and elbow and shoulder proximal force at arm deceleration ($r = 0.35 - 0.98$, $p < 0.05$). However, in PRO, BV and EVT were not related to each other ($r = 0.01$) but were related to elbow flexion torque and shoulder anterior shear force at arm acceleration ($r = 0.32 - 0.52$, $p < 0.05$). In Pro, EVT, but not BV, was related to elbow medial shear force at arm acceleration, shoulder rotation torque at arm cocking, and elbow and shoulder proximal force at arm deceleration ($r = 0.69 - 0.96$, $p < 0.05$), and was inversely related to upper trunk rotation at foot contact ($r = -0.31$, $p < 0.05$). **CONCLUSION:** The results of this study indicated that PRO achieve higher fastball velocities and experience greater elbow varus torques than HS pitchers. However, in PRO pitchers, those who achieved the highest fastball velocities did not necessarily experience the greatest EVTs; whereas in HS pitchers, those who threw harder generally experienced higher EVTs. The inverse relationship seen in PRO, but not HS, pitchers for EVT and upper trunk rotation may suggest that PRO pitchers have a greater ability than HS pitchers to utilize their trunk to generate the forces necessary to achieve higher fast ball velocities.

E-31 Free Communication/Poster - Gait Biomechanics
 Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2603 Board #123 June 2 9:30 AM - 11:00 AM
Comparisons Between Adiposity Indexes In The Association With Postural Instability In Older Women
 Juscelia C. Pereira, Silvia G.R. Neri, André B. Gadelha, Ana L. M. Correia, Ana C. David, Ricardo M. Lima. *University of Brasilia, Brasilia, Brazil.*
(No relationships reported)

PURPOSE: To compare adiposity indexes in the association with postural instability in older women. **METHODS:** A cross-sectional study was conducted on 147 elderly women, aged 60 to 84 years. Participants underwent body fat distribution assessment using dual-energy X-ray absorptiometry (DXA) and five anthropometric indexes were measured (waist circumference, WC; waist-to-height ratio; body mass index; and concity index). Balance control (BC) was evaluated using a force platform and all participants performed the following trials: opened base, eyes open (OBEO) and opened base, eyes closed (OBEC). Center of pressure (CoP) speed and the range of displacement on the anteroposterior (AP) and mediolateral (ML) axes were obtained from the average of three measurements. Pearson's and Spearman's correlation were conducted to identify the relationship between adiposity indexes and stabilometric measures. Volunteers were stratified in tertiles according to adiposity index; one-way ANOVA followed by Bonferroni post-hoc and Kruskal-Wallis with the Mann-Whitney test were used to compare the stabilometric variables between groups. **RESULTS:** WC was the index that best correlated with the range of displacements, showing significant relationships in the following conditions $OBEC_{AP}$ ($r = 0.337$; $p < 0.001$), $OBEO_{AP}$ ($r = 0.240$; $p = 0.003$), $OBEO_{ML}$ ($r = 0.222$; $p = 0.007$), $OBEC_{ML}$ ($r = 0.266$; $p = 0.001$). Moreover, volunteers in the highest tertile of WC had a greater range of displacements compared with lowest tertile in conditions $OBEO_{AP}$ (2.30 ± 0.51 vs. 1.99 ± 0.48 cm, $p = 0.011$), $OBEO_{ML}$ (1.47 ± 0.45 vs. 1.23 ± 0.44 cm, $p = 0.005$), $OBEC_{AP}$ (2.85 ± 0.68 vs. 2.35 ± 0.65 cm, $p = 0.001$), $OBEC_{ML}$ (1.60 ± 0.50 vs. 1.29 ± 0.48 cm, $p = 0.010$). Participants

in the lowest tertile showed smaller displacements compared with middle tertile in conditions OBE_{AP} (1.99±0.48 vs. 2.29±0.53 cm, $p=0.012$), OBE_{ML} (1.23±0.44 vs. 1.52±0.47 cm, $p=0.001$), OBE_{AP} (2.35±0.65 vs. 2.72±0.66 cm, $p=0.022$), and OBE_{ML} (1.29±0.48 vs. 1.56±0.55 cm, $p=0.034$). **CONCLUSION:** WC was the adiposity index the best correlated with postural instability, and subjects with greater WC also exhibited the poorest BC in older women. These results suggest that WC, an easy and low cost measure, might be associated with the risk of falling in the elderly, and support the concept that obesity impairs BC.

2604 Board #124 June 2 9:30 AM - 11:00 AM
Gait And Pelvic Angle Symmetry As A Function Of Age In Women 55 And Older

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 (No relationships reported)

Serious injuries due to falls in people 65 years and older is a critical cost and quality of life issue in our society; slowed and degraded gait is of particular concern in older women. Falling often correlates with impaired gait and balance caused by loss of muscular strength and/or sensory impairments. Gait and pelvic angle symmetries (between left and right sides of the body) are key measures of gait quality. **PURPOSE:** The goal of this study, an initial phase in a larger project, was to characterize the relationship between age and several gait symmetry measures in women 55 and older. **METHODS:** 20 healthy female participants (ages 55-83) walked along a hallway while their gait characteristics were monitored; each participant walked 4 times at their self-selected pace. Data on pelvic tilt, obliquity, and rotation symmetry, as well as overall gait symmetry (similarity of trunk accelerations on the left and right sides) were assessed using an inertial sensor (BTS-G Walk) placed on the low back (L5). **RESULTS:** Pelvic tilt symmetry, which ranged from 30-98%, showed a statistically significant relationship with age in these older women walkers ($p=0.009$); age explained 33% of the variation in pelvic tilt symmetry. Neither pelvic rotation ($p=0.33$), pelvic obliquity ($p=0.99$), or gait symmetry ($p=0.46$) showed significant relationships to age. **CONCLUSIONS:** These initial findings reveal a particular focus of gait impairment as a function of age in older women -- pelvic tilt symmetry. Interventions to address this aspect of gait may improve walking patterns, and thus dynamic stability, in older walkers.

2605 Board #125 June 2 9:30 AM - 11:00 AM
Variability and Stability of 13-19 Month Old Infants' Gait Affected by External Perturbation

Sally-Marie Futch, Sydney Wilhoite, Brandon Harris, Barry M. Munkasy, Li Li, FACSM. *Georgia Southern University, Statesboro, GA.* (Sponsor: Li Li, FACSM)
 (No relationships reported)

Although there has been research conducted on motor development, children's walking behavior, differences between adult and children's gait with perturbation, and the effect of diaper perturbation versus unclothed on gait, there has been little to no research on different diaper perturbations on gait. **PURPOSE:** The purpose of this study was to examine how a physical perturbation (a dry and a wet diaper versus underwear) affect 13 to 19 month old children's gait. **METHODS:** The project was approved by the University's IRB, and participation was granted with written consent from a legal guardian. Sixty children ranging from 13 to 19 months in age were recruited for this study. Each child completed five trials for three conditions in a single session. Each trial consisted of the child walking on an instrumented walkway (GaitRite CIR Systems, Sparta, NJ) for at least five continuous steps wearing a dry diaper, a wet diaper, and underwear, all of which were provided to the participants. Diapers were wet using a 100 ml syringe of room temperature water. Step length (m/step), step rate (steps/s), and left and right support base (m) were analyzed using a 7x3 MANOVA. **RESULTS:** Significant main effects for age and condition, but no significant interaction were observed. For step length and rate, 13 and 19 months deviate from the means of each other and all the other ages. Step length: 0.21±0.04, 0.332±0.034, Step rate: 3.0±0.4, 3.7±0.6, 13 and 19 month respectively. Significant age difference was observed for left and right support base. Significant differences were also observed for left and right support base (1.4±.36, 1.5±.36 for wet diaper and underwear, respectively), but not for step length and rate. **CONCLUSION:** A wet diaper did not affect step length or step rate. However, there was an effect that occurred between age group and step length, step rate, left and right support base. These factors are impacted by maturation. Further research needs to address whether these conditions influence other gait parameters.

2606 Board #126 June 2 9:30 AM - 11:00 AM

Relationship Between Body Fat And Selected Gait Parameters

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 (No relationships reported)

Over the years obesity has become a widespread pandemic that has affected many people. Obese persons experience difficulty ambulating and conducting daily activities. While body mass indexing is typically used to identify obese individuals percent body fat was preferred for this study because body mass index presents as an inaccurate obesity classification (Shah, 2012). It has been proposed that as percent body fat increases joint mechanics of the hip, knee, and ankle will increase as well on all three planes. **PURPOSE:** The purpose of this study is to show the correlation between body percent fat and lower extremity joint mechanics. **METHODS:** 54 participants (24 male, 30 female; Height: 170.9±9.2 cm, Weight: 74.4±18.8 kg) were fit with reflective markers on the bony landmarks of the lower extremity and asked to walk across Bertec force plates (Bertec, Inc, Columbus, OH) a total of 10 times. Kinematic data were collected and normalized to body weight and collected with Vicon Nexus 2.4 (Vicon, Inc., Oxford, UK) and processed through Visual 3D software (C-Motion, Inc., Germantown, MD). Body composition was measured using a Bod Pod (CosmedUSE, Inc., Chicago, IL). Data were analyzed using a Pearson correlation coefficients ($\alpha=0.05$). **RESULTS:** The data revealed a significant relationship between percent body fat and stride width ($r^2=0.368$) as well as peak ankle plantarflexion moment ($r^2=0.373$) ($p=0.032$ and $p=0.005$ respectively). No other significant relationships were observed. **CONCLUSIONS:** Based on this data, step width and peak plantar flexor moments were increased with increased body fat percentage, suggesting that persons with a larger percent body fat require more force to propel themselves forward to toe off. Strengthening plantar flexors, or reducing body fat percentage, may allow those with high percent body fat to ambulate and perform other daily tasks efficiently. Further research is needed to examine non-normalized data to show practical effects. Additionally, the current study used primarily active individuals, a comparison to sedentary individuals is needed.

2607 Board #127 June 2 9:30 AM - 11:00 AM

High Capacity Older Adults Exhibit More Biomechanical Plasticity than Low Capacity Older Adults

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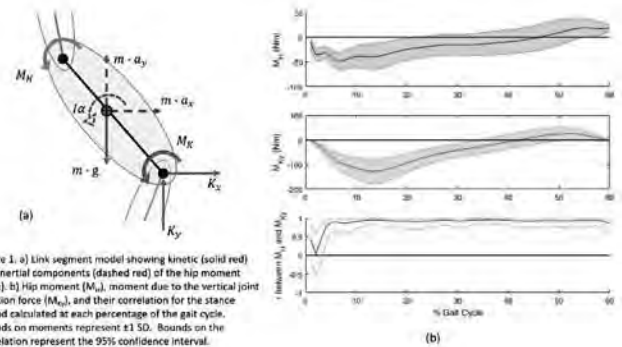
Old compared to young adults exhibit increased hip and decreased ankle joint work during level walking. This distal-to-proximal redistribution of joint work is known as biomechanical plasticity and is a successful strategy for maintaining walking performance into old age. It is unknown however whether high-functioning adults, (e.g. those with relatively fast walking speed) exhibit larger magnitudes of plasticity enabling them to walk well or whether low-functioning adults exhibit larger magnitudes of plasticity to simply enable them to walk. The literature weakly suggests that "low-performing" compared to "high-performing" old adults exhibit larger magnitudes of biomechanical plasticity. We seek to more precisely identify the nature of biomechanical plasticity with age and its relationship with physical capacity. **PURPOSE:** To compare magnitude of biomechanical plasticity between high and low capacity old adults during level walking. **METHODS:** 3D motion capture gait analyses were conducted on 30 old adults (n = 19 females; age = 74.7 yrs.) walking at self-selected speeds. Short Form Health Survey (SF-36) physical component scores were used as measures of physical capacity. Ratios of positive hip work to positive ankle work and peak positive hip extensor power to peak positive plantarflexor power were used as measures of biomechanical plasticity. Student's t-tests were used to compare the top 10 (n = 8 females; age = 76.5 yrs.) and bottom 10 (n = 5 females; age = 72.8 yrs.) individuals based on their SF-36 PC scores. **RESULTS:** High capacity adults exhibited larger ratios of both hip/ankle positive work (0.948 vs 0.613, $p=0.01$) and hip/ankle peak positive power (0.599 vs 0.375, $p=0.003$) compared to low capacity adults. High capacity adults exhibited faster self-selected walking speed (1.39 vs 1.22 m/s, $p=0.01$) and longer stride lengths (1.46 vs 1.29 m, $p=0.002$) compared to low capacity adults. **CONCLUSION:** Old adults with high physical capacity exhibited a larger magnitude of biomechanical plasticity compared to old adults with low physical capacity. This allowed the high capacity individuals to maintain faster self-selected walking speeds and longer stride lengths compared to the low capacity individuals – two variables that may help these individuals maintain higher capacities.

2608 Board #128 June 2 9:30 AM - 11:00 AM
Test-retest Reliability Of The Walk-to-run Transition Stride Frequency Predicted From Behavioral Attractors
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We recently showed that the observed walk-to-run transition stride frequency agrees with a transition stride frequency predicted in a novel way by the two stride frequencies applied during treadmill walking and running at freely chosen velocities and freely chosen stride frequencies. The two latter stride frequencies are defined as behavioral attractors. **PURPOSE:** To test the day-to-day reliability of the predicted walk-to-run transition stride frequency determined by this novel approach. **METHODS:** Healthy individuals ($n=25$, 19 men and 6 women of age, height, and body mass of 26.6 ± 4.2 years, 1.77 ± 0.08 m, and 76.4 ± 11.6 kg, respectively) were recruited for a laboratory test of treadmill walking and running. The two behavioral attractors were determined during walking and running at freely chosen velocities and stride frequencies. Subsequently, the walk-to-run transition stride frequency was predicted to occur at the point where the walking stride frequency starts to get closer to the running attractor than to the walking attractor. The laboratory test was repeated after 4-8 days. Intraclass correlation coefficient ($ICC_{3,1}$), standard error of measurement (SEM), and smallest real difference (SRD) were calculated as measures of reliability. **RESULTS:** The freely chosen stride frequency during walking was 57.7 ± 4.1 and 59.1 ± 4.8 strides min^{-1} in test 1 and 2, respectively ($p=0.03$). The freely chosen running stride frequency was 81.8 ± 3.7 and 81.9 ± 3.1 strides min^{-1} in test 1 and 2, respectively ($p=0.67$). The predicted walk-to-run transition stride frequency was 69.7 ± 3.3 and 70.5 ± 3.4 strides min^{-1} in test 1 and 2, respectively ($p=0.08$). The $ICC_{3,1}$ of the predicted walk-to-run transition stride frequency was 0.89, the SEM was 1.1 strides min^{-1} , and the SRD was 3.1 strides min^{-1} . **CONCLUSION:** The predicted walk-to-run transition stride frequency showed almost perfect relative reliability and high absolute reliability.

2609 Board #129 June 2 9:30 AM - 11:00 AM
Hip Moment Prediction with a Subset of Inverse Dynamics Components
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 (No relationships reported)

Purpose Joint moments, calculated via inverse dynamic (ID) analyses, represent the net effect of all forces spanning a joint, and are used as a surrogate to represent joint demand and are used to describe movement patterns. However, because excessive instrumentation is required, ID analyses are rarely used outside of a laboratory setting. Insight into joint moments using simply collected quantitative measures has the potential to impact a variety of settings (e.g. movement retraining, sports performance, etc.). Therefore, the objective of this study was to determine if hip moment could be predicted using a subset of ID analysis components. **Methods** Kinematic and force platform data were captured for 12 healthy subjects (9M/3F, age: 59.8 ± 7.8 yrs, BMI: 25.1 ± 2.9) walking at 1m/s. Sagittal-plane hip moment during stance period was calculated using ID analysis. Pearson correlations (r) were calculated at every percentage of the stance period between the hip moment and the kinetic components ($M_{MK}, M_{Kx}, M_{Kz}, M_y$) and inertial components (M_{Iy}, M_{Ix}, M_{Iz}) of the thigh from the ID calculations (Fig. 1a). 95% confidence intervals that did not cross zero were considered to be significant, and mean correlations throughout stance were calculated. **Results** Hip moment was highly correlated ($r = 0.93$) with M_{Kx} , the moment due to vertical joint reaction force at the knee for 94.4% of the stance period and highly negatively correlated ($r = -0.83$) with M_g , the moment due to gravity. Inertial components of the thigh were not correlated with hip moment. **Conclusions** The results indicate that hip moment can be predicted with vertical knee joint reaction force and thigh orientation. Because the moment due to the vertical reaction force at the knee is dominated by the ground reaction force, this can be estimated using instrumented insoles. In summary, the hip moment during stance shows promise for being predicted with simple regression equations and minimal instrumentation.



2610 Board #130 June 2 9:30 AM - 11:00 AM
Measuring Stride Intervals Using Wearable Devices For Solo And 3-legged Walking
 Sara J. McAllister¹, Anna N. Ahn¹, Cassandra Davis², Pallavi Deshpande², Leanna M. Namovic³, Kenneth S. Robertson⁴, N P. Reeves⁵, John G. Milton⁶. ¹Harvey Mudd College, Claremont, CA. ²Claremont McKenna College, Claremont, CA. ³Scripps College, Claremont, CA. ⁴Pitzer College, Claremont, CA. ⁵College of Osteopathic Medicine, Michigan State University, East Lansing, MI. ⁶Claremont Colleges, Claremont, CA.
 (No relationships reported)

Developing computer algorithms to reliably estimate stride times is an important first step for applying wearable devices for assessing gait outside a laboratory setting. The fundamental problem for identifying heel strikes using numerical techniques is multiple local maxima in fore-aft accelerations. Thus, when stride times vary, algorithms that use a fixed sampling interval cannot identify those accelerations associated with heel strike. **PURPOSE:** We assess the ability of wearable devices that measure both 3D accelerations and 3D angular velocities to measure stride times during solo treadmill and paired subject 3-legged walking. **METHODS:** Acceleration was measured in the plane parallel to the walking surface (a_x) using a Shimmer3 (Dublin, Ireland) attached to the shin. The angular velocity in the sagittal plane (or pitch) (Ω_p) provided a measure of heel strike. The algorithm identified heel strike as the first a_x maxima that occurs after the maximum in Ω_p . The stride times calculated using this method were compared to stride times measured using a force sensitive resistor (FSR; Interlink Electronics, Camarillo, CA) placed under the heel. The two methods were compared at various walking speeds on a treadmill (1.25, 1.5, 1.75, and 2.0 $m s^{-1}$). Three-legged walking speeds ranged from 1.0 to 3.0 ms^{-1} included 55 stumbles ($N = 25$ pairs of subjects). **RESULTS:** The identified heel strike using the wearable unit occurred $\approx 28 \pm 5$ ms after heel strike measured using an FSR. The stride times calculated using the algorithm differed from the FSR by an average of 2.0 ± 0.16 ms. Less than 0.1% of the strides were not identified by the algorithm. **CONCLUSION:** The wearable unit and algorithm is suitable for use in gait studies measuring stride times during solo and 3-legged walking. Supported by HHMI grant number 52007536 and 52007544.

2611 Board #131 June 2 9:30 AM - 11:00 AM
Effects of Carrying a Loaded Energy Harvesting Backpack on Trunk Lean
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 (No relationships reported)

Soldiers are fielded with a wide range of loads to carry including battery powered electronic devices. An energy harvesting backpack (EHB) was developed to convert gait kinetic energy into electrical power, providing a power source to recharge batteries and reduce the load of extra batteries carried in standard backpacks. Little is known about the kinematic effects of carrying the EHB compared to the military standard assault pack (AP). **PURPOSE:** To determine if trunk lean changes when carrying the EHB compared to the AP and whether these changes are affected by pack, load, and speed. **METHODS:** Sixteen subjects (28.6 ± 4.7 years; 173.9 ± 10.1 cm; 76.9 ± 16.1 kg) walked on an instrumented treadmill under 8 combinations of pack, load, and speed conditions each for 5 minutes. Conditions included 1) pack: AP and EHB, 2) load: 7.9 kg (light) and 15.9 kg (heavy), and 3) speed: 1.34 m/s and a self-selected faster speed. Due to its design, the empty EHB mass was 4.4 kg greater than the AP. Kinematic data

were collected to calculate trunk lean relative to the vertical axis (degrees). A 3-way repeated measures ANOVA was used to determine effects of pack, load, and speed on trunk lean with an alpha level set a priori at $p < 0.05$. Post-hoc pairwise comparisons were performed with Bonferroni corrections. **RESULTS:** A significant main effect of speed on trunk lean ($F_{1,13}=44.1$, $p < 0.001$) was observed where forward lean was greater at faster speeds (Slow: 3.8 ± 0.6 ; Fast: 7.5 ± 0.7 , $F_{1,13}=44.1$, $p < 0.001$). There was a significant pack x load interaction on trunk lean (AP-Light: 1.4 ± 2.1 ; AP-Heavy: 4.6 ± 2.3 ; EHB-Light: 5.5 ± 2.9 ; EHB-Heavy: 10.9 ± 3.4 ; $F_{1,13}=15.5$, $p = 0.002$). Subjects using the EHB walked with greater increase in forward lean when carrying the heavy load. **CONCLUSION:** Walking with heavy loads and carrying the EHB produced greater increase in forward lean when compared to the AP. This suggests a potential nonlinear effect of pack and load on trunk lean. The weight cost or oscillation of the EHB may also contribute to these changes in gait. Phase relationships between the user and EHB centers-of-mass could be examined in future research to study the effects on gait biomechanics. Further analysis is also warranted to determine tradeoffs in power generated from the EHB and Soldier biomechanics while walking with the system.

2612 Board #132 June 2 9:30 AM - 11:00 AM

Test-retest Reliability of Spatial-temporal Characteristics In Novice Walkers

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(No relationships reported)

Infant walkers have immature gait patterns. Small perturbations to gait, such as a dry diaper, could impact their already unstable spatial-temporal gait characteristics. However, little is known regarding the test-retest reliability of spatial temporal measurements as measured by the GAITRite of novice walkers in dry diapers.

PURPOSE: To determine the reliability of spatial-temporal gait characteristics, such as Velocity, Cadence, Stride length, and Base of Support in 13-16 month old novice walkers wearing a dry diaper. **METHODS:** The project was approved by local IRB board and participated with written consent from legal guardians. 18 novice walkers, 9 males and 9 females, (14.4 ± 1.0 months of age) participated in a series of 5 walking trials at a self-selected pace in a dry diaper on the GAITRite System (sampling rate 120Hz) on two separate testing sessions one week apart (Day 1 and 2). During each session, participants were fitted with the dry diaper and encouraged to walk 5 or more steps continuously for each trial, five trials total, over the GAITRite. Upon completion of each testing session, the raw data was exported and averaged across five trial for each day. Average gait velocity (cm/s), cadence (step/s), stride length (cm) and base of support (cm) were calculated at each time point. Intraclass Correlations were employed to assess between-day reliability. **RESULTS:** Gait Velocity, 92.3 ± 25.0 and 93.6 ± 20.0 , for Day 1 and 2 respectively, ICC = 0.848 (95% CI = 0.594 to 0.943); Cadence, 208.6 ± 34.7 and 209.9 ± 25.8 , for Day 1 and 2 respectively, ICC = 0.836 (95% CI = 0.561 to 0.939); Stride Length = 53.0 ± 9.0 , and 53.5 ± 7.8 , for Day 1 and 2 respectively, ICC = 0.916 (95% CI = 0.777 to 0.969), Base of support, 10.9 ± 2.6 , 10.9 ± 1.6 , for Day 1 and 2 respectively, ICC = 0.767 (95% CI = 0.376 to 0.913). **CONCLUSION:** The results of the study demonstrated excellent test-retest reliability for Gait Velocity, Cadence, and Stride Length and good test-retest reliability for Base of support when testing 13-16 month old novice walkers in a dry commercially available diaper on the GAITRite. Future research needs to address the test-retest reliability of infants wearing a wet diaper since wet diapers introduce great perturbation to walking.

2613 Board #133 June 2 9:30 AM - 11:00 AM

Altered Locomotive Hip Joint Patterns in Patients with Chronic Ankle Instability

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(No relationships reported)

Lateral ankle sprains are common among athletes and often times lead to chronic ankle instability (CAI). Altered hip joint biomechanics during functional activity has been noted in CAI patients. However, few studies have comprehensively examined locomotive hip joint movement strategies in subjects with CAI. **PURPOSE:** To examine gait patterns of frontal and sagittal hip kinematics, kinetics, and muscle activation in those with and without CAI. **METHODS:** 100 CAI patients ($M=49$, $F=51$; 22 ± 2 yrs, 174 ± 10 cm, 71 ± 14 kg, $82 \pm 9\%$ FAAM ADL, $62 \pm 13\%$ FAAM Sports, 4.5 ± 2.6 ankle sprains) and 100 controls ($M=56$, $F=44$; 22 ± 3 yrs, 172 ± 13 cm, 72 ± 18 kg, 100% FAAM ADL & Sports, no previous sprains) performed five walking trials, while hip joint angles, moments and muscle activation were collected during the stance phase. Functional analyses ($\alpha = .05$) were used to compare the entire stance phase of gait between groups. Functions of each group as well as 95% confidence intervals (CI) were plotted to determine significant differences. If functions and associated 95% confidence intervals did not cross zero, group differences existed. **RESULTS:** Figure

1. CAI subjects demonstrated increased hip flexion and extension, likely a result of greater hip joint moments during stance. CAI patients decreased hip adduction during 45-70% and increased hip abduction between 90-100% of stance. CAI subjects decreased hip abduction moment during 10-14% of stance. Gluteus maximus and medius activation decreased during mid-and terminal stance of gait. **CONCLUSION:** Lack of EMG activation combined with altered biomechanics at the proximal joint may alter the position and loading of distal joints in the chain, potentially affecting injury risk.

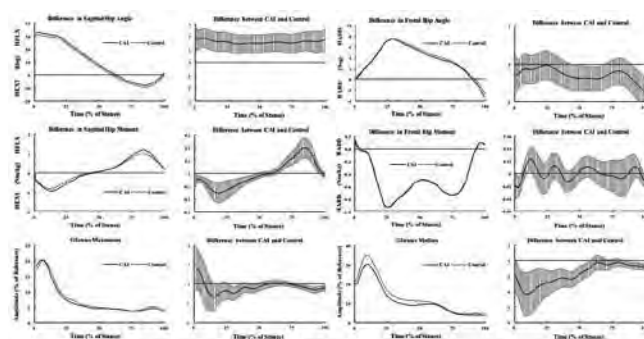


Figure 1. Hip flexion/extension (HFLX/EXT) and hip adduction/abduction (HAD/HAB) angle, HFLX/EXT and HAD/HAB moment, and hip joint EMG amplitudes for gluteus maximus and gluteus medius during stance phase of walking trials. Mean differences (solid black curve) and corresponding 95% CI (shaded area) are plotted as a function of time. When the shaded area does not overlap with the zero line (red horizontal line), a significant difference ($p < 0.05$) is indicated between groups.

2614 Board #134 June 2 9:30 AM - 11:00 AM

Effect Of Activity-related Pain On Gait Characteristics During 4-meter Usual-pace Walking Across The Lifespan

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Purpose: Recent literature suggests activity-related pain in older adults may play a role in gait impairment and lead to declines in mobility that pose threat to older adult independence. While research shows this to be a function of adopting slower but more variable physical movements, the underlying mechanism is unclear. The purpose of this study was to test whether activity-related pain during walking plays a role in gait impairments that may be responsible for slower, more varied walking typically experienced by older adults.

Methods: 16 young (26.7 ± 6.2 yrs), 44 middle-aged (54.5 ± 6.7 yrs), and 40 older adults (72.6 ± 6.1 yrs) were asked to walk 4-meters at a usual pace over a computerized gait analysis system. Gait characteristics were averaged over three trials. Self-reported pain was measured using the Borg CR10 pain scale immediately following four separate walking tasks of various intensity (5-8 min duration each). Average scores were then used to categorize people into either a pain ($n=57$) or no pain category ($n=43$). Among those reporting pain, the average self-reported scores across all activities ranged from 0.1 to 4.3 with a mean of 1.0 ± 1.0 . Regression models were used to estimate the difference of gait characteristics between those with and without pain during different walking scenarios.

Results: In middle-aged adults, individuals with pain had a faster gait cycle time than individuals without pain (1.2 ± 0.1 vs 1.1 ± 0.1 s, $p = 0.036$), but there was no difference between those reporting pain and those not in young ($p = 0.622$) or older adults ($p = 0.668$). Additionally, no difference was found in walking speed, step length differential, or average base of support between individuals with and without pain across all age categories ($p > 0.05$).

Conclusion: While individuals with pain did have faster gait cycle than individuals without pain in middle-aged adults, this effect was not observed among older adults. However, the similarity in walk speed between individuals with and without pain in older adults may suggest the use of strategies to compensate for the walking-related pain and maintain gait characteristics. Future work is needed to investigate mid-age differences in gait cycle due to pain and possible gait-maintenance strategies as aging with pain occurs.

2615 Board #135 June 2 9:30 AM - 11:00 AM
Altered Gait Characteristics In Individuals With Medial Knee Osteoarthritis
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Knee osteoarthritis (KOA) is one of the most predominant causes of pain, functional decline and disability in elderly. In China the prevalence of radiographic KOA was 42.8% in women and 21.5% in men. Medial KOA has been shown to affect a multitude of biomechanical and gait parameters.

PURPOSE:

The objective of study were to investigate the multi-joint of lower extremity motor coordination during walking in individuals with KOA, and then supplies biomechanics theoretical basis for the prevention and rehabilitation of KOA.

METHODS:

Motion analysis system and force platforms were used to measure biomechanical data of medial KOA individuals and age-matched controls during walking. Each participant walked at a self-selected, comfortable pace on a 10-m walkway. All biomechanical variables characterizing sagittal-plane joint function were compared between two groups using Independent-Samples T test. The level of significance was set at $\alpha=0.05$.

RESULTS:

Significant reductions were observed for medial KOA group compared to control group in terms of the left, right step length ($0.62\pm 0.05\text{m}$ vs. $0.70\pm 0.02\text{m}$, $P<0.05$; $0.61\pm 0.05\text{m}$ vs. $0.68\pm 0.05\text{m}$, $P<0.05$) and gait speed ($1.28\pm 0.12\text{m/s}$ vs. $1.39\pm 0.13\text{m/s}$, $P<0.05$).

Significant differences were obtained in the peak flexor ($0.77\pm 0.13\text{Nm/kg}$ vs. $1.00\pm 0.23\text{ Nm/kg}$, $P<0.05$) and extensor muscle torque ($-0.58\pm 0.16\text{Nm/kg}$ vs. $-0.88\pm 0.20\text{ Nm/kg}$, $P<0.05$) of left hip between medial KOA and controls; Ankle joint angle at the heel-strike portion in medial KOA individuals were greater than controls ($-5.11\pm 5.22^\circ$ vs. $-1.03\pm 3.75^\circ$, $P<0.05$). Besides, peak dorsiflexor moment ($0.19\pm 0.05\text{Nm/kg}$ vs. $0.29\pm 0.07\text{ Nm/kg}$, $P<0.05$) were different between two groups. During the heel-strike portion, midstance portion and terminal portion of stance phase, Significant differences were obtained in the peak angle of left knee between two groups ($-6.9^\circ \pm 1.9^\circ$ vs. $-2.2^\circ \pm 1.6^\circ$, $P<0.05$; $-16.6^\circ \pm 2.5^\circ$ vs. $-18.0^\circ \pm 2.6^\circ$, $P<0.05$; $-9.2^\circ \pm 2.3^\circ$ vs. $-5.5^\circ \pm 1.9^\circ$, $P<0.05$). Besides, knee extensor muscle torque of heel-strike in KOA group are less than that in control group.

CONCLUSION:

The biomechanical changes of knee induced by disease will alter the angle, muscle torque of adjacent joints. So in future rehabilitation and prevention of medial KOA, we should not only do focus on knee joint alone, but also other joints motion.

2616 Board #136 June 2 9:30 AM - 11:00 AM
Obesity Is Associated with Altered Plantar Pressure Distribution in Elderly Women
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Increased plantar pressure has been found to be related with higher incidence of foot pain, reduced physical activity and a greater risk of falling. Although there is evidence suggesting that obesity is linked to foot disorders, the association between obesity and plantar pressure of older adults has been poorly investigated. **PURPOSE:** To examine the association between obesity and plantar pressure distribution and to evaluate its relationship with body fat distribution in older women. **METHODS:** 211 volunteers (67.99 \pm 6.25 years; 27.86 \pm 4.4 kg/m²) took part in this cross-sectional study. Anthropometric measures were taken for body mass index calculation. The cut-off values for overweight and obesity were 25 kg/m² and 30 kg/m², respectively. Whole body, android and gynoid fat percentage was assessed using dual-energy X-ray absorptiometry. Peak plantar pressure at six anatomical regions (hindfoot, midfoot, forefoot, hallux, lesser toes and whole foot) was evaluated during gait using an Emed AT-4 pressure platform. Kruskal-Wallis test was conducted to compare peak pressure between obese, overweight and normal weight volunteers. Spearman's correlation was used to examine its relationship with body fat distribution. Significance level was set at $p<0.05$. **RESULTS:** Obese volunteers generated increased peak pressure at midfoot (187.26 \pm 54.24 kPa) compared to both normal weight (128.52 \pm 39.47 kPa, $p<0.001$) and overweight (165.74 \pm 58.42 kPa, $p=0.001$). Peak plantar pressure was also increased in overweight compared to normal weight ($p<0.001$). At forefoot, peak pressure was higher in the obese (498.15 \pm 177.08 kPa) compared to normal weight volunteers (420.41 \pm 138.14 kPa, $p=0.007$). Whole body, android and gynoid fat percentage were significantly associated with peak pressure at midfoot ($p=0.411$, $p<0.001$; $p=0.536$, $p<0.001$; and $p=0.358$, $p<0.001$, respectively) and forefoot ($p=0.220$, $p=0.001$; $p=0.167$, $p=0.015$; and $p=0.188$, $p=0.006$, respectively). **CONCLUSIONS:**

Overweight and obesity are associated with increased peak pressure in older women, regardless of body fat distribution patterns. Therefore, clinicians dealing with foot problems should consider the effect of increased bodyweight on plantar pressure.

2617 Board #137 June 2 9:30 AM - 11:00 AM
The Kinematic Effects Of KT Flex And Knee Sleeves On The Hip And Knee
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Reported Relationships: B. Burton: Contracted Research - Including Principle Investigator; Study Funded by KT Tape, PI - J. Brent Feland.

Knee sleeves and similar products are often used by runners and walkers to ameliorate knee pain and provide support during exercise. A new product, KT Flex (a kinesio style tape with an integrated stabilizing plastic stay) is purported to add more support than KT tape strips or knee sleeve with stabilizer springs. Limited studies exist on Knee kinematics using sleeves and/or tape.

Purpose: To determine the effect of the prototype KT Flex product, knee sleeve with stabilizing springs and two other KT Tape conditions on lower extremity hip and knee kinematics and ground contact time during running and walking.

Methods: 23 Healthy College aged individuals (18 men, 5 women) (age 23.42 \pm 2.66, 177.04 cm \pm 7.72, 68.73 kg \pm 12.95) served as their own control and completed all 5 conditions in random order. All subjects walked (3 mph) and jogged (7 mph) on an instrumented treadmill for 30 seconds under 5 separate conditions: 1) Normal (no intervention), 2) KT Flex on lateral knee, 3) KT Flex on lateral and KT Tape on medial knee, 4) KT Tape on medial and lateral knee, and 4) Knee sleeve with medial and lateral support springs. 18 reflective markers were used with 12 Vicon motion analysis cameras. Peak knee flexion during both stance and swing, peak hip flexion during swing, and peak knee and hip rotation were measured. Motion capture data was processed using Visual 3D. The results were evaluated using a General linear model ANOVA with pairwise comparisons for both walking and jogging conditions.

Results: The only significant difference was found in Peak knee flexion angle during stance phase of walking between the knee sleeve and KT Flex with Medial KT Tape ($p=.034$). The knee sleeve kept the knee in 3° more flexion. No other significant ($p>0.05$) differences were found between any of the measured variables within walking or jogging conditions.

Conclusion: The KT Flex prototype product and generic knee sleeve with spring support do not alter gait kinematics during running and the effect on measured variables were similar. The knee sleeve caused more flexion in stance during walking. Both types of equipment can be used without interfering with normal running mechanics. These findings are significant to serious runners considering using knee support products which have been reported in the literature to help reduce various pain related syndromes.

2618 Board #138 June 2 9:30 AM - 11:00 AM
Functional Patterns of Knee Neuromechanics during Stance in Subjects with Chronic Ankle Instability
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 (No relationships reported)

Patients with chronic ankle instability (CAI) have been shown to display altered gait mechanics. While many studies have focused on the ankle joint, knee-gait mechanics are not well documented. **PURPOSE:** To examine knee biomechanics and muscle activation patterns during walking in those with and without CAI. **METHODS:** 100 CAI patients (M=49, F=51; 22 \pm 2 yrs, 174 \pm 10 cm, 71 \pm 14 kg, 82 \pm 9% FAAM ADL, 62 \pm 13% FAAM Sports, 4.5 \pm 2.6 ankle sprains) and 100 controls (M=56, F=44; 22 \pm 3 yrs, 172 \pm 13 cm, 72 \pm 18 kg, 100% FAAM ADL & Sports, no previous sprains) performed five walking trials, while knee joint angles, moments, and EMG activation were measured. Functional analyses were used to compare variables between groups across the stance phase of gait ($\alpha=.05$). If functions and associated 95% confidence intervals did not cross zero, group differences existed. **RESULTS:** Figure 1. Compared to controls, CAI patients increased valgus angle during initial loading and reduced valgus angle during pre-swing. The valgus moment decreased during loading response and terminal stance. The CAI group reduced knee flexion angle during mid-stance, likely a result of a reduced knee extension moment tied to decreased vastus lateralis activation. Medial hamstring activation was decreased during initial loading and mid-stance. **CONCLUSIONS:** CAI patients demonstrated altered knee neuromechanic patterns in a way that reduced knee flexion; likely a result of less knee extension moment and vastus lateralis and medial hamstring activation. Changes in knee joint mechanics may increase injury risk during functional movement. More data are needed to link these findings to injury risk.

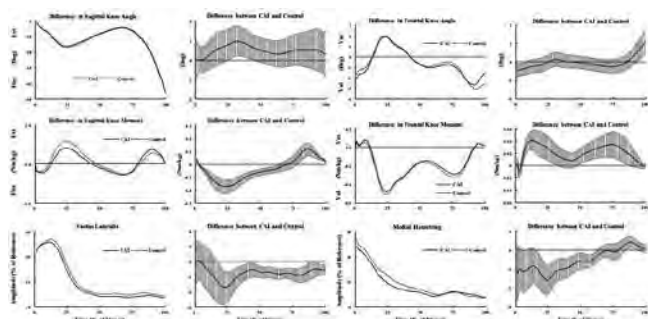


Figure 1. Knee flexion/extension (Flex/Ext) and knee varus/valgus (Var/Val) angle, Flex/Ext and Var/Val moment, and EMG amplitude for vastus lateralis and medial hamstring during stance phase of walking tasks. Mean differences (bold solid curve) and corresponding 95% CI (shaded area) are plotted as a function of time. When the shaded area does not overlap with the zero line (red horizontal line), a significant difference ($p < 0.05$) is indicated between groups.

2619 Board #139 June 2 9:30 AM - 11:00 AM
Comparison Of Absolute Gait Parameters Between Breast Cancer Survivors And Healthy Controls During Forward And Backward Walking

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Older breast cancer survivors (BCS) report more falls and less stability than older adults with no cancer history. Spatio-temporal gait parameters are often used as indicators of fall risk in older adults. **PURPOSE:** To assess the differences in forward, backwards, and accelerated forward walking in BCS in comparison to a control group. **METHODS:** 13 postmenopausal BCS (mean age: 58.5±8.5 years) and 8 control (mean age: 60.8±6.1 years) participated. Four BCS had surgery, chemo and radiation done. Gait was measured on the 16x4' Zeno walkway. Participants completed 5 trials each of forward, backward, and accelerated forward walking conditions. Participants had a lead and follow-up distance of 1m to capture steady-state gait. Gait speed, step length, step time, and stride width were used as dependent variables. A mean of five trials was used to run a Group X Condition ANOVA. **RESULTS:** Significant group main effect indicated that BCS (59.63±1.38cm) had significantly shorter step length compared to healthy controls (64.42±1.76 cm) across all conditions ($P=0.045$). Significant condition main effect was observed for all the variables (all post hoc tests $P < 0.001$). All participants walked significantly slower during backwards condition (0.91±0.03m/s), followed by forward (1.24±0.03m/s) and accelerated forward (1.76±0.06m/s) conditions. All participants walked with significantly shorter step length during backwards condition (48.43±1.47cm), followed by forward (64.38±1.01cm) and accelerated forward (73.26±1.29cm) conditions. All participants took significantly step time during accelerated forward condition (0.42±0.01s) compared to forward (0.52±0.01s) and backward (0.54±0.02s) conditions. All participants walked with significantly wider stride during backwards condition (16.07±0.77cm) compared to forward (7.65±0.47cm) and accelerated forward (7.31±0.50cm) conditions. No significant interaction was observed. **CONCLUSION:** Shorter step length irrespective of forward or backwards walking could indicate a more conservative gait approach among BCS. Overall, spatio-temporal gait parameters among BCS seem to be similar compared to healthy controls. Whether these results hold true based on exposure to surgery and/or radiation and/or chemo therapy needs to be determined.

2620 Board #140 June 2 9:30 AM - 11:00 AM
Concussion Recovery: Gait Characteristics In Collegiate Student-athletes

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BACKGROUND: Sports-related concussions have recently become one of the highest profile injuries in the athletic community. Concussions result from significant force to the brain that induces pathophysiological processes that affect its function. These effects can often present themselves through different combinations of physical, cognitive, emotional, and sleep symptoms. While neurocognitive computerized evaluations can provide useful information regarding self-report symptoms as well as quantitative measures of neurocognitive performance, they may not be sensitive to alterations in balance and gait which may last longer. **PURPOSE:** To assess gait characteristics in concussed NCAA Division 1 collegiate student-athletes at various time periods following a concussion. **METHODS:** 47 participants completed an

assessment of gait at baseline ($n=24$), while symptomatic ($n=13$) and/or when cleared to return-to-play ($n=10$). The gait protocol (10m walk under single and dual task conditions) was assessed through the use of the Mobility Lab software using ADPM sensor system. Gait measures included cadence, gait speed, step length, step duration and double stance time. **RESULTS:** A 2 (cognitive load) x 3 (phase assessment) MANOVA was conducted. There was a significant overall cognitive load main effect ($p < 0.05$), assessment phase main effect ($p < 0.05$) and a cognitive load x assessment phase interaction ($p < 0.05$). Univariate analysis showed there were significant differences for all variables when a cognitive load was added ($p < 0.05$). There were no significant differences found for gait speed ($p > 0.05$), but significant differences were found between assessment phase groups for double support ($p < 0.05$), step duration ($p < 0.05$) and cadence ($p < 0.05$). **CONCLUSIONS:** Time point in recovery and cognitive load affects gait patterns and will overall speed may not show differences in recover, underlying mechanisms of control still remain affected even when student-athletes are returned to play. This has implications for concussion recovery and susceptibility to injuries if not fully recovered.

2621 Board #141 June 2 9:30 AM - 11:00 AM
Shorter Distance In 6-minute Walk Test In People With Multiple Sclerosis Demonstrating Leg Strength Asymmetries

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One of the early signs of Multiple Sclerosis (MS) is weakness on one side of the body, which is experienced by more than 75% of people with MS (PwMS). In addition, up to 92% of PwMS are affected by fatigue. Our previous findings indicate that leg strength asymmetries are associated with imbalanced muscle activity during walking. **Purpose:** To determine the association between leg strength asymmetries and walking characteristics, as indicated by total distance covered and step count, during a 6-minute walk test in PwMS. **Methods:** PwMS (aged 46-52 yrs) with self-reported asymmetries (2-5 on a 1-5 scale) and moderate disability (PDDS score 2-6) completed a series of maximal voluntary contractions of the knee extensors on each leg. Subsequently, participants walked as quickly, and safely as possible during a 6-minute walk test in a hallway with 2 cones placed 29 m apart. iPods with built-in accelerometers were strapped on both ankles to detect steps. In addition, ratings of perceived exertion (RPE) and distance covered were recorded every minute. Stride length was then calculated by dividing total distance by step count. **Results:** The distance covered by the PwMS was 391 ± 110 m with 572 ± 86 steps. The average increase in stride length from minute 1 to minute 6 was 8 ± 4 %. The average difference in leg strength was 27 ± 12 %. The subject with the greatest leg strength asymmetry (37%) demonstrated the shortest distance during the 6-minute walk test (307 m) and the greatest change in stride length (12%). Furthermore, RPE and distance covered each minute remained constant during the 6 minutes. **Conclusion:** These preliminary data indicate that leg strength asymmetries may result in altered walking strategies during a 6-minute walking test in PwMS. While previous studies have used the 6-minute walking test as a measurement of fatigue, in this sample, fatigability, defined as a decline in performance over time, appears to rather manifest itself as changes in walking characteristics.

2622 Board #142 June 2 9:30 AM - 11:00 AM
Changes In Healthy Old Adults' Gait Biomechanics Following Short-term Lower Extremity Power Training

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PURPOSE: Age-related slowing of walking speed predicts many clinical conditions later in life. A variety of exercise programs can increase old adults' habitual and fast gait speed. However, the biomechanical mechanism of how old adults make use of the newly acquired physical abilities during gait is still unknown. Here, we examined the kinematic and kinetic mechanisms of how lower extremity power training increases healthy old adults' gait speed. **METHODS:** 12 males and 10 females (age 70-81 y) were randomly assigned to a control ($n = 7$) and training group ($n = 15$). The training intervention consisted of 16 sessions, administered over 8 weeks to improve lower extremity muscle power by

having participants explosively leg press progressively increasing loads of 30-40% of 1-repetition maximum (1RM). We measured participants' leg muscle strength in five muscle groups and gait biomechanics before and after the training intervention. **RESULTS:** Training increased maximal leg press load by ~40% ($P < 0.05$) and maximal voluntary force in five groups of leg muscles by ~32% ($P < 0.05$) but not in the no-exercise control group. Training (12.3%) vs. control (7.4%) tended to increase habitual and fast gait speed (21.1 vs. 8.9%) more (all $P < 0.05$). In the training group only, these increases in gait speed correlated with increases in stride length (habitual: $r^2 = 0.84$, fast: $r^2 = 0.89$). Training made old adults' gait more erect, as hip and knee extension increased in the stance phase of gait. Training increased ankle joint power by 3.3 J (control: -0.4 J, Group by Time interaction: $P < 0.05$), which correlated $r^2 = 0.58$ and $r^2 = 0.67$ with increases in habitual and fast gait speed without changes in hip and knee joint powers. **CONCLUSION:** After the intervention, old adults walked with a more erect gait due to increases in hip and knee extension in the stance phase of gait. The small but significant increase in ankle joint but not in hip and knee joint power correlated with increases in gait speed. The present results provide the first mechanistic insights into how short-term lower extremity power training improves healthy old adults' gait biomechanics. Supported by JSPS KAKENHI Grant Number 16K21320.

2623 Board #143 June 2 9:30 AM - 11:00 AM
High Intensity Cycling Improves Spatiotemporal and Kinematic Gait Parameters in Parkinson's disease Patients
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 (No relationships reported)

Purpose: Gait dysfunction is a cardinal symptom of Parkinson's disease (PD). Alterations in gait are more pronounced during dual-task conditions where a cognitive and motor task are performed simultaneously. We have demonstrated that high-intensity aerobic exercise programs improve gait function under single-task (ST) conditions, however its impact on gait function while dual-tasking (DT) is unknown. A fundamental gap exists in understanding how high intensity exercise may impact DT performance. The aim of this project was to determine the changes in gait performance under ST and DT conditions following an 8-week cycling program. **Methods:** Eleven individuals with idiopathic PD were recruited to participate in an 8-wk stationary cycling intervention. Participant's gait was analyzed before and after the intervention using the Computer Assisted Rehabilitation Environment (CAREN) virtual reality system to assess upper and lower extremity kinematics. Participants walked on a treadmill at a self-selected speed while performing three cognitive tasks: N-back, Serial 7's and Verbal fluency. **Results:** MDS-UPDRS scores significantly improved from pre to post testing (-4.72 ± 5.54). Participants demonstrated significant increases in velocity (0.169 ± 0.61 m/s) ($p=0.01$), arm swing path length, hip joint range of motion (ROM), and knee joint ROM during both ST and DT conditions after the cycling intervention when compared to baseline. The ST condition was significantly greater than DT conditions for all parameters. Change in path length during ST conditions from pre to post testing (0.086 ± 0.135 m) was significantly greater than the N-Back (0.020 ± 0.136 m), Serial 7's (0.018 ± 0.130 m), and Verbal fluency (-0.002 ± 0.119 m) ($p=0.005$). Hip and knee ROM for single task were also found to be significantly greater ($p < 0.05$) when compared to DT. **Conclusions:** High-intensity cycling can improve gait dysfunction in PD. Changes occurred in both ST and DT conditions, with greater improvements seen under ST conditions. The increases found after the 8-wk cycling intervention suggest that high-intensity exercise elicits centrally mediated changes in the brain, allowing participants to allocate fewer cognitive resources to gait performance. This study was supported by a grant through the National Institute of Health R01NS673717.

2624 Board #144 June 2 9:30 AM - 11:00 AM
The Effect of a Backpack Hip Strap on Energy Expenditure While Walking.
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Previous studies have demonstrated that the energy cost of carrying a backpack increases as the mass of the load carried increases. Conflicting results have been found when research examined the effect of duration on energy expenditure while carrying a backpack. A potential confounding variable could be the design of the backpack, particularly the use of a backpack hip strap. **PURPOSE:** To examine the effect of backpack hip strap use on walking energy expenditure while carrying a loaded backpack.

METHODS: A crossover design was used in which fifteen young, healthy male subjects walked at a self-selected pace for two 10-minutes in two backpack loading conditions: with a hip strap (strapped) and without a hip strap (non-strapped). Oxygen consumption (VO_2), rating of perceived exertion (RPE), respiratory exchange ratio (RER), and heart rate (HR) were monitored throughout each 10-minute trial. Change scores from the 4th to 10th minute were calculated for each variable. A t-test was used to evaluate the difference between conditions for each variable. **RESULTS:** The change in VO_2 (-0.62 ± 0.40 vs. 0.33 ± 0.23 , $p = 0.04$) and change in RPE (1 ± 0.25 vs. 2 ± 0.21 , $p < 0.01$) from the 4th to the 10th minute were different for the strapped versus non-strapped condition, respectively. There was no difference in the change in RER (0.04 ± 0.01 vs. 0.03 ± 0.01 , $p > 0.05$) or HR (3.53 ± 0.93 vs. 4.07 ± 1.39 , $p > 0.05$) for the strapped versus unstrapped condition, respectively. **CONCLUSIONS:** Wearing a hip strap reduced the energy expenditure and perceived exertion in as little as 10 minutes of walking compared the non-strapped condition. Future work should consider the effect of a hip strap on these variables while hiking for extended periods.

2625 Board #145 June 2 9:30 AM - 11:00 AM
Altered Lower Extremity Joint Energetic Patterns in Patients with Chronic Ankle Instability during Walking
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A lateral ankle sprain is among the most common sports-related injuries often leading to chronic ankle instability (CAI). Identification of energetic patterns in patients with CAI may clarify underlying injury pathomechanics of CAI. **PURPOSE:** To examine the effect of CAI on energetic patterns of the lower extremity joints during walking. **METHODS:** 100 CAI patients (M=49, F=51; 22 ± 2 yrs, 174 ± 10 cm, 71 ± 14 kg, $82 \pm 9\%$ FAAM ADL, $62 \pm 13\%$ FAAM Sports, 4.5 ± 2.6 ankle sprains) and 100 controls (M=56, F=44; 22 ± 3 yrs, 172 ± 13 cm, 72 ± 18 kg, 100% FAAM ADL & Sports, no previous sprains) performed five walking trials, while ankle, knee and hip joint powers (W/kg) were measured during the stance phase of walking tasks. Functional analyses ($\alpha = .05$) were used to evaluate difference in joint power between groups. If functions and associated 95% confidence intervals did not cross zero, group differences existed. **RESULTS:** Figure 1. CAI subjects had less ankle eccentric power and concentric power during early to mid and late stance phase respectively. CAI demonstrated decreased eccentric knee joint power during the initial phase and increased eccentric knee joint power during pre-swing phase. Both concentric and eccentric hip joint power were increased throughout the entire stance phase in patients with CAI. **CONCLUSIONS:** The CAI group increased proximal joint energy absorption and generation to compensate for decreased distal joint power during walking compared to a control group. More data are needed to determine if joint power redistribution in CAI patients is a risk factor for further ankle injury.

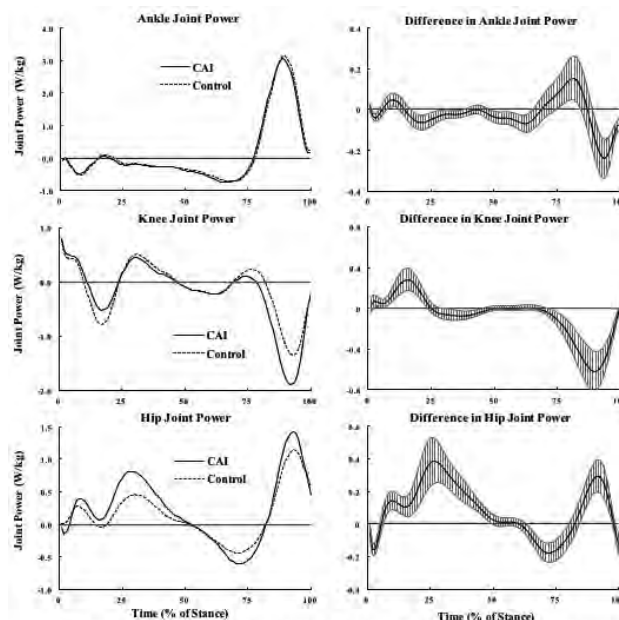


Figure 1. Ankle, knee and hip joint power during stance phase of walking tasks between groups (CAI vs. Control). Mean differences (bold solid curve) and corresponding 95% CI (shaded area) are plotted as a function of time. When the shaded area does not overlap with the zero line (bold horizontal red line), a significant difference ($p < 0.05$) is indicated between groups.

2626 Board #146 June 2 9:30 AM - 11:00 AM
Effects of Strength and Proprioceptive Exercises on Walking Energetic Patterns in Chronic Ankle Instability Patients

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Chronic ankle instability (CAI) patients often exhibit altered walking mechanics, due to strength and proprioceptive deficits associated with CAI. Reduced strength and proprioception function may decline a gait energetic efficiency, which can reduce shock absorption and power generation. It is unclear whether strength and proprioceptive training can affect walking energetics for CAI patients. **PURPOSE:** To examine the effect of a 6-week ankle and hip rehabilitation program on ankle, knee, and hip joint energetic patterns during walking in CAI patients. **METHODS:** 15 CAI patients (23±2 yrs, 178±8 cm, 76±9 kg, 83±7% FAAM ADL, 56±10% FAAM Sports, 3.6±1.1 MAII, 4.7±2.0 ankle sprains) performed ankle and hip strength and proprioceptive exercises (i.e., theraband, wobble board, etc.) 3 times per week, for 6 weeks (this was the rehab group). 14 CAI patients (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 3.4±1.2 MAII, 5.9±3.3 sprains) performed no rehabilitative exercises (this was the control group). We measured ankle, knee, and hip joint power during walking for all patients before and after the exercises. Functional statistics ($\alpha=.05$) were used to evaluate the influence of the rehab exercises on joint power for both groups across the entire stance phase of walking. **RESULTS:** Figure 1. The rehab intervention resulted in up to 0.07 W/kg more positive ankle power (concentric) between 19 and 26% of stance and up to 0.06 W/kg more positive knee power (concentric) between 40 and 48% of stance. No changes were detected in hip joint power during the stance phase of walking. **CONCLUSION:** Data suggest that the strength and proprioceptive training results in an improved gait energetic efficiency through the increased ankle and knee power generation during mid-stance. As greater muscular strength can lead to an increase in power absorption and generation, the intervention focusing on strength should be beneficial in improving walking energetics in a CAI population.

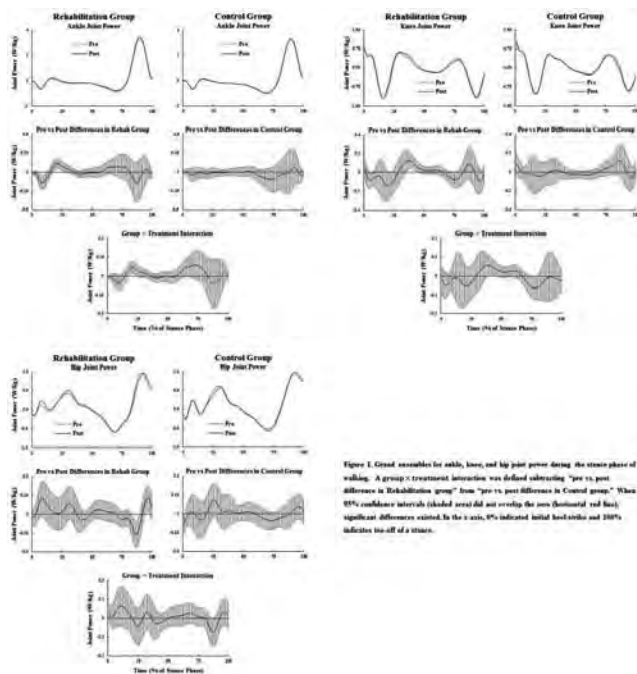


Figure 1. Grand averages for ankle, knee, and hip joint power during the stance phase of walking. A group x treatment interaction was defined subtracting "pre vs post" differences in Rehabilitation group from "pre vs post" differences in Control group. When 95% confidence intervals (shaded area) did not overlap the zero (horizontal red line), significant differences existed. In the x-axis, 0% indicated initial heelstrike and 100% indicates toe-off of a stance.

2627 Board #147 June 2 9:30 AM - 11:00 AM
Performing The Six-minute Walk Test Is Linked To Increased Risk Of Falling For Persons With Ms

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A major health concern for individuals with MS is the likelihood of suffering a fall. The cause of any fall is often multifaceted, given the numerous physiological changes linked to this disease process. For this population, tiredness and fatigue are prominent factors linked to increased falls risk, given that these metrics have been linked to a decline in balance, walking ability, sensation and general muscle function. **PURPOSE:** To assess the effect of performing a standardized endurance task (the six-minute walk test, 6MWT) on gait, balance, strength and falls risk in older adults with MS. **METHODS:** Twenty-three persons with MS (mean 55.1±9.1 yr) participated in this study whereby their walking ability, balance and falls risk was assessed prior to and after performing the 6MWT. Each person's falls risk was assessed using the Timed Up and Go (TUG) test and the Physiological Profile Assessment (PPA). The PPA incorporates physiological measures related to falls including vision, sensation, posture, reaction time and muscle strength. Walking ability was assessed using a 20 ft GAITRite mat. **RESULTS:** At baseline, the MS persons had an increased falls risk reflected by higher PPA values (2.4±0.4), slow TUG times (13.9±0.4 s) compared to age-matched normative adults. Following the 6MWT, the MS group exhibited no significant changes in gait performance from baseline (velocity 1.07 to 1.04 ms, p=0.284; Cadence 15 to 17 steps/min, p=0.645). In contrast, significant declines in knee extension strength (from 27.3 to 23.2 kg, p<0.05) and increases in postural sway (from 8.3+3 to 11.5+3 cm, p<0.05) and falls risk (2.8+0.3, p<0.05) were for the MS group. **CONCLUSION:** Compromised balance control leading to the increased likelihood of suffering a fall is a major problem for persons with MS. For the current study, we assessed the impact of performing the standardized clinical assessment of endurance on gait, balance and overall falls risk. Interestingly, the immediate effects of the 6MWT were not reflected by any notable change in gait performance. However, declines in balance control, knee extension strength, and increased falls risk were seen following the 6MWT. Overall, it would appear that while mobility (i.e. gait) of the person with MS was not affected by this endurance task, general stability and balance were compromised.

2628 Board #148 June 2 9:30 AM - 11:00 AM
Individuals with Chronic Ankle Instability Exhibit Altered Ground Reaction Force Patterns during Walking

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 (No relationships reported)

Lateral ankle sprains frequently occur and often lead to chronic ankle instability (CAI). CAI has been shown to alter neuromuscular function and walking mechanics which impact ground reaction force (GRF). **PURPOSE:** To examine patterns of ground reaction forces across the stance phase of gait in those with and without CAI. **METHODS:** 100 CAI patients (M=49, F=51; 22±2 yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.5±2.6 ankle sprains) and 100 controls (M=56, F=44; 22±3 yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports, no previous sprains) performed five walking trials. Three dimensional GRFs (anterior-posterior, medial-lateral, and vertical) were measured during the stance phase of gait (0-25%: initial stance, 25-50%: loading response, 50-75%: midstance, and 75-100%: terminal stance). Functional linear models were used to compare difference in GRFs between the groups during walking ($\alpha=.05$). If functions and associated 95% confidence intervals did not cross zero, group differences existed. **RESULTS:** Figure 1. CAI subjects demonstrated greater vertical GRF during 0-10% and 67-95% of stance. Patients with CAI also increased posterior and anterior GRFs during 10-20% and 70-95% of stance respectively. Lateral GRF was greater in CAI subjects during 65-75% of stance compared to controls. **CONCLUSION:** CAI subjects may compensate for ankle instability with a more rigid walking strategy by increasing anterior-posterior, lateral and vertical GRFs during the stance phase of gait. The greater GRF of the CAI group indicates altered gait mechanics which could increase loads on lower extremity joints and potentially increase re-injury risk.

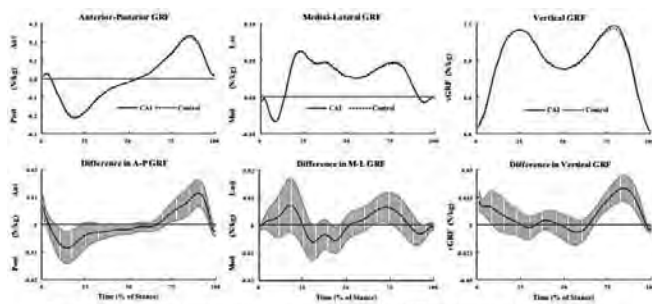


Figure 1. Anterior (+) / posterior (-), lateral (+) / medial (-), and vertical ground reaction force (GRF) during stance phase of walking tasks. Mean differences (bold solid curve) and corresponding 95% CI (shaded areas) are plotted as a function of time. When the shaded area does not overlap with the zero line (bold horizontal red line), a significant difference ($p < 0.02$) is indicated between groups.

E-32 Free Communication/Poster - Methodology

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2629 Board #149 June 2 11:00 AM - 12:30 PM
Does the Polar FT60 Fitness Test™ Accurately Predict Maximal Oxygen Consumption in Healthy Subjects?

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Accurately predicting maximal oxygen consumption ($\dot{V}O_{2max}$) in healthy individuals as part of a fitness assessment is a common practice in some fitness and wellness centers where maximal testing is not practical. One system used to predict $\dot{V}O_{2max}$ is the Polar FT60 Fitness Test™ which predicts maximal oxygen consumption based on an individual's resting heart rate and prior three month activity level. While these systems are somewhat popular, the question remains concerning their validity and accuracy in predicting $\dot{V}O_{2max}$ in healthy subjects. **PURPOSE:** To determine the validity of the Polar FT60 Fitness Test™ in accurately predicting $\dot{V}O_{2max}$ in healthy individuals. **METHODOLOGY:** Thirty-one subjects volunteered for the study (males=13; females=18; age=27.61±5.46yrs; WT=71.50±15.00kg; HT=169.32±14.00cm; BMI=24.09±3.84kg/m²; BF%=20.58±10.00). Volunteers reported to the lab where their predicted maximal oxygen consumption was assessed using the Polar FT60 Fitness Test™ following manufacturer's recommendation. Maximal oxygen consumption was then determined using a standard maximal treadmill protocol where $\dot{V}O_{2max}$ was assessed with a calibrated Parvo Medics' TrueOne® 2400 metabolic system. **RESULTS:** Results indicate that the Polar FT60 Fitness Test™ significantly overestimates maximal oxygen consumption by ~9.75% (predicted $\dot{V}O_{2max}$ =49.77±10.74ml/kg/min; actual $\dot{V}O_{2max}$ =44.92±8.12ml/kg/min; $p < 0.001$; 95% CI=2.188, 7.515). **CONCLUSION:** These results indicate that the Polar FT60 Fitness Test™ significantly overestimates maximal oxygen consumption in this population of healthy subjects.

2630 Board #150 June 2 11:00 AM - 12:30 PM
Accuracy And Practicality Of A NIRS Device On Blood Lactate Levels

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(No relationships reported)

Historically, cyclists have relied upon blood lactate analysis and/or metabolic testing to determine their fitness level and training zones. However, these methods are now being challenged by Near Infrared Spectroscopy (NIRS). The BSX Insight is a wearable NIRS device that claims to predict lactate threshold by analyzing changes in muscle oxygenation. **PURPOSE:** The purpose of this study was to compare the accuracy of the BSX Insight against blood lactate and ventilatory threshold analyses. **METHODS:** Nine highly trained cyclists (18-55 years of age) performed a graded exercise test while wearing the Insight and data was simultaneously collected via the TrueOne 2400 metabolic cart and Lactate Plus analyzer. Lactate threshold heart rate (HR) and power as predicted by the Insight was compared with blood lactate threshold (LT) as determined by the Dmax method and with the ventilatory threshold (VT) as determined by the respiratory exchange ratio (RER) method, V-slope method, and ventilatory equivalency (VEQ) method. **RESULTS:** Average LT power output as determined by the BSX Insight was not significantly different when compared to Dmax, RER, VEQ, and Vslope ($P = 0.811$). Average LT power output from the Insight showed a positive correlation with Dmax ($r = 0.869$), RER ($r = 0.964$), VEQ ($r = 0.970$), and Vslope ($r =$

0.949). Average LT HR as determined via the BSX Insight device was not statistically different when compared to Dmax, RER, VEQ, and Vslope ($P = 0.386$). The average percent difference of LT HR from the Insight compared with all other methods was within 5% (Dmax = 2.29%, RER = -2.56%, VEQ = -2.74%, Vslope = 0.545). **CONCLUSIONS:** The wearable BSX Insight device is good at predicting LT HR and power output during a cycling test and muscle oxygenation can be used to estimate LT. The BSX Insight device may be an extremely helpful tool for those cyclists who do not have the ability or access to utilize more expensive testing protocols.

2631 Board #151 June 2 11:00 AM - 12:30 PM
Reliability Of An On-court Basketball-specific Protocol

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Reported Relationships: K.A. Barnes: Salary; PepsiCo, Inc. Ownership Interest (Stocks, Bonds); PepsiCo, Inc.

There is limited information available on sport-specific performance protocols in basketball, particularly where reliability has been assessed. **Purpose:** To determine the reliability of a set of drills designed to assess a wide variety of skills related to basketball-specific performance. **Methods:** Seventeen (8 guards, 9 posts) competitive, male basketball players (17±1 y, 72.6±11.9 kg) completed a familiarization visit followed by two identical experimental trials. Subjects ate a consistent diet 24 h before each trial and consumed 500 ml water and a granola bar 3 h before each trial. The protocol began with a 10-min warm up, followed by four ~20-min quarters consisting of 13 basketball drills; involving sprinting, vertical jumping (VJ), shooting, dribbling, passing, pre-planned agility, reactive agility, and a basketball-specific cognitive task (recall of a mock scouting report and game plan). Heart rate (HR) was measured continuously. Subjects received the same volume of a carbohydrate-free, electrolyte beverage to maintain euhydration during both trials. Paired samples t-tests and coefficient of variation (CV) were used to assess the reliability of each drill (between mean values of the two trials). **Results:** There were no differences between trials in mean HR (160 ± 11 bpm vs. 161 ± 10 bpm, $p=0.77$). There were no differences in performance between trials for any of the drills ($p > 0.05$). Between-trial CV's by drill were as follows: 15-s VJ max height (11.5%) and mean height (6.8%), pre-planned agility (3.9%), passing accuracy (9.8%), dribbling speed (3.7%), mid-range shooting accuracy (13.1%), lay up accuracy (3.3%), reactive agility (7.0%), lane slides (3.5%), 3-point shooting accuracy (14.7%), sprints (4.3%), rebounding (7.9%), free throw accuracy (15.8%), and accuracy on the cognitive task (8.8%). Shooting accuracy was more reliable in the guards vs. posts; mid-range (9.0% vs. 15.4%), 3-point (8.5% vs. 19.4%), and free throw (9.4% vs. 18.7%). **Conclusion:** The reliability of the basketball drills in 14-19 y players ranged from 3 to 16% and varied by player position. Future research is needed to determine the validity (e.g., identifying different skill levels) and sensitivity (e.g., measuring the efficacy of nutritional interventions) of this novel basketball-specific protocol.

2632 Board #152 June 2 11:00 AM - 12:30 PM
Time of Day and Leg Dominance Influence Estimated and Actual Maximal Single Leg Hop Performance

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(No relationships reported)

PURPOSE: To determine whether time of day and leg dominance influence estimated and/or actual maximal single leg hop (SLH_{max}) performance. **METHODS:** 22 healthy participants (mean age 21.7 ± 2.5 years, 16 males and 6 females) estimated their SLH_{max} performance and performed a SLH_{max} (on dominant and non-dominant legs) during a morning (6-8am) and an evening (6-8pm) experimental session. All outcome measures were analysed using separate two-way repeated measures analysis of variance (ANOVA) with Leg Dominance (DOM vs NONDOM) and Time of Day (AM vs PM) as within subject factors. **RESULTS:** There was no difference in estimated SLH_{max} between the morning and evening sessions ($p=0.58$). Participants had a mean estimated SLH_{max} distance of 137 ± 32.2 cm in the morning and 139.5 ± 33.4 cm in the evening. Actual SLH_{max} was greater in the evening session than in the morning ($p < 0.05$). Participants achieved an actual SLH_{max} distance of 166 ± 34.9 in the morning and 171.3 ± 31.8 cm in the evening. Participants did estimate a greater SLH_{max} on their dominant compared to non-dominant leg ($p < 0.01$) but there was no difference in SLH_{max} performance between legs ($p=0.55$). When using their dominant leg, participants estimated they could hop a SLH_{max} distance of 141.9 ± 32.9 cm and performed an actual hop distance of 169.3 ± 34.2 cm. When using their non-dominant leg, participants estimated they could hop a maximal SLH distance of 134.6 ± 32.3 cm and performed an actual hop distance of 168 ± 32.7cm. **CONCLUSION:** The SLH_{max} is a functional outcome measure that evaluates lower limb muscular power and is used clinically to track progress of lower limb musculoskeletal injury. Like other tests of lower limb power there are differences in SLH_{max} between time of day. However,

unlike other tests of lower limb performance, individuals were not able to accurately estimate those time of day differences in performance or the lack of differences in performance between dominant and non-dominant legs. Overall, it is interesting that for time of day and leg dominance, participants either did not perceive differences that were present or perceived differences that were not present.

2633 Board #153 June 2 11:00 AM - 12:30 PM
Resting and Post-exercise Heart Rate Detection from Fingertip and Facial Photoplethysmography Using a Smartphone Camera

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 (No relationships reported)

Modern smartphones allow measurement of heart rate (HR) via detection of pulsatile photoplethysmographic (PPG) signals from the fingertips or the face without physical contact by extracting subtle beat-to-beat variations of skin color that is similar to HR fluctuations with built-in cameras.

PURPOSE: To evaluate HR measurements at rest and after exercise using a smartphone based PPG detection application.

METHODS: Forty healthy subjects (50% males; mean age 24.7 ± 5.2 years; Von Luschan skin color range 14-27) underwent treadmill exercise using the Bruce protocol. Simultaneous PPG signals were recorded per subject by (i) facing the front camera and (ii) placing index fingertip over the back camera of iPhone 6Ss and analyzed by the *Cardio-Heart Rate Monitor + 7 Minute Workout Exercise Routine for Cardio Health and Fitness* (Cardio Inc., Cambridge, MA) smartphone application for HR compared to continuous ECG as reference. Recordings of 20 seconds duration each were acquired at rest, immediately post moderate (50-70% maximum HR) and vigorous (70-85% maximum HR) intensity exercise and repeated successively until return to resting HR. Bland-Altman plots were used to examine agreement between ECG and PPG estimated HR. HR monitors are considered accurate if the correlation coefficient (r) is ≥ 0.93 and root mean square error (RMSE) is ≤ 5 beats per minute (bpm) or $< 6.8\%$.

RESULTS: Mean HR was 73 ± 13 bpm (range 53-114) at rest and 97 ± 21 bpm (51 to 157) post exercise. 477 fingertip and 582 facial PPG measurements were recorded and analyzed. Fingertip PPG estimated HR were strongly correlated with both resting ECG HR ($r = 0.997$ and RMSE = 1.025 bpm or 1.404%) and post-exercise HR ($r = 0.995$ & RMSE = 2.074 bpm or 2.220%). Correlation of facial PPG estimated HR were stronger with resting ECG HR ($r = 0.997$ & RMSE = 1.020 bpm or 1.428%) and was also strong with post-exercise HR ($r = 0.984$ & RMSE = 3.673 bpm or 3.931%). Bland-Altman plots showed better agreement between ECG with fingertip than facial PPG estimated HR.

CONCLUSIONS: HR detection by the Cardio smartphone application is considered accurate at rest and after moderate and vigorous intensity exercise in a healthy young adult sample. Although touchless facial PPG detection is convenient, it may not be able to consistently detect a HR when body motion is excessive after exercise.

2634 Board #154 June 2 11:00 AM - 12:30 PM
Repeatability of Heart Rate Variability Across Exercise Modes

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Heart rate variability (HRV) is a common method for assessing autonomic nervous system function. Little research has explored the repeatability of HRV during exercise, particularly with differing exercise modes.

PURPOSE: To compare HRV variables during steady-state exercise at the same intensity during treadmill (TM) and Cycle (C) exercise.

METHODS: Eleven men (Age = 21.4 ± 2.2; BMI = 24.7 ± 3.1 kg/m²) completed 3 maximal graded exercise tests, 2 TM and 1 C. During each test, a 5-minute, steady-state stage was completed, with a target of 5.0 METs. Oxygen consumption (VO₂) was measured via indirect calorimetry. HRV was measured using the Polar V800 watch, and analyzed with Kubios HRV software. Time [Standard deviation of RR intervals (SDNN) and mean squared difference of successive RR intervals (RMSSD)] and frequency [high frequency power (HF), low frequency power (LF), normalized HF (HFnu), normalized LF (LFnu), and the LF/HF ratio] measures of HRV were analyzed, with non-normally distributed data Log transformed for analysis.

RESULTS: Heart rate, VO₂ and HRV measures did not differ between TM trials. Heart rate (111.4 ± 14.1 vs. 112.0 ± 15.8 bpm for TM and C, respectively) and VO₂ (19.2 ± 1.1 vs 19.1 ± 1.2 ml·kg⁻¹·min⁻¹) did not differ between TM and C trials. Minute ventilation (38.1 ± 13.9 vs 38.5 ± 13.7) also did not differ. Respiratory exchange ratio was lower during the TM trial (0.80) compared to the C trial (0.86, P < 0.01).

No significant mean differences were noted any HRV variable. Intraclass correlation coefficients were significant for SDNN (0.87), RMSSD (0.78), LF (0.83), HF (0.76), but not for HFnu (0.38), LFnu (0.38), or the LF/HF ratio (0.43). Bland-Altman analysis showed good agreement for all HRV variables (P > 0.05).

CONCLUSION: Results suggest that HRV variables measured during steady-state exercise at moderate exercise intensity were repeatable, particularly those associated with parasympathetic function. Future research is needed at higher intensities, when parasympathetic withdrawal has occurred, and sympathetic control of heart rate is the dominant factor.

2635 Board #155 June 2 11:00 AM - 12:30 PM
Maximal Heart Rate Varies Across Laboratory, Field Testing, and Competition Among Collegiate Female Hockey Athletes.

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 (No relationships reported)

In order to prescribe training intensities based on maximal heart rate (MHR), it is important to determine the potential differences in MHR using a variety of different testing conditions. Systematic differences in MHR across testing and competition conditions are poorly defined. **PURPOSE:** To determine if MHR varies between laboratory testing, field testing, practice, games and an age-prediction equation in collegiate female hockey athletes. **METHODS:** MHR was measured in 16 NCAA Division 1 female hockey athletes during a progressive, graded maximal treadmill test (MHR_{GXT}), on-one fitness testing (MHR_{FIELD}), one season of practices (MHR_{TRAIN}) and games (MHR_{MATCH}), and estimated by an age prediction equation (208-0.7 x age; MHR_{PRED}). Participants were excluded if they failed to obtain 2 out of 3 criteria during MHR_{GXT}: 1) RER ≥ 1.1 , 2) plateau in VO₂ and 3) attainment of $\geq 90\%$ of MHR_{PRED}. MHR measures were compared across different methods by Kruskal-Wallis tests and Pearson correlation coefficients were determined between the different methods. **RESULTS:** MHR_{GXT} (194.5 ± 6.0bpm) was significantly higher than MHR_{FIELD} (192.3 ± 4.9bpm, $p = 0.037$) and lower than MHR_{TRAIN} (200.1 ± 8.3bpm, $p = 0.0018$) and MHR_{MATCH} (201.1 ± 11.0bpm, $p = 0.01$), but not significantly different from MHR_{PRED} (193.8 ± 0.9bpm, $p = 0.64$). Significant correlations were found between MHR_{GXT} and MHR_{FIELD} ($r = 0.79$, $p < 0.001$) but not MHR_{TRAIN} ($r = 0.41$, $p = 0.11$) or MHR_{MATCH} ($r = 0.10$, $p = 0.70$). MHR_{PRED} was not correlated with any other methods ($r = 0.15$ to 0.22, $p > 0.05$ for all). **CONCLUSIONS:** Among elite female hockey athletes, MHR_{GXT} and MHR_{FIELD} were significantly lower than practices and games. This suggests that MHR from competition may overestimate the heart rate that is representative of maximal aerobic capacity. Use of this value as a reference to prescribe training volume could result in unintentionally higher training loads with potentially increased risk of overtraining or injury.

2636 Board #156 June 2 11:00 AM - 12:30 PM
Validation Of The Bruce Versus A New Customized Submaximal Treadmill Protocol For Determining "True" Vo2max

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 (No relationships reported)

A customized submaximal exercise test for cycle ergometry was reported as a superior estimate of maximum oxygen uptake (VO_{2max}) in comparison to the YMCA bike test.

PURPOSE: Following similar methodology, we sought to evaluate a custom submaximal treadmill test (MSET) with the widely used Bruce submaximal protocol. **METHODS:** Participants (29 women and 21 men; age = 31.37 ± 11.44 y, BMI = 24.02 ± 3.03) performed a graded exercise test (GXT) with a subsequent exhaustive, square-wave bout for the verification of "true" VO_{2max}. In counterbalanced-order, subjects then completed submaximal protocols. The MSET consisted of two 3-min stages estimated at 35% and 70% of VO_{2max}, where VO_{2max} was estimated with a linear regression equation utilizing gender, BMI, age, and self-reported physical activity. **RESULTS:** VO₂ values from the GXT and verification bout were 47.2 ± 7.7 and 47.0 ± 7.7 ml·kg⁻¹·min⁻¹, respectively (ICC = 0.99, CV = 2.0%, TE = 0.83 ml·kg⁻¹·min⁻¹), with the highest value used as "true" VO_{2max} (47.7 ± 7.7 ml·kg⁻¹·min⁻¹). Neither the Bruce (45.95 ± 6.97 ml·kg⁻¹·min⁻¹) nor the MSET (47.3 ± 9.4 ml·kg⁻¹·min⁻¹) differed from "true" VO_{2max}. The MSET had a "very large" measurement agreement with "true" VO_{2max} (ICC = 0.78, CV of 9.1%, TE = 4.07 ml·kg⁻¹·min⁻¹). Bruce had a "large" measurement agreement with "true" VO_{2max} (ICC = 0.62, CV of 10.0%, TE = 4.51 ml·kg⁻¹·min⁻¹). **CONCLUSION:** Our findings indicate that the MSET is superior to the Bruce protocol because it yields a better measurement agreement for "true" VO_{2max}, is more time efficient, and can be used to prescribe exercise.

2637 Board #157 June 2 11:00 AM - 12:30 PM
Sex Differences In The Optimal Intensity For Cycle Ergometer Verification Of VO₂max
 Brandon J. Sawyer, Janie C. Unkefer, Kaiti A. Freeberg, Stephanie D. Gagnon, Nicholas McMahon, Kai Pattison, Jennifer M. Beers, Brett B. Baughman. *Point Loma Nazarene University, San Diego, CA.* (Sponsor: Robert Pettitt, FACSM)
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PURPOSE: Using a verification phase test (VP) following a graded exercise test has been shown to be superior to secondary criteria to determine a "true" VO_{2max}. It has not been determined if a sex difference in the optimal intensity for cycle ergometry VP testing exists. **METHODS:** 31 participants (16 females, age: 21±1.5 yrs, BMI: 23.2±3.3 kg/m²; 15 males, age: 22±1.5 yrs, BMI: 24.5±2.2 kg/m²) completed a ramp VO_{2max} test, then on 4 subsequent days, in random order, completed VP tests at 80, 90, 100, and 105% of the peak wattage achieved during the initial ramp test. **RESULTS:** The VO_{2max} values for each test (Ramp, 80, 90, 100, and 105%) for women were 2.36±0.35, 2.29±0.34, 2.34±0.33, 2.35±0.31, 2.32±0.32 L/min and for men were 3.65±0.66, 3.67±0.71, 3.67±0.67, 3.56±0.51, 3.49±0.48 L/min. For males VO_{2max} at 105% was significantly lower than Ramp (P=0.02), 80% (P<0.01), and 90% (P=0.02). Also VO_{2max} at 80% (P=0.07) and 90% (P=0.08) was marginally higher than at 100%. Females showed no significant differences between VO_{2max} values for any VP or Ramp test. 10 of the 16 female subjects had their highest VO_{2max} during the 100 or 105% VP, while 12 of 15 male subjects had their highest from a VP at a submaximal wattage. When comparing all VPs a significant sex x test interaction (P=0.01) was observed. **CONCLUSIONS:** Submaximal VP intensities of 80% and 90% of max wattage achieved on the ramp test produce the highest VO_{2max} values in males. In females the maximal and supramaximal intensities most frequently produced the highest VO_{2max} values whereas the 80% led to excessive time to exhaustion (9.23±4.99 min). In order to obtain the highest VO_{2max} values in the most optimal test time we recommend using 90% of max wattage in males and 100 or 105% of max wattage in females.

2638 Board #158 June 2 11:00 AM - 12:30 PM
Determining The Optimal Work Rate For Cycle Ergometer Verification Phase Testing In Males With Obesity
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PURPOSE: The applicability of verification phase (VP) testing as a means to confirm the attainment of a 'true' VO_{2max} in males with obesity is widely unknown due to only two previous published studies on this population. The aim of the present study was to assess the validity of verification phase testing on separate days in males with obesity and determine the optimal work rate at which the highest VO_{2max} can be elicited. **METHODS:** Nine healthy males with obesity between the ages of 18 and 35 (age = 24.1 ± 6.1 years; body mass index [BMI] = 33.2 ± 4.2 kg/m²) performed a ramp-style VO_{2max} test on the cycle ergometer followed by four randomly assigned constant power (verification phase) tests on separate days. VP tests were set at 80, 90, 100 and 105% of maximal wattage (W_{max}) attained during the ramp test. **RESULTS:** All participants but one attained a higher, but not significant, VO_{2max} (L/min) during a VP test to values elicited during the initial ramp test. A trend (p=0.06) was shown for VO_{2max} during the 90% (3.61 ± 0.54 L/min) VP to be higher than the ramp (3.37 ± 0.39 L/min). A trend (p=0.06) was also seen for VO_{2max} during the 90% VP (3.61 ± 0.54 L/min) to be higher than the 105% (3.41 ± 0.53 L/min) test. HR_{max} was significantly lower/ during the 105% VP (170 ± 17 b/min) compared to the 80% (177 ± 16 b/min, P=0.02) and 90% (176 ± 14 b/min, P=0.02) VP tests. **CONCLUSION:** Verification phase tests at submaximal work rates, of 90% of W_{max} attained during the ramp test, may elicit the highest VO_{2max} and HR_{max} in males with obesity. Using a verification test in this population may provide more accurate VO_{2max} results as well as more accurate HR based exercise prescriptions.

2639 Board #159 June 2 11:00 AM - 12:30 PM
Breathing Valve Resistance Alters Physiological Responses During a Graded Exercise Test
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 (No relationships reported)

The graded exercise test (GXT) is a fundamental tool in the field of exercise physiology, which requires the use of a two-way breathing valve to direct inspiratory and expiratory airflow. These two-way breathing valves impose resistances to airflow and can increase the work of breathing, thus altering an individual's physiological response to a GXT. **PURPOSE:** To examine the physiological responses during a GXT when using two-way breathing valves with differing resistances to airflow. **METHODS:** Forty healthy subjects participated in this study (10 endurance trained males (ETM), 10 endurance trained females (ETF), 10 recreationally active males (RAM), and 10 recreationally active females (RAF)). On two separate occasions, subjects performed identical GXTs using either the Rudolph 2700 (high resistance) or the Daniels' (low resistance) breathing valve. The GXTs were completed on a treadmill and consisted of a submaximal and a maximal phase. During the submaximal phase, running economy (RE), energy expenditure (EE), ventilation (V_E), heart rate (HR) and respiratory exchange ratio (RER) were measured. During the maximal phase, peak oxygen consumption (VO_{2peak}), V_E, HR, RER and time to exhaustion (TTE) were measured. **RESULTS:** When using the Daniels' valve, all groups had significantly better RE (-2.7, -3.5, -1.9, and -1.8% for ETM, ETF, RAM and RAF, respectively, p<0.05) and lower EE (-2.4, -3.4, -2.7, and -2.0% for ETM, ETF, RAM, and RAF, respectively, p<0.05) across all submaximal speeds. The ET group also had lower V_E (4.6 and 3.8% for ETM and ETF, respectively, p<0.05) when using the Daniels' valve across all submaximal speeds. During the maximal phase, TTE was significantly longer when using the Daniels' valve for all groups (6.0, 10.9, 6.2 and 9.8% for ETM, ETF, RAM and RAF, respectively, p<0.05). There were no other differences between valves in all groups for the submaximal or maximal portions of the GXT. **CONCLUSION:** These findings indicate that higher resistance two-way breathing valves alter the assessment of an individual's RE, V_E and EE during submaximal exercise. Although breathing valve resistance altered TTE, VO_{2peak} was unchanged. Therefore, airflow resistance of a breathing valve must be considered when comparing physiological responses to a GXT in the applied and research settings.

2640 Board #160 June 2 11:00 AM - 12:30 PM
Correlation Between Mock-nba Combine And Laboratory Measures In Ncaa Dii Men's Basketball Players
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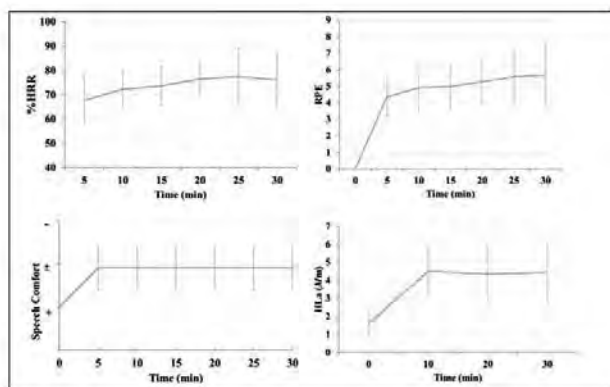
Combine style field-testing and laboratory-testing are commonly used to assess and track changes in fitness levels in athletes. **Purpose:** The purpose of this study was to examine the relationship between combine tests and changes in aerobic markers and anthropometrics during off-season conditioning in men's Division II basketball players. **Methods:** Anthropometrics were obtained on 12 NCAA Division II men's basketball players (20.5 ± 1.0 yrs; 190.2 ± 8.5 cm; 95.3 ± 15.9 kg) during the post-season (Post) and again during pre-season (Pre). All players completed a discontinuous, incremental maximal treadmill protocol with alternating 3 min run and 90 sec rest stages. Expired respiratory gases and heart rate (EKG) were measured continuously (ParvoMedics, Provo, UT). Oxygen consumption (VO₂) and heart rate (HR) measurements were obtained at stage 3, stage 4, and volitional exhaustion. Body composition values were obtained via Bodpod (Cosmed, Rome, Italy). During the off-season an NBA-style combine fitness protocol was implemented, testing: standing vertical jump, maximum vertical jump, lane agility, three-quarter court sprint speed, 3-RM squats, and 185lbs bench press repetitions. Statistical analysis included dependent t-tests for Post versus Pre lab-based measures. Pearson correlations were run between off-season changes (Pre minus Post) and combine data. **Results:** No significant changes were found for height, weight, or body composition. Significant differences (p ≤ 0.05), via t-tests, were found for VO_{2max} (Post: 57 ml/kg/min; Pre: 53 ml/kg/min), VO₂ stage 4 (Post: 58 ml/kg/min; Pre: 54 ml/kg/min) and HR maximum (Post: 193 bpm; Pre: 182 bpm). Correlations were observed between 185lbs bench press repetitions and changes in fat mass (r = -0.845, p ≤ 0.05) and fat-free mass (r = 0.882, p ≤ 0.05). Additional significant correlations included changes in percent of HRmax at stage 3 with maximal vertical jump (r = -0.864, p ≤ 0.05) and changes in percent of HRmax at stage 4 with lane agility (r = 0.967, p ≤ 0.05). **Conclusion:** Combine fitness data correlated minimally with changes observed in aerobic kinetics and anthropometrics between post and pre-season testing. Thus, various fitness assessment measures must be used when assessing fitness levels in basketball players due to the diverse physical demands of the sport.

2641 Board #161 June 2 11:00 AM - 12:30 PM
Biomechanical Comparison Of Countermovement Jumps On Land And In Water: Age Effects
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The use of a reduced impact, aquatic environment for physical activity and rehabilitation in older adults has become a focus of recent literature. **PURPOSE** The present study sought to evaluate the mechanical specificity of countermovement jumps performed on land and in water in older adults. **METHODS** Fifty-six young (22.0 ± 3.9 years) adults and twelve healthy older (57.3 ± 4.4 yr) adults were asked to perform maximal countermovement jumps on land and in chest-deep water. Kinetic and kinematic measures of jump performance were obtained using a tri-axial force platform and two dimensional videography, respectively. **RESULTS** As expected, peak (PP) and mean mechanical power (MP) outputs were greater ($p < .001$) for jumps performed by young vs older adults (PP: 7322 ± 4035 W; MP: 3049 ± 1771 W) and for jumps performed by all subjects in water (PP: 9387 ± 3981 W; MP: 3781 ± 1864 W) vs land. Compared to young adults, older adults experienced less of an increase in bodyweight normalized PP and MP for jumps performed in water vs land ($p < 0.05$). Peak movement velocities in older adults tended to be slower, with older adults spending 55% greater time in body unweighting. Compared to land, unweighting time increased more in the water for older adults (Land: 0.5 ± 0.3 s; Water: 1.2 ± 0.7 s) than young adults (Land: 0.4 ± 0.1 s; Water: 0.7 ± 0.2 s). Across ages, amortization rate was 26% greater for jumps performed in water and, in comparison with younger adults, amortization time in older adults was 20% longer in duration. A 1444% increase in peak dorsiflexion velocity for jumps performed in water ($66 \pm 34^\circ/s$ vs. $4 \pm 7^\circ/s$), suggests that loading strategy during amortization is likely unique from land-based jumping. **CONCLUSION** The aquatic environment produces jumping movements that are mechanically distinct from jumping movements performed on land. The results of the present study suggest that jumping in an aquatic environment may be beneficial in older adults training to improve mechanical power output and lower-extremity neuromuscular function.

2642 Board #162 June 2 11:00 AM - 12:30 PM
Talk Test As A Marker For Maximal Lactate Steady State In Athletes
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The Talk Test (TT) is a simple surrogate of standard methods of exercise prescription. **Purpose:** To evaluate if the TT can identify Maximal Lactate Steady State (MLSS) in athletes. **Methods:** Well-trained triathletes ($m=7$, $f=5$) performed two incremental cycle tests to identify stages of the TT (101 words, with stages of Last Positive (LP), Equivocal (EX) and Negative (NEG) relative to speech comfort) and respiratory markers (VT, RCT, VO_{2max}). They also performed multiple constant power output (PO) rides to identify MLSS. During the steady-state rides HR, RPE, TT, and blood lactate were measured. **Results:** The PO at steady-state MLSS (201 ± 48 W) was significantly different than at incremental LP-1 (173 ± 57 W), EQ (223 ± 51 W) and NEG (250 ± 52 W). It was not significantly different than incremental LP (195 ± 52 W). During the course of the steady-state rides, HR was $\sim 75\%$ HRR, blood lactate was ~ 4.5 mmol, l^{-1} , RPE was $\sim 5-6$, and speech comfort was constant at EQ. **Conclusions:** In well-trained athletes, the LP stage of the TT yields a PO that approximates MLSS during steady-state exercise.



2643 Board #163 June 2 11:00 AM - 12:30 PM
Comparison of the Talk Test and Percent Heart Rate Reserve for Exercise Prescription
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Exercise intensity is traditionally prescribed using %HRmax, %HRR, %VO_{2max} or %VO_{2R}. Recently, the Talk Test (TT) has been proposed as an alternative method to guide exercise intensity. However, it is unknown if prescribing exercise intensity solely using the TT can provoke training responses that are comparable to traditional guidelines. **PURPOSE:** To compare the training responses consequent to training using either the TT or %HRR. **METHODS:** Forty-four subjects (17 males and 27 females: age= 20.4 ± 3.02 yrs; ht= 170.5 ± 9.79 cm; wt= 71.9 ± 13.63 kg) completed an incremental maximal cycle ergometer test, were stratified by VO_{2max} and gender, and randomly assigned to training groups guided by either %HRR ($n=20$) or the TT ($n=24$). Both groups completed 40-minute training sessions 3 days per week for 10 weeks. In the HRR group, exercise intensity was targeted at 40-59 %HRR for weeks 1-4, 50-59 %HRR for weeks 5-8, and 60-79 %HRR for weeks 9-10. In the TT group, exercise intensity was targeted at the highest power output that still allowed for comfortable speech. Changes in VO_{2max}, peak power output (PPO – watts and watts/kg), ventilatory threshold (VT); and PO at VT, were compared between groups using two-way ANOVA with repeated measures. **RESULTS:** There were significant ($p < .05$) pre vs. post increases in VO_{2max} (TT= $+10.6\%$; HRR= $+11.5\%$), PPO – watts (TT= $+18.5\%$; HRR= $+14.1\%$), PPO – watts/kg (TT= $+19\%$; HRR= $+14\%$), VT (TT= $+56.9\%$; HRR= $+32.7\%$), and PO at VT (TT= $+39\%$; HRR= $+43\%$) in both groups as a result of training, with no significant differences ($p > .05$) in the magnitude of improvement between groups. **CONCLUSION:** Guiding exercise prescription using the TT is a simple and effective method for prescribing exercise intensity and elicits improvements in exercise performance that are comparable to traditional %HRR guidelines.

2644 Board #164 June 2 11:00 AM - 12:30 PM
Repeatability Of 5-km Time Trials On A Non-motorized Treadmill
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 (No relationships reported)

Non-motorized treadmills (NMT) allow for continuous self-selection of pace during time trials (TT). Belt resistance of NMT results in reduction in time-trial performance versus treadmill or road running, but the repeatability between NMT TT is not well-documented. **PURPOSE:** This study examined variability across three, 5-km time trials on a NMT (Curve 3.0, Woodway Inc., Waukesha, WI). **METHODS:** Eleven male runners (30 ± 10 y) with no previous experience running on the NMT, were instructed to cover 5-km on the NMT as quickly as possible on 3 occasions. Time was not expressed, but runners were informed of distance at each km and when 0.3 km remained. RPE, velocity, and power were assessed/averaged for each kilometer. **RESULTS:** There was no main effect ($p = 0.48$) for trial number based on completion time, but mean finishing time was 22 s slower during the TT2 versus TT1. Intraclass correlation was high for TT1-TT2, (ICC = 0.95), but improved for TT2-TT3 (ICC = 0.99). Bland-Altman plots reveal the 95% upper and lower levels of agreement were -173 to 217 s for TT1-TT2, but drastically improved for TT2-TT3 (-116 to 63 s). Main effects were found for time but not trial on RPE, velocity, or power based on trial when data was broken down into 1-km intervals. **CONCLUSION:** Despite a lack of statistical significance between time trials, there was a trend in the data for runners to start TT2 with a more cautionary pace for the first 2-km. Multiple participants anecdotally reported posterior leg muscle fatigue that they were unaccustomed to experiencing during road or motorized treadmill running, possibly explain the pacing modification. When NMT are used for performance testing of 5-km distance, we suggest a familiarization TT be initiated before experimental treatment sessions.

2645 Board #165 June 2 11:00 AM - 12:30 PM
The Validity Of A Ruler-Based Alternative To The Sit And Reach Test In Females
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Previous research on male subjects demonstrated the validity and reliability of a new ruler-based protocol as an alternative to the Modified Sit and Reach test (Cullum and Turley, 2016 MSSE Abstract). In contrast to the Sit and Reach test, which requires specialized equipment and a person to administer the test, the new protocol only requires commonly available tools and can be administered by the subject without assistance. To date, however, this protocol has not been validated for a female population.

PURPOSE: The purpose of this study is to assess the validity and reliability of the ruler-based protocol as an alternative to the Modified Sit and Reach test for a female population.

METHODS: Sixty-two females participated in the research project. Following a measurement of height and weight, subjects completed in a randomized order the modified Sit and Reach test using the standard measurement device and the new ruler-based protocol. This procedure had subjects stand with a 12-inch ruler extended from between their hands, bend over at the waist, and allow the floor to push the ruler into their hands as far as possible. The remaining length beyond their fingertips was recorded as their score. A Pearson correlation was utilized to compare the results from the two protocols. A second group of 32 subjects performed both tests in a randomized order on two separate occasions to establish the test-retest reliability of the protocols, as indicated by Intraclass Correlation.

RESULTS: The analysis comparing the two protocols resulted in an r value of -0.826 . The two trials for the test-retest analysis of the Sit and Reach protocol yielded a mean and standard deviation of 15.35 ± 3.03 inches and 15.95 ± 3.16 inches, while trials for the new protocol resulted in values of -3.76 ± 3.28 inches and -3.48 ± 3.41 inches. The test-retest analysis determined Intraclass Correlation values of 0.950 for the Sit and Reach test and 0.956 for the new protocol.

CONCLUSIONS: There was a strong correlation between the ruler-based protocol and the sit and reach test, in conjunction with very high high test-retest reliability for both protocols, suggesting that a valid measurement of an individual's hip and lower back flexibility can be obtained with the new protocol.

2646 Board #166 June 2 11:00 AM - 12:30 PM
The Effect of Cadence on Muscular Activity and Performance During the Push-Up Exercise
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The push-up is a classic exercise that is used to strengthen the upper body. It is popular because it is a body weight exercise which can be modified to accommodate different ability levels. The push-up is also used to assess muscular endurance during fitness testing. Though several standardized protocols have been established, there are still execution related issues that have not been fully examined to date, which may affect interpretation of testing and training outcomes. **PURPOSE:** To study the effects of cadence on performance and electromyographic (EMG) activity of the pectoralis major and triceps brachii during a push-up exercise to failure in young and healthy college males. **METHODS:** Thirteen subjects (age = 22.5 ± 3.4 years) recruited for this study. Height, weight and body composition were measured. Subjects completed one-set of push-ups to failure at the following cadence during 5 randomly assigned sessions: (1) 120 beats per minute (bpm), (2) 60 bpm, (3) 40 bpm, (4) 30 bpm, (5) self-selected pace (SSP). EMG activity of the right pectoralis major and right triceps brachii were recorded during each session. Repeated measures ANOVA were used to determine differences between sessions. **RESULTS:** Subjects completed $35.15 (+17.70)$ push-ups at the self-selected pace, $23.15 (+13.99)$ at the 30 bpm, $25.23 (+12.83)$ at 40 bpm, $28.31 (+12.89)$ at 60 bpm and $31.31 (+15.04)$ at 120 bpm. The total number of completed repetitions was significantly different between sessions. SSP, which equated to 98 bpm ($+20.75$) was greater than 30 bpm ($p=.000$), 40 bpm ($p=.001$), and 60 bpm ($p=.019$). Push-ups performed at 120 bpm was greater than 30 bpm ($.033$) and 40 bpm ($p=.015$) and push-ups performed at 60 bpm was greater than 40 bpm ($p=.002$). There were no differences in the EMG activity of the pectoralis major or triceps brachii between the 5 cadence sessions. **CONCLUSIONS:** Young and healthy college-age subjects performed more push-ups to failure at a self-selected pace compared to slower cadences without differences in EMG activity in the pectoralis major or triceps brachii. Self-selected pace appears to be optimal in terms of push-up performance compared to slower cadences and supports self-selected for testing purposes. However, additional work is necessary to investigate higher cadences, additional muscles, and energy costs at different speeds.

2647 Board #167 June 2 11:00 AM - 12:30 PM
Estimation of the Lactate Threshold Using a New Wireless Near-Infrared Spectroscopy System
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 (No relationships reported)

Lactate threshold (LT) is an important variable to consider for aerobic training programs and has traditionally been analyzed by measuring blood lactate concentration ([La]) during maximal exercise tests. Previously, near-infrared spectroscopy (NIRS) techniques have been used to non-invasively estimate the LT during maximal exercise tests by assessing the microvascular oxygenation (SmO_2) response. **PURPOSE:** To determine the validity and reliability of a new wireless NIRS system in estimating the LT during a maximal exercise test. **METHODS:** 10 subjects with minimal cycling experience (29 ± 3 yrs, 1.8 ± 0.1 m, 79.1 ± 12.6 kg, 35.8 ± 5.6 mL/kg/min) performed two exercise sessions, separated by 7 d, of a step protocol ($+25$ W / 3 min) to volitional fatigue on a Monark 839E cycle ergometer. During session 1, arterialized venous blood samples were collected during the last 15 s of each stage to assess [La]. Additionally, the SmO_2 response (NIRS1) was continuously recorded at a sampling rate of 2 Hz using a wireless NIRS sensor placed on the vastus lateralis. To assess reliability of the NIRS system, the SmO_2 response was measured again during session 2 (NIRS2) as the subjects repeated the same cycling step protocol from session 1. All SmO_2 data were averaged over the last 15 s of each stage. Thresholds based upon the [La], NIRS1, and NIRS2 responses to the increasing work rate were detected via visual inspection, by 3 experienced investigators blinded to the subjects and conditions, and computer modeling (Dmax, Modified Dmax). One-way, repeated measures ANOVA was used to test for significant differences ($p < 0.05$) between threshold detection methods ([La], NIRS1, NIRS2). **RESULTS:** Moderate-good inter-rater reliability between visual inspection raters was observed (ICC = 0.58-0.80). Visual inspection of the thresholds displayed no difference between threshold detection methods ([La] = 114 ± 12 W, NIRS1 = 114 ± 21 W, NIRS2 = 109 ± 26 W). No difference was detected between threshold detection methods when analyzed using the Dmax ([La] = 130 ± 44 W, NIRS1 = 120 ± 28 W, NIRS2 = 138 ± 32 W) or modified Dmax ([La] = 130 ± 44 W, NIRS1 = 119 ± 28 W, NIRS2 = 136 ± 32 W). **CONCLUSIONS:** The new wireless NIRS system may be able to accurately and reliably estimate the LT during maximal exercise tests performed on a cycle ergometer in a healthy, adult population.

2648 Board #168 June 2 11:00 AM - 12:30 PM
Effectiveness of a Student-Led Worksite Wellness Project Addressing Health-Related Physical Fitness
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Individuals who are not regularly physically active are at a greater risk for developing chronic diseases, with at least 1.9 million annual deaths attributed to physical inactivity, making it the fourth leading cause of global mortality.

PURPOSE: To measure the impact of a 14-week student-led wellness project aimed at increasing physical activity while also addressing four components of health-related physical fitness: cardio-respiratory fitness, musculoskeletal fitness, body composition, and flexibility. **METHODS:** 46 apparently healthy adults volunteered to participate in this study. Week 1 and 14 were devoted to pre- and post-fitness assessment data collection utilizing The President's Challenge Adult Fitness Test. Weeks 2-13 were dedicated to addressing the participants' goals, as well as any strengths/weakness identified in the first fitness assessment. Data were compared using paired t-tests.

RESULTS: There were statistically significant ($p < .05$) improvements in the following variables from pre- to post-assessment: resting heart rate (73.6 vs. 68.3 bpm), weight (88.7 vs. 86.6 kg), waist circumference (91.1 vs. 86.8 cm), BMI (30.1 vs. 29.3 kg/m²), VO_{2max} (29.7 vs. 34.7 mL/kg/min), musculoskeletal fitness (push-ups: 17.1 vs. 27.6; sit-ups: 28.3 vs. 42.7), flexibility (37.1 vs. 41.5 cm), and overall fitness score (38.5 vs. 58.4%). **CONCLUSIONS:** Exercise Science students were effective at improving overall physical fitness and decreasing overall mortality risk in an apparently healthy adult population. Colleges and Universities with Exercise Science programs should aim to decrease physical inactivity on campus by implementing student-led worksite wellness initiatives.

2649 Board #169 June 2 11:00 AM - 12:30 PM
Validation Of A 10-point OMNI Rating Of Perceived Exertion Colored Scale
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Using visual cues such as colors along with the standardized numerical and verbal descriptors in OMNI scales may be more appealing to an exercise cohort to measure perceived exertion accurately. **Purpose:** To examine the concurrent and construct validity of a newly developed 10-point OMNI Ratings of Perceived Exertion (RPE) Colored Scale (OMNI-Color) in young adult women and men. **Methods:** 40 subjects (age (yrs): 22.75 ± 1.79 ; weight (kg): 60.05 ± 10.67 ; height (cm): 167.12 ± 5.87) participated in a cross-sectional, perceptual estimation paradigm to assess exertional perception via two exercise protocols: a load-incremented cycle ergometer protocol ($n = 20$) and a progressive graded treadmill protocol ($n = 20$). Equal number of participants of each gender were recruited for each study and all participants undertook the respective protocols on two separate trials, one week apart. Oxygen uptake (VO_2 ; $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), heart rate (HR; $\text{beats} \cdot \text{min}^{-1}$) and RPE were recorded at each exercise stage. RPE was estimated with the OMNI-Color and either the OMNI Adult Walk/Run Scale (OMNI-WS) or the Adult OMNI Scale of Perceived Exertion for Cycle Ergometer Exercise (OMNI-Cycle) in a counterbalanced and randomized manner for respective studies. Correlations between the scales were used to examine the construct validity. Concurrent validity was evaluated with correlations between the RPE values of OMNI-Color, and both VO_2 and HR. **Results:** Linear regression analyses showed that the RPE derived from the OMNI-Color distributed as a positive linear function for both VO_2 and HR ($r = .97$ to $.99$; $p < .05$) for total cohort. In the cycle ergometer protocol, RPE derived from the OMNI-Color distributed as a linear function of the OMNI-Cycle ($r = 0.996$ to 0.998 ; $p < .01$) for both genders. In the progressive graded treadmill protocol, RPE derived from the OMNI-Color distributed as a linear function of the OMNI-WS ($r = .998$ to $.999$; $p < .05$) for both genders. Independent sample t test found no significant differences between OMNI-Color and OMNI-Cycle or OMNI-WS. **Conclusion:** Both concurrent and construct validity were established for the OMNI-Color. OMNI-Color may be used as an alternative scale to measure RPE during exercise, regardless of modality. Future research can further explore the scale's validity and applicability to other populations.

2650 Board #170 June 2 11:00 AM - 12:30 PM
Validation Of Heart Rate Sensor And Phone App In Lab Versus Home-based Environment
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Purpose: Heart rate variability (HRV)—beat-to-beat changes in the time interval between consecutive cardiac cycles—is a manifestation of the autonomic nervous system. The existing literature reflects validation studies of HRV using portable devices as compared to data generated by an electrocardiogram. In view of this agreement the present investigation, using a portable system, sought to establish if HRV measurements taken in the laboratory and home environments were equivalent. **Methods:** Twenty men (Age 24.4 ± 3.9 year; Height 179.3 ± 8.0 cm; Weight 86.9 ± 19.4 Kg) volunteered to obtain six HRV readings on separate days, three in a controlled laboratory (L) environment and three days at home (H). A coin toss determined the environment in which three HRV recordings would occur first. A commercially available heart rate (HR) sensor coupled to a cell phone app was used to record all data; the results were analyzed by a downloaded HRV software package. Subjects were familiarized with the HR sensor and phone app prior to data collection. All data were recorded in the morning with subjects resting in the supine position and breathing normally. No device was used for pacing purposes. The phone app recorded 60 sec of coronary electrical signals for analysis. **Results:** Nonsignificant environmental differences in grand mean HR ($H=62.9$, $L=61.2$), mean RR ($H=1008.8$, $L=1024.8$), RMSSD ($H=86.06$, $L=79.41$), pNN50 ($H=39.72$, $L=42.72$), and LF/HF ($H=2.151$, $L=2.386$) were found. A subject-to-subject r^2 coefficient of determination analysis contrasting environments yielded a variance for HR (.61), mean RR (.70), RMSSD (.85), pNN50 (.54), and LF/HF (.07). **Conclusion:** For our sample, a commercial heart rate sensor and phone app provided a valid system for recording morning HRV at rest in a home-based setting; these findings consequently open the door for future field research using this monitor and phone app system.

2651 Board #171 June 2 11:00 AM - 12:30 PM
Ventilatory Thresholds Differ Between Bruce And Self-paced Vo2Max Tests
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Self-paced $\text{VO}_{2\text{max}}$ tests (SPV) are a fairly recent development in cardiorespiratory testing. SPV's have been considered valid for measuring $\text{VO}_{2\text{max}}$, however, other measurements such as ventilatory threshold (VT) are also important when completing such cardiorespiratory testing and have not been adequately studied. It has been suggested that VT cannot be measured during SPV. **PURPOSE:** The purpose of this study was to determine whether the first VT (VT1) and second VT (VT2) could be identified during an SPV and how it compared to VT1 and VT2 determined during a Bruce protocol. It was hypothesized that VT1 and VT2 could be determined during SPV and would not be different than the VT1 and VT2 identified during the Bruce protocol. **METHODS:** 10 healthy, recreationally active subjects (9 male, 1 female, 25.4 ± 9.0 years) completed SPV and Bruce protocols on the same treadmill in random order. Gas sampling was processed as 15 breath moving averages. VT1 and VT2 were determined by identifying breaks in the VE , VE/VO_2 , $\text{P}_{\text{ET}}\text{O}_2$, VE/VCO_2 and $\text{P}_{\text{ET}}\text{CO}_2$ versus time slopes as well as the VE versus VCO_2 slope. The researcher analyzing VT was not involved in testing and was blind to the protocol. VT1 and VT2 was expressed as a percentage of the maximal VO_2 ($\% \text{VO}_{2\text{max}}$) attained during the respective protocol. Paired t -tests were used to identify differences between protocols for $\text{VO}_{2\text{max}}$, VT1 and VT2. **RESULTS:** $\text{VO}_{2\text{max}}$ was not different between Bruce and SPV protocols (55.5 ± 5.5 vs 56.6 ± 4.5 $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, respectively, $p = 0.15$). Five tests (4 during SPV) produced atypical slopes and VT2 identification was difficult. VT1 occurred at a higher $\% \text{VO}_{2\text{max}}$ in SPV (41.1 ± 8.1 SPV vs 32.2 ± 7.4 Bruce, $p = 0.005$) as did VT2 (86.4 ± 7.5 SPV vs 67.8 ± 8.9 Bruce, $p < 0.001$). **CONCLUSIONS:** SPV allowed subjects to alter their pace and their ventilatory responses making it more difficult to identify VT. Higher VT in SPV is in contrast to recent research. The magnitude of difference in VT may be due to both the difficulty in identifying VT in SPV and also the potential for SPV to allow subjects to alter their metabolic requirements and postpone anaerobiosis. Measurement of blood lactate throughout testing is needed to aid in the validation of VT in SPV.

2652 Board #172 June 2 11:00 AM - 12:30 PM
Relationship Between Physiological Lab Tests and On-Ice Measures Among NCAA DIII Collegiate Hockey Players
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Previous scientific studies have examined the connection between physical fitness tests and NHL draft success (Burr, 2008). Others examined correlation of physiological lab test results and measures such as plus/minus score and skating speed in collegiate hockey players (Peyer, 2011). **PURPOSE:** To determine if laboratory physiological test results correlate to on ice measures obtained from a wearable sensor including accelerations, heart rate and breathing rate. **METHODS:** Seven NCAA division III hockey players consented to procedures approved by Adrian College Human Subjects Committee. Lab tests including the Wingate, treadmill running $\text{VO}_{2\text{max}}$ and lactate threshold were performed four times periodically throughout the five-month hockey season. The Wingate was used to determine mean power (MP), peak power (PP), and anaerobic fatigue (AF) values. Treadmill $\text{VO}_{2\text{max}}$ tests were performed using procedures previously validated (Peyer, 2011), which provided $\text{VO}_{2\text{max}}$ and time on treadmill variables. Aside from $\text{VO}_{2\text{max}}$ and lactate threshold, V2 Lac (Lactate levels at end of $\text{VO}_{2\text{max}}$ test) and V2 Lac P1 (levels one minute after test) were also determined. On-ice measures were obtained from wearable sensors (Zephyr, MD), which consisted of a triaxial accelerometer, as well as HR and breathing rate (BR) monitor. Accelerations were used to calculate Mechanical Intensity (MI), which reflected instantaneous accelerations and Load (ML), which reflected cumulative accelerations over time. HR and BR were used to calculate instantaneous physiological intensity (PI) and physiological load (PL) an accumulation of these physiological values over the session. Statistical analyses were performed using SPSS 21.0 (IBM, NY) **RESULTS:** The strongest correlations were observed between Wingate variables AF and MI (.60, $p < .001$), PP and ML (.54, $p < .001$), AF and ML (.58, $p < .001$). Strong inverse correlations were observed between ML and both V2 Lac (-0.512 , $p = .001$) and V2 Lac P1 (-0.544 , $p < .001$). **CONCLUSION:** There are positive correlations between laboratory measures of anaerobic fitness and on-ice accelerations. Further,

lower lactate accumulation following a VO₂max test is associated with the ability to generate higher cumulative accelerations during on-ice sessions among NCAA DIII hockey players.

2653 Board #173 June 2 11:00 AM - 12:30 PM
Comparison Of Pre- And Post-season Laboratory And On-ice Measures Among NCAA Division III Hockey Players

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(No relationships reported)

PURPOSE: The purpose of this study was to compare on-ice physiological measures to pre- and post- season off-ice physiological laboratory tests to determine i) the relationship between off-ice tests and on-ice performance and ii) changes over the course of a season among collegiate ice-hockey players. **METHODS:** Seven NCAA D III male ice hockey players (age 22 ± 0.5, weight 87.89kg ± 6.1kg, height 185.4cm ± 3.4 cm) participated in procedures approved by the Adrian College Human Subjects Committee. Laboratory tests including the Wingate anaerobic test, treadmill VO₂max test, and lactate threshold tests, were performed at the beginning and end of the 5 month hockey season. Peak power output (PP), mean power output (MP), and anaerobic fatigue (AF) were assessed by the Wingate test. A VO₂max test, previously validated among ice hockey players, was used to obtain VO₂max values and time on treadmill. Lactate levels were also measured at the end of the VO₂max test (V2 Lac) and one minute after the completion of the test (V2 Lac P1). Subjects wore a Zephyr bioharness (Zephyr, MD) to measure on-ice physiological exertions during all practices and games. The sensor measured triaxial accelerations, breathing rate, and heart rate. Statistics were performed using SPSS 21.0 (IBM, NY). Season-long measures were divided into quartiles to correspond to laboratory testing. Data from the sensors from the first and last quartiles was compared to pre- and post-season lab tests. **RESULTS:** There were no significant differences from pre- to post-season among any laboratory tests. In contrast, there were significant decreases in average on-ice accelerations at 10, 20, 30 and 60 seconds (p < .05). There were non-significant changes in average accelerations over 20 minutes, while average accelerations over 45 minutes significantly increased (p < .05). **CONCLUSION:** The increase in average accelerations over 45 minutes from pre- to post- season suggest an increase in on-ice aerobic fitness. The decrease in average accelerations during anaerobic measures at 10 to 60 seconds suggest decreased anaerobic capacity of the subjects that were not identified by Wingate tests. Wearable sensors may provide additional information to laboratory testing for the assessment of physiological changes across a season among collegiate hockey players.

2654 Board #174 June 2 11:00 AM - 12:30 PM
Determination of Trials Needed for Measurement Consistency of Standing Long Jump in Collegiate Volleyball Players

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(No relationships reported)

Lower body power is an important physical attribute of competitive volleyball athletes. In order to best evaluate such an attribute, it is important that the test reliability is established using a sport specific athlete group and used in a realistic application to the particular sport. Furthermore, identification of the appropriate number of trials to use during assessment, insures accuracy of scores and time efficiency for coaches. **PURPOSE:** This aim of this investigation was to establish the minimum number of trials needed for reliability of the standing long jump (SLJ) in female collegiate volleyball players. **METHODS:** Nine female athletes (age: 18.3 ± 0.5 yrs, height: 179.2 ± 5.3 cm, mass: 68.8 ± 7.9 kg) completed five trials of a SLJ. Jumps were performed at 2, 6, 10, 14 and 18 minutes following a dynamic warm-up. In an attempt to simulate the active nature of sport, the athletes alternated between walking and jogging the length of a basketball court between successive trials. For the SLJ, subjects performed a standard countermovement SLJ and distance in centimeters was measured from the starting line to the rear-most heel upon landing. Pearson (PCC) and Intraclass (ICC) Correlation Coefficients were calculated between successive trials. **RESULTS:** Means for the for the successive trials were as follows: Trial 1: 191.4 ± 10.1 cm; Trial 2: 196.1 ± 10.2 cm; Trial 3: 200.0 ± 10.3; Trial 4: 200.0 ± 11.8 cm; Trial 5: 200.7 ± 9.6 cm. Mean difference between successive trials (i.e. Trials 2 to 1, 3 to 2, 4 to 3 and 5 to 4) were; 4.8 ± 6.9, 3.8 ± 5.5, -0.40 ± 5.6 and 1.1 ± 5.4. PCC and ICC for successive trials were: 0.77 and 0.82; 0.86 and 0.89; 0.88 and 0.91; 0.89 and 0.91. **CONCLUSIONS:**

Given the parameters of this study, adequate assessment of SLJ performance is best achieved using three trials. Enhanced consistency was not realized with application of additional trials. Therefore, when testing female collegiate volleyball athletes for lower body power using the SLJ, three trials are sufficient.

2655 Board #175 June 2 11:00 AM - 12:30 PM
Comparison Of Cardiorespiratory Responses During Body Weight-supported Treadmill And Standard Treadmill Exercise

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(No relationships reported)

Treadmills that partially support body weight are used in some rehabilitation settings. Cardiorespiratory responses to this type of exercise have been reported in very few published studies.

PURPOSE: To determine the cardiorespiratory response to graded exercise on a standard treadmill (ST) and body weight-supported treadmill (BWST). **METHODS:** In random order, 20-36 yr old adults (n = 6 males, 4 females) performed BWST and ST trials. Identical exercise sessions were performed on each treadmill except 25% of body weight was supported by the BWST. On each treadmill a two-minute warm up was performed at 2 mph and 0% grade, followed by 6 minutes of exercise at 3% grade at each of the following treadmill velocities: 3, 4.5, and 6 mph. Expired respiratory gases were analyzed each minute. Steady state heart rate, VO₂, VCO₂, and RER were calculated as the average value during the final three minutes of each 6 min exercise stage. Blood pressure and RPE were recorded during the final minute of each stage. A 2x3 repeated measures ANOVA was used to determine significant differences at the p < .05 level, and the LSD method for post hoc analyses. **RESULTS:** There was a significant difference (p < .05) in absolute VO₂ between ST and BWST at 4.5 mph (2.14 ± .39 v 1.42 ± .27 l·min⁻¹) and 6 mph (2.75 ± .58 v 1.79 ± .40 l·min⁻¹). Relative VO₂ was significantly different (p < .05) at each exercise intensity between treadmills (ST v BWST: 16.0 ± 1.1 v 13.6 ± 1.2; 31.2 ± 2.0 v 20.6 ± 2.4; 39.8 ± 1.9 v 25.8 ± 2.9 ml·kg⁻¹·min⁻¹). There was a significant difference (p < .05) in VCO₂ between the ST and BWST at 4.5 mph (2.10 ± .43 v 1.32 ± .26 l·min⁻¹) and 6 mph (2.88 ± .63 v 1.68 ± .39 l·min⁻¹). There was a significant difference (p < .05) in RER between the ST (1.05 ± .08) and BWST (.94 ± .06) at 6 mph. The HR was significantly different (p < .05) between ST and BWST at 4.5 mph (162 ± 17 v 128 ± 17 bpm) and 6 mph (182 ± 13 v 146 ± 17 bpm). There was a significant increase (p < .05) in SBP on the ST (144 ± 20 v 163 ± 25 v 175 ± 22 mmHg) and BWST (128 ± 11 v 143 ± 13 v 155 ± 16 mmHg) at each exercise intensity. There were no significant differences in DBP at any point during exercise. There was a significant difference (p < .05) in RPE on the ST at 6 mph (15 ± 1), 4.5 mph (12 ± 1), and 3 mph (9 ± 1). **CONCLUSION:** There appears to be a lower cardiorespiratory response during body weight-supported exercise and traditional treadmill exercise.

2656 Board #176 June 2 11:00 AM - 12:30 PM
Agreement Between Electromyographic Fatigue And Ventilatory Thresholds During Taekwondo Specific Test

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(No relationships reported)

PURPOSE: The aim of the present study is to compare electromyographic fatigue and ventilatory thresholds during taekwondo specific test.

METHODS: 10 male taekwondo athletes (20 ± 2 yrs, body mass 67.5 ± 6.3 kg, height 176 ± 9 cm) participated in the study. The University ethics committee approved this study (opinion #765.698). At first visit, anthropometric assessment and TKDet were performed. TKDet were constituted by 1-min progressive stages of kicking sequences, and kicking interval started from 4,6s and reduced 0,4s every minute until participant's fatigue. Expired gases were measured continuously with portable analyzer VO2000 (MedGraphics, Saint Louis, USA). Ventilatory thresholds were determined with the ventilatory equivalents method. EMG acquisition was performed with the wireless EMG system connected to a pair of surface electrodes placed in the rectus femoris, according to SENIAM recommendations. EMG signal was recorded continuously during the tests with a frequency of 2000 Hz. EMG was filtered by third order Butterworth band-pass filter. RMS values were calculated during every non-superimposing windows with 1s duration. EMG thresholds were detected by piecewise regression (two inflections - three segments line). Parametric data were described by mean and standard deviation, 95% confidence interval of mean and compared with Paired T-test (effect size Cohen's d). Non-parametric data were described by median and interquartile range, 95% confidence interval of median and compared with Wilcoxon test (effect size z/√n). The coefficient of variation and standard error of measure were reported to describe data variability, and intraclass correlation coefficient was calculated to determine the agreement. P < 0.05 was adopted for all tests.

RESULTS: Detailed results were present in table 1.

CONCLUSIONS: Although the $\dot{V}O_2$ values are similar, these methods may not be interchangeable to determine training zones. Supported by CAPES, CNPq, and FAPERJ.

Table 1 – Comparison of cardiopulmonary exercise tests' electromyographic fatigue and ventilatory thresholds (n=10)

		Mean (SD) or Median (IR)	95% CI	CV (%)	SEM	β (ES)	ICC (ICC's 95% CI)
1st Thresholds	Stage ^{NP}	Vt1	3 (3)	1 – 4	38.8	0.3	0.001* (-0.88)
		EMGt1	1 (1)	3 – 4	22.2	0.3	
	VO ₂ (mL.kg ⁻¹ .min ⁻¹)	Vt1	38.7 (1.4)	37.7 – 39.7	3.7	8.5	0.53 (0.21)
		EMGt1	37.9 (3.6)	35.3 – 40.5	9.6	15.7	
	VO ₂ (%)	Vt1	74.8 (5.8)	70 – 79	7.8	10.4	0.55 (0.23)
		EMGt1	72.7 (8.6)	67 – 79	11.9	11.4	
2nd Thresholds	Stage	Vt2	8 (1)	8 – 8	9.6	38.9	0.10 (0.57)
		EMGt2	7 (1)	7 – 8	13.7	22.2	
	VO ₂ (mL.kg ⁻¹ .min ⁻¹)	Vt2	47.1 (4.8)	43.8 – 50.6	10.4	3.7	0.02* (0.84)
		EMGt2	44.1 (5.0)	40.5 – 47.7	11.4	9.6	
	O ₂ (%)	Vt2	90.1 (3.6)	88 – 93	4.0	7.8	0.03* (0.86)
		EMGt2	84.3 (7.3)	79 – 89	8.6	11.9	

Absence of ^{NP} denotes parametric data, presented as mean (standard deviation) and 95% confidence interval of mean (inferior limit – superior limit). CI – Confidence Interval. CV – Coefficient of Variation. SEM – Standard Error of Measure. ES – Effect Size. ICC – Intraclass Correlation Coefficient. ^{NP} Denotes non-parametric data, presented as median (interquartile range) and 95% confidence interval of median (inferior limit – superior limit). Parametric data compared through Paired T-test (Cohen's d effect size). Non-parametric data compared through Wilcoxon signed rank test (z/vn effect size). EMGt – Electromyographic threshold. VO₂ – Oxygen uptake. Percentage variables (%) were calculated with the peak value observed at each test. * Denotes significant T-test's p or Intraclass Correlation Coefficient.

2657 Board #177 June 2 11:00 AM - 12:30 PM
Reliability and Smallest Worthwhile Difference in Reactive Strength Index Modified in Male and Female Athletes

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Reactive strength index modified (RSImod) has gained awareness as a means of assessing and monitoring explosive movement performance among athletes. RSImod utilizes time-to-take-off (TtT) and vertical jump height (VJ) to assess the explosive power of an athlete. Despite its wide spread use, the degree of improvement in RSImod necessary to mark a real improvement versus random variation has not been well established. **PURPOSE:** To determine reliability and smallest worthwhile difference (SWD) in RSImod in college athletes. **METHODS:** Seventy-three NCAA Division-I male (n = 59) and female (n = 16) athletes volunteered to participate. Two countermovement VJ trials were recorded from dual force plates with data processed using METLAB. To control arm movement, hands grasp a PVC tube placed across shoulders behind the neck. VJ height was calculated from flight time. TtT was estimated as the duration from the start of the jump (first negative deflection greater than 10N of the force record associated with the countermovement) to take-off from the force plate. RSImod was calculated as the VJ height divided by TtT. Peak force (PF/kg) and peak power (P/kg) relative to body mass was determined from force recordings. Rate of force development (RFD) was determined from peak force per unit time during the vertical movement and the peak (PRFD) was recorded. **RESULTS:** TtT, PF/kg, P/kg, and PRFD were not significantly different between trials. Interclass correlation coefficients ranged from 0.83 for PRFD to 0.92 for PF/kg. Men had significantly higher RSImod (0.41 ± 0.08) and PP/kg (55.3 ± 14.4 N/kg) than women (0.34 ± 0.08 and 46.2 ± 6.7 N/kg), but TtT was significantly shorter in women (0.79 ± 0.13 s) than men (0.96 ± 0.10). RFD/kg was not significantly different between men (137.0 ± 80.8 N/kg) and women (99.9 ± 39.7 N/kg). CV% ranged from 3.4% for PF/kg to 18.3% for RFD/kg with RSImod being 7.9%. SDW% ranged from 10.8% for PF/kg to 59.5% for PRFD, with RSImod being 22.4%. CV% and SWD% for RSImod were 7.7% and 21.9%. **CONCLUSIONS:** Given the variation and relatively high SWD% and the between trial difference in RSImod, the novelty of the test protocol may warrant familiarization sessions prior to actual measurement to insure more consistent values among trials despite ICC values that appear acceptable.

2658 Board #178 June 2 11:00 AM - 12:30 PM
Validity of Linear Position Transducers Versus the Optotrak 3D Motion Capture System

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Assessment of barbell velocity during resistance training is an effective tool to gauge progress in strength and power and to manage intra-session fatigue. The criterion measurements of velocity are 3D motion capture or force plate systems; however, the cost of these implements is extraordinary and impractical. Therefore, linear position transducers (LPTs) are commonly used for velocity calculation. Specifically, the TENDO Weightlifting Analyzer System (TWAS), which costs >\$1,000 is widely used. However, the Open Barbell System (OBS) LPT was recently developed for a cost of <\$300. **PURPOSE:** To investigate if average concentric velocity calculations during the barbell back squat via the TWAS and OBS were valid compared to the Optotrak Certus 3D (OC3D) motion capture system. **METHODS:** Twenty-Five males (Age: 25±3yrs, Body Mass: 89.0±14.7kg, Body Fat Percentage: 12.9±4.5%) performed a one-repetition maximum (1RM) back squat followed by one set of maximum repetitions at 70% of the established 1RM. Average velocity (AV) was calculated on every 1RM attempt and every repetition at 70% of 1RM with the OC3D, TWAS, and OBS. For OC3D, AV was calculated from the observed y-coordinates (i.e. vertical position) via post-process coding in the MATLAB program. Both LPTs were attached to the right side of the barbell via a Velcro strap, and AV was displayed immediately upon completion of the lift for the LPTs. Independent samples t-tests between each LPT and OC3D were used to compare AV differences between devices. To assess agreement between LPTs and OC3D, intraclass correlation coefficients (ICCs) and 95% confidence intervals (CI) were calculated. Significance was set at p<0.05. **RESULTS:** The number of usable samples from all 1RM squat attempts and repetitions at 70% of 1RM were as follows: OC3D-522, TWAS-573, and OBS-558. There was no difference for AV between OC3D vs. TWAS (p=0.54) or OC3D vs. OBS (p=0.48). Regarding ICCs the OBS had an ICC of 0.936 in comparison to OC3D with a 95% CI of 0.914-0.952; while TWAS had an ICC of 0.870 compared to OC3D with a 95% CI of 0.830-0.899. **CONCLUSION:** Our results indicate that ICC values and CIs associated with the OBS show better validity in comparison to the criterion OC3D for AV than does TWAS. Therefore, the OBS is an effective low-cost option to assess AV during resistance training.

2659 Board #179 June 2 11:00 AM - 12:30 PM
Comparison of Two Commonly Used Metabolic Measurement Systems.

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The portable metabolic analyzer (MA) has been commonly utilized in assessing sport- or physical activity related energy expenditure. However, little is known about the validity of the portable MA. **PURPOSE:** To determine the accuracy of oxygen consumption (VO₂) and carbon dioxide (VCO₂) production measured by the portable MA, Oxycon Mobile 5.0 (OM) using the Parvo Medic TrueOne 2400 metabolic cart (MC) as a criterion measure. **METHODS:** A total of 19 participants (age: 19-45 yrs) completed the same exercise protocols during the two separate visits. The metabolic analyzers (i.e., OM and MC) were randomly assigned for the visit. The exercise protocol included 15 mins for resting (laying down), 5 mins for sitting, standing, 3 mph, 4 mph, 5 mph, 6 mph running, and 2.5 mph cool down with a minute break between each activity. Measures of VO₂ and VCO₂ from OM were statistically compared to the values from the MC. Pearson correlation was calculated to identify the measurement relationship between the OM and the MC. Mean absolute percentage error (MAPE) was calculated to examine the measurement error of OM. Cohen's D was calculated to investigate the effect size of the measurement difference. **RESULTS:** The strong overall agreements of VO₂ and VCO₂ between the OM [r=0.94 (p<0.01)] and MC [r=0.96 (P<0.01)] were observed. For each stage of the exercise protocol, Pearson r of VO₂ and VCO₂ measurement between the OM and MC were 0.33 and 0.34 for resting, 0.26 and 0.31 for sitting, 0.28 and 0.33 for standing, 0.57 and 0.30 for 3mph, 0.68 and 0.53 for 4mph, 0.74 and 0.63 for 5mph, 0.78 and 0.76 for 6mph, 0.70 and 0.47 for 2.5mph cool down. Calculated MAPEs of VO₂ and VCO₂ for each stage are as follow: 19.22%, 13.06% for resting, 14.49%, 7.53% for sitting, 6.32%, 0.19% for standing, 10.78%, 8.70% for 3mph running, 7.49%, 5.23% for 4mph running, 4.23%, 1.22% for 5mph running, 3.87%, 0.47% for 6mph running, 3.34%, 4.34% for 2.5mph cool down. Effect size for VO₂ and VCO₂ were 0.78 and 0.43 for resting, 0.54 and 0.23 for sitting, 0.27 and 0.01 for standing, 0.44 and 0.33 for 3mph, 0.34 and 0.22

for 4mph, 0.19 and 0.04 for 5mph, 0.19 and 0.02 for 6mph, 0.11 and 0.11 for 2.5mph cool down. **CONCLUSIONS:** VO₂ and VCO₂ measured in walking and running (running 3, 4, 5, 6mph) were more valid than the light physical activities (i.e., laying down, sitting, and standing).

2660 Board #180 June 2 11:00 AM - 12:30 PM
Power Push-up Tests Performed from the Knees and Toes in Young Male Athletes
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 (No relationships reported)

The power push-up (PPU) is an explosive upper-body test performed on a force plate and has recently replaced the bench press test in high school football combines such as the U.S. Army National Combine and Under Armour All-American Combine. **PURPOSES:** Compare the PPU test performed from the knees versus the toes across 3 age groups (6-9, 10-11, and 12-15 yr) of young male athletes and report the test-retest reliability. **METHODS:** Sixty-eight boys (mean±standard deviation (SD); height=154±14 cm; mass=47±16 kg) were tested twice over 5 days. The PPU was performed on a force plate from the knees and from the toes. Measurements included peak force (PF, N), peak rate of force development (pRFD, N·s⁻¹), average power (AP, W), and peak power (PP, W). Two-way ANOVAs (position x age) were performed, while intraclass correlation coefficients (ICC_{2,1}), standard errors of measurement (SEM), coefficients of variation (CV), and minimum detectable changes (MDC) were calculated. **RESULTS:** PF, pRFD, and PP were greater (p ≤ 0.05) from the knees for the 10-11 and 12-15 yr groups, whereas AP was greater (p ≤ 0.05) from the knees for all age groups. PF and pRFD were greater (p ≤ 0.05) in 12-15 yr than 6-9 and 10-11 yr from the knees and the toes. Table 1 shows the mean values and test-retest reliability metrics. **CONCLUSIONS:** PF, pRFD, AP, and PP were greater from the knees than the toes, and the oldest age group (12-15 yr) demonstrated the highest PF and pRFD values. However, the only consistently reliable measure was PF when the PPU test was performed from the knees in 10 to 15-year-olds; pRFD was also reliable from the knees in 12-15-year-olds. None of the measures from the youngest age group were reliable, and neither of the power measures (AP or PP) were reliable across all ages.

Table 1. Mean values (± 95% confidence intervals, CI), intraclass correlation coefficients (ICC_{2,1}), standard errors of measurement (SEM), coefficients of variation (CV), and minimum detectable changes (MDC) for each age group

Age (years)	Variable	Position	Trial 1 Mean (± 95% CI)	Trial 2 Mean (± 95% CI)	ICC _{2,1}	SEM	CV (%)	MDC
6-9	PF (N)	Knees	84.81 (± 18.09)	97.64 (± 19.03)	0.58	32.66	35.80	90.53
		Toes	78.37 (± 30.67)	85.27 (± 24.36)	0.16	67.69	81.82	187.62
	pRFD (N·s ⁻¹)	Knees	1023.58 (± 231.61)	1195.29 (± 342.10)	0.37	621.35	56.91	1722.28
		Toes	1587.61 (± 1926.79)	2078.14 (± 1585.18)	-0.07	4849.19	264.57	13441.26
	AP (W)	Knees	32.17 (± 14.01)	18.18 (± 8.37)	-0.05	33.14	131.65	91.86
		Toes	10.40 (± 4.08)	9.39 (± 4.15)	-0.08	11.36	114.81	31.49
PP (W)	Knees	72.21 (± 32.11)	40.26 (± 16.85)	-0.03	73.02	129.86	202.40	
	Toes	33.40 (± 18.12)	47.43 (± 35.74)	-0.02	76.67	189.70	212.52	
10-11	PF (N)	Knees	113.91 (± 15.48)	114.89 (± 15.23)	0.84	21.49	18.79	59.57
		Toes	84.53 (± 12.14)	82.07 (± 13.32)	0.59	28.71	34.46	79.57
	pRFD (N·s ⁻¹)	Knees	1469.86 (± 297.08)	1462.00 (± 248.13)	0.56	636.48	43.42	1764.24
		Toes	1466.92 (± 1304.46)	818.15 (± 108.07)	0.01	3274.57	286.60	9076.65
	AP (W)	Knees	35.04 (± 10.21)	27.62 (± 9.04)	0.66	20.04	63.95	55.34
		Toes	23.67 (± 10.97)	11.32 (± 3.81)*	-0.01	30.27	173.08	83.92
PP (W)	Knees	79.21 (± 23.17)	70.16 (± 27.85)	0.73	46.91	62.81	130.03	
	Toes	67.30 (± 35.05)	28.28 (± 9.64)*	0.05	91.95	192.39	254.87	
12-15	PF (N)	Knees	167.35 (± 35.70)	161.41 (± 31.47)	0.93	31.67	19.27	87.79
		Toes	128.72 (± 34.84)	127.28 (± 30.28)	0.89	37.88	29.59	105.00
	pRFD (N·s ⁻¹)	Knees	2295.63 (± 785.43)	2128.42 (± 577.47)	0.88	836.75	37.83	2319.37
		Toes	1734.42 (± 993.13)	1879.14 (± 869.38)	0.97	545.29	30.18	1511.45
	AP (W)	Knees	62.47 (± 20.75)	44.87 (± 25.23)*	0.74	40.63	75.70	112.62
		Toes	32.64 (± 12.59)	25.12 (± 14.01)	0.37	37.20	128.79	103.10
PP (W)	Knees	138.67 (± 40.86)	98.37 (± 56.01)*	0.70	90.81	76.62	251.70	
	Toes	79.79 (± 31.96)	58.60 (± 31.39)	0.55	75.34	108.87	208.82	

PF = peak force, pRFD = peak rate of force development, AP = average power, PP = peak power. * Indicates that trial 2 was less than trial 1 (p ≤ 0.05).

E-33 Free Communication/Poster - Monitoring

Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2661 Board #181 June 2 9:30 AM - 11:00 AM
Tracking Of Blood Lactate Response Across Eight Sessions Of Muscular Endurance Resistance Training
 John W. Farrell III, David J. Lantis, Gregory S. Cantrell, Debra A. Bembem, FACSM, Rebecca D. Larson. University of Oklahoma, Norman, OK. (Sponsor: Dr. Debra A. Bembem, FACSM)
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 (No relationships reported)

Muscular endurance resistance training (MERT) has been shown to improve the onset of blood lactate accumulation (OBLA). It has been speculated that improvements in OBLA following MERT is related to metabolic adaptations associated with continued exposure to increased blood lactate concentrations. **PURPOSE:** The purpose of this study was to investigate metabolic responses during each training session of a 4 week MERT program in aerobically trained males. **METHODS:** 17 males, ages 18-45, participated in this study. Subjects were randomly assigned to either an experimental (EX) or control (CON) group, 9 EX and 8 CON. Baseline measures included VO_{2max} and OBLA using a cycle ergometer, and 1 repetition maximum (1RM) for: leg press (LP), leg curl (LC), and leg extension (LE). The EX group performed MERT (4 sets of 12-15 repetitions at 50% of 1RM for LP, LC, and LE) for 4 weeks with 2 sessions per week. Resistance was increased after 4 sessions to accommodate any potential strength gains. Pre and post blood lactate concentrations were measured for each MERT session. Both groups were instructed to maintain current aerobic training throughout the study with participants returning to the lab to repeat all baseline measures. T-tests were used to determine if significant between group differences existed using delta scores (post-pre). **RESULTS:** No significant differences in baseline measurements were observed (p>0.05). No significant group differences were observed for VO_{2max}, OBLA, LP, and LE. However, significant group differences were observed for LC (kg) (EX 9.21±5.35 vs. CON: -0.142±5.08). The average blood lactate response (mmol/L) for the first 4 MERT sessions ranged from 7.0±0.716 to 13.8±1.76 and the last 4 sessions ranged 8.23±0.956 to 13.8±0.763. **CONCLUSIONS:** 4 weeks of MERT did not significantly improve VO_{2max}, OBLA, LP, and LE but did improve LC. Although subjects performed all MERT at the same percentage of 1RM a large range of lactate responses were observed between subjects. The range in lactate responses suggests that the relative intensity of the exercise and metabolic responses were not the same between subjects. It may be more appropriate to assign training load with MERT based on lactate response to ensure similar metabolic responses between subjects.

2662 Board #182 June 2 9:30 AM - 11:00 AM
Varying Exercise Intensities: The Accuracy of Three Self-Monitoring Heart Rate and Physical Activity Wearable Devices

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 (No relationships reported)

Physical activity tracking wearables have emerged as a popular method for consumers to assess their daily activity, calories expended and heart rate. However, less is known if these health measures are valid at various levels of exercise intensity.

PURPOSE: To examine heart rate (HR) and energy expenditure (EE) validity of three popular wrist-worn activity monitors at different exercise intensities.

METHODS: 62 participants (36 females, 46.8% non-white) wore the Apple Watch (AW), Fitbit Charge HR (FCHR) and Garmin Forerunner 225 (GF). Validity was assessed by 2 criterion devices: HR chest strap and a metabolic cart. Participants completed a 10-min seated baseline; separate 4-min stages of light, moderate and vigorous-intensity treadmill exercises; and a 10-min seated recovery. Data from devices were compared to each criterion via two-way RM-ANOVA and Bland-Altman analysis. Differences were expressed in mean absolute percentage error values (MAPE).

RESULTS: AW - HR MAPE between 1.14-6.70%. HR not significantly different at the start (p = .13), baseline (p = .76) or vigorous intensity (p = .84). Lower HR readings during light (p < .05), moderate (p < .01) and recovery (p < .01). EE MAPE between 14.07-210.84%. Measured higher EE at all stages (p < .01). FCHR - HR MAPE between 2.38-16.99%. HR not significantly different at start (p = .43) or moderate intensity (p = .34). Lower HR readings during baseline, vigorous and recovery (p < .001) and higher HR in light (p < .001). EE MAPE between 16.85-84.98%. Measured higher EE at baseline (p < .05), light (p < .001) and moderate (p < .001). GF - HR MAPE between 7.87-24.38%. HR not significantly different

at vigorous intensity ($p = .35$). Measured higher HR readings start, baseline, light, moderate ($p < .001$) and recovery ($p < .05$). EE MAPE between 30.77-155.05%. Measured higher EE at all stages ($p < .001$).

CONCLUSION: This study provides one of the first validation assessments for the Fitbit Charge HR, Apple Watch and Garmin Forerunner 225. An advantage and novel approach of the study is the examination of HR and EE at specific PA intensities. Establishing validity of wearables is of particular interest as these devices are being used in weight loss interventions and could impact findings. Future research should investigate why differences between exercise intensities and the devices exist.

2663 Board #183 June 2 9:30 AM - 11:00 AM

Sex and Age Differences in Wrist and Hip Accelerometry in Adults

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(No relationships reported)

INTRODUCTION: While hip accelerometry has traditionally been considered the gold standard in the measurement of physical activity, wrist-worn devices have gained popularity in both research and consumer markets. The relationships between these measurements are not well characterized.

PURPOSE: To compare acceleration measurements between hip- and wrist-worn devices in younger (Y) and middle-aged (MA) men and women.

METHODS: 37 healthy, non-smoking, Y (18-39 years; 10M,10F) and MA (40-65 years; 8M,9F) adults participated in this one-visit, observational study. Participants wore a triaxial accelerometer on their non-dominant wrist and corresponding hip during a series of 14 well-defined, but varied-intensity common activities. Three-way mixed repeated measures ANOVAs (age by sex by device location) were used to assess cohort differences in accelerations for each activity, with movement speed as a covariate when appropriate (e.g. self-selected walking velocity). Significance was set at $p \leq 0.005$ to adjust for multiple comparisons.

RESULTS: After correcting for self-selected walking speed, over-ground walking wrist accelerations were approximately 50% greater in women compared to men in both age groups ($p = 0.004$, effect size, $d = 1.2$) despite no difference in hip accelerations ($p = 0.15$). Accelerations for other activities did not differ by sex ($p > 0.03$). MA adults demonstrated greater accelerations than Y adults ($p = 0.005$; $d = 0.82$) with sweeping but no other tasks ($p > 0.05$). Wrist accelerations were often measured to be greater than hip but not consistently so.

CONCLUSIONS: Hip and wrist accelerations demonstrated few sex and age differences and were not consistently related to each other. The sex difference in wrist accelerations suggests lifestyle physical activity may be overestimated in women using wrist accelerometry. The inconsistent relationship between hip and wrist accelerations suggests previous hip cut points cannot be reliably used for wrist assessments.

RESEARCH SUPPORT: In part by the Physical Therapy & Rehabilitation Department, University of Iowa; NIH Grant UMI AR06338; and the U.S. Army.

DISCLAIMER: The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the views of the Army or the Department of Defense.

2664 Board #184 June 2 9:30 AM - 11:00 AM

The Degree Of Tracking Of Physical Fitness And The Possibility Of Anti-tracking

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(No relationships reported)

PURPOSE: The purpose of this study was to ascertain the degree of tracking of physical fitness by examining the relationship of physical fitness in children at 5 and 12 years of age using longitudinal data. In addition, anti-tracking was investigated in children who were classified into the low physical fitness group at the age of 5 years and belonged to a sports club at the age of 12 years.

METHODS: Subjects included 126 children who performed the physical fitness test when they were 5 and 12 years old. To determine the amount of tracking, we calculated the Pearson correlation coefficient between assessments at 5 and 12 years. Children who were classified into the low physical fitness group at 5 years of age were further divided into the group that belonged to the sports club (SG) and the group that did not belong to the sports club (CG) at the time of 12 years of age.

RESULTS: Among boys, physical fitness assessment at 12 years showed a significant correlation with that at 5 years in terms of overall physical fitness ($r=0.671$), throwing ($r=0.766$), and jumping ($r=0.467$). Among girls, physical fitness assessment showed a significant correlation with overall physical fitness ($r=0.559$), jumping ($r=0.338$),

running ($r=0.680$), and throwing ($r=0.524$). The significant difference in the overall physical fitness between SG and CG was observed in girls. The overall physical fitness was significantly higher in SG than in CG ($t=2.751$, $p=0.005$).

CONCLUSIONS: These results suggest that characteristics of physical fitness at the age of 12 were strongly influenced by the overall physical fitness at the age of 5 in both boys and girls. Analysis of anti-tracking results did not show a big effect. In particular, it was remarkable in boys. Supported by Grant-in-Aid for Scientific Research (B) (No.16H03271) from Ministry of Education, Culture, Sports, Science and Technology in Japan.

2665 Board #185 June 2 9:30 AM - 11:00 AM

GPS Analysis of Elite Chinese Male Hockey Players During Competition: Based on New IHF Rules

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PURPOSE: The aim of this study was to investigate the physiological demands of a match under the new rules as compared to the old rules.

METHODS: Four matches analyzing 16 elite Chinese field hockey players (Height: 178 ± 4.41 cm.; Weight: 76.50 ± 6.12 kg) were recorded by using global positioning system (SPI Elite, GPSports, Australia) and analyzed using Team AMS (v2014.11) software during 2015 Chinese National Tournament. All the matches were filmed by using two high definition cameras (HDR-SR12E, Sony, Japan), which were placed on the top of the stadium and filmed each half field respectively. Exact timing, including beginning and ending of each quarter, timing and details of substitutions, playing time of each player and positional changes, were reviewed post-match and used to edit the GPS data. Multiple paired t-tests were used to compare data between different positions and different quarters. Significance was set at $P \leq 0.05$. Average values were used to compare differences between new rules' and old rules' hockey matches.

RESULTS: The mean total distance covered by each player was 5788 ± 1710 m, and overall mean playing time was 37.8 ± 14.0 min. Compared with other positions, strikers had a significantly greater high-intensity activity (>14 km/h) percentage (strikers: $29.7 \pm 4.8\%$; midfielders: $25.6 \pm 5.8\%$; defenders: $17.9 \pm 3.3\%$; $P < 0.01$). Average sprint (defined as speed >19 km/h, interval of at least 1 second) counts for each player was 25.5 ± 9.9 per match, with an average duration of 2.5 ± 0.3 s. About 75% of sprint distances were between 5-20m, with recovery times varying greatly, however the two most frequently observed recovery times were >120 s (36%) and 0-40s (35%). The average repeated-sprint (defined as time interval between two sprints was less than 60s) counts were 11.4 ± 6.9 , and the average percentage of repeated-sprint counts and average recovery interval of repeated-sprints were $40.1 \pm 16.8\%$ and 23.0 ± 8.3 s respectively.

CONCLUSIONS: These results suggest that players are required to complete more high intensity bouts in a shorter time period (37.8 ± 14.0 vs. 51.9 ± 17.8 min) however average total distance was less under the new IHF rules.

Supported by NSSFC and Xinmiao Project through key project 13BTY049 and 2016R40593.

2666 Board #186 June 2 9:30 AM - 11:00 AM

An Examination of Body Mass Index Influence on Activity Tracker Accuracy

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(No relationships reported)

A variety of activity trackers with evolving technology are commercially available, yet it remains uncertain the influence body size has on these devices' accuracy (as previous activity trackers have been), which would compromise their generalizability.

PURPOSE: To examine the accuracy of consumer-grade activity trackers in quantifying steps and moderate-vigorous physical activity (MVPA) engagement in free-living conditions in a diverse sample of body mass index (BMI) categories. **METHODS:** Sixty individuals (21.1 ± 1.5 years, 2.3 ± 0.2 ft stride length) across three BMI categories ("Normal" [$n=25$]: $20-24.9$ kg/m²; "Overweight" [$n=22$]: $25-29.9$ kg/m²; "Obese" [$n=13$]: ≥ 30 kg/m²) wore four activity trackers during one 24-hour day (wear time 12.7 ± 1.9 hours). On the non-dominant side of the body, the Fitbit Charge HR (Charge) and Jawbone UP3 (UP3) were worn on the wrist and the Fitbit One (ONE) on the waist, with the NL1000 activity tracker (NL; serving as the criterion device) worn on the dominant side of the waist. Mixed between-within ANOVA analyses were performed to examine differences in steps and MVPA for the activity trackers across three BMI categories. **RESULTS:** There were no differences in steps or MVPA for the individual devices across BMI categories. In the Normal group, the UP3 (6667 ± 3366 steps) and ONE (7400 ± 8135 steps) underestimated steps ($p=0.000$), compared to the NL (8135 ± 3562 steps). Similarly, in the Overweight group, the UP3 (8799 ± 3986 steps) and ONE (9019 ± 3841 steps) underestimated steps (NL 9312 ± 3986 steps, both $p < .05$). In the Obese group the Charge overestimated

steps (8847 ± 4168 , $p < .05$) and the ONE underestimated steps (7726 ± 3791 , $p < .05$), compared to the NL (8224 ± 4264 steps). The UP3 overestimated MVPA in the Normal group (67.7 ± 44.3 minutes), compared to the NL (27.6 ± 16.3 , $p = .000$). In both the Overweight and Obese groups, the UP3 overestimated MVPA (Overweight: 81.5 ± 44.3 minutes, Obese: 77.5 ± 39.4 minutes, both $p = .000$), whereas the ONE underestimated MVPA (Overweight: 25.9 ± 26.5 minutes, Obese: 19.5 ± 25.3 minutes, both $p < .05$), compared to the NL (Overweight: 36.6 ± 19.2 minutes, Obese: 31.6 ± 27.3 minutes). **CONCLUSION:** Within BMI groups, the UP3 underestimated steps and overestimated MVPA, the ONE underestimated steps and MVPA, whereas the Charge performed relatively well for both measures.

2667 Board #187 June 2 9:30 AM - 11:00 AM

Accuracy of Garmin and Polar Smart Watches to Predict VO₂max

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(No relationships reported)

Smart watches have greatly evolved since their first release. With advancements in technology, many smart watches can now estimate aerobic capacity. These watches are user-friendly and affordable but there are no current investigations that have reported accuracy to predict VO_{2max}. **PURPOSE:** The purpose of this study was to compare actual VO_{2max} values (AMax) to predicted VO_{2max} values obtained from the Garmin Forerunner 230 (230Max) and 235 (235Max) smart watches as well as the V800 Polar smart watch (PMax). The Garmin watches predict VO_{2max} based upon heart rate values obtained during a 10 min, self-paced outdoor run. The Polar watch predicts VO_{2max} based upon resting heart rate variability. **METHODS:** Eighteen females (BMI=24.9 \pm 3.3 kg/m², age=24.7 \pm 3.8, AMax=42.9 \pm 4.8 ml/kg/min) and 24 males (BMI=26.6 \pm 3.3 kg/m², age=24.2 \pm 4.4, AMax=49.5 \pm 5.8 ml/kg/min) participated in this study. PMax values for each individual were obtained following a 10 min supine rest and were based upon the different training ranges that can be programmed into the watch. Participants then completed a treadmill VO_{2max} test. Within 48 hours of completing the treadmill VO_{2max} test, individuals completed a 10 min, self-paced outdoor run using both Garmin smart watches. Paired sample T-tests were used to determine if there were differences between AMax and the predicted VO_{2max} of each watch. **RESULTS:** There were significant differences between AMax and PMax (2.5 \pm 6.8 ml/kg/min, $p = 0.029$), 230Max (-0.3 \pm 3.4 ml/kg/min, $p = 0.02$) and 235Max (-1.1 \pm 4.0 ml/kg/min, $p = 0.026$) in females. In males there were significant differences between AMax values and PMax (-6.0 \pm 7.7 ml/kg/min, $p = 0.001$), 230Max (-1.1 \pm 3.4 ml/kg/min, $p = 0.149$) and 235Max (-3.2 \pm 4.2 ml/kg/min, $p = 0.002$). **CONCLUSION:** In females, predicted VO_{2max} values were significantly different from AMax values and the differences ranged from an overestimation of 2.5 ml/kg/min to an underestimation of 1.1 ml/kg/min. In males, predicted VO_{2max} values were significantly different from AMax values and the watches consistently overestimated VO_{2max} (range -1.1 to -6.0 ml/kg/min). Caution should be taken when using these predicted values for exercise prescription especially in men.

2668 Board #188 June 2 9:30 AM - 11:00 AM

Comparison Of Vo2Max Values Obtained From The Garmin Forerunner 230 And 235

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(No relationships reported)

The use of optical sensing technology has provided exercise watches with the ability to assess heart rate without the need of a chest strap. The Garmin Forerunner 230 (G230) and 235 (G235) are identical watches with the exception that the G230 uses a chest strap to measure heart rate (HR) and the G235 measures HR via an optical sensor built into the watch. The use of a chest strap to measure exercise HR is a proven and reliable technology whereas the use of an optical sensor to measure exercise HR is still a developing technology. Both watches provide an estimate of VO_{2max} (PMax) based upon distance ran and HR during a self-paced 10 min outside run. Average HR (AHR), maximal HR (MHR), cadence, and kcals are also recorded. **PURPOSE:** The purpose of this study was to compare PMax, AHR, MHR, distance, kcals, and cadence values obtained from the G230 and the G235 during a self-paced 10 min outside run. **METHODS:** Eighteen females (BMI=24.9 \pm 3.3 kg/m², age=24.7 \pm 3.8, VO_{2max}=42.9 \pm 4.8 ml/kg/min) and 24 males (BMI=26.6 \pm 3.3 kg/m², age=24.2 \pm 4.4, VO_{2max}=49.5 \pm 5.8 ml/kg/min) reported to a paved trail, free of any GPS interference to complete a self-paced 10 min run while wearing both watches and the HR strap associated with the G230. Participant's gender, age, height, and weight were also entered into each watch before the run. **RESULTS:** In females, AHR was significantly higher in the G230 (4.3 \pm 4.8 bpm, $p = 0.004$) but there was no significant differences in PMax (-0.8 \pm 1.86 ml/kg/min, $p = 0.118$) when compared to the G235. In males, AHR was significantly higher in the G230 (8.1 \pm 15.2 bpm, $p = 0.028$) and the PMAX was significantly lower in the G230 (2.1 \pm 2.0 ml/kg/min, $p = 0.000$) when compared to the G235. There were no significant differences between watches for MHR, distance, cadence, or kcal in females or males. **CONCLUSION:** The AHR values from the

G230 were significantly higher than the values from the G235 in both males and females. The PMax values from the G230 were significantly lower than the values from the G235 in men. In males, the differences in AHR are responsible for differences in PMax between watches since there are no differences between the other variables measured during the run. Caution should be taken when using exercise HR values obtained from an optical sensor.

2669 Board #189 June 2 9:30 AM - 11:00 AM

The Validity And Agreement Of Running Distance Measurements By A Consumer Accelerometer And Gps

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(No relationships reported)

Distance running is a tremendously popular sport/fitness activity amongst US adults. Individualizing training volume (i.e., distance) is necessary to optimize training responses and reduce injury risk. While personal global positioning satellite (GPS) devices are a validated means of accurately measuring distance, the validity of distance measurements by accelerometer-based physical activity monitors is unknown.

PURPOSE:

Assess the concurrent validity and agreement of distance measurements by a commercially-available physical activity monitor to those of a personal GPS device during self-paced running.

METHODS:

Twenty-four recreational runners ($n = 12$ females) wore a personal GPS (Garmin ForeRunner 10, GPS) and commercially-available physical activity monitor (MOVband accelerometer, MB) on the dominant wrist during three separate outdoor training runs. Participants followed their normal training schedules, such that the pace and duration of each run was voluntarily determined by the participant. The association between MB and GPS distance measurements was determined using Pearson's correlation analysis. The 95% limits of agreement between MB and GPS were calculated according to the method of Bland and Altman. Specifically, the upper and lower limits of agreement were calculated as the mean of the differences (d) between GPS and MB \pm (1.96 x the standard deviation of the differences), expressed as: $d \pm 1.96s$.

RESULTS:

There was a significant, positive association of a large effect size between measurements of distance by GPS and the commercially-available physical activity monitor (MB) ($r = 0.763$, $p < 0.001$). However, the calculated limits of agreement (-1.946 to 2.025km) between GPS and accelerometer measurements suggest that individual MB measurements may be up to 2km above or below GPS.

CONCLUSION:

We suggest that non-GPS distance measurements by commercially-available physical activity monitors may be useful for monitoring overall, cumulative volume for health and fitness purposes. However, these measurements fall short of GPS when high accuracy is needed, as in training programs designed to enhance performance. These findings cannot be generalized to all accelerometer devices.

2670 Board #190 June 2 9:30 AM - 11:00 AM

Accuracy of Wearable Devices for Determining Physiological Measures during Different Physical Activities

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(No relationships reported)

PURPOSE: Wearable technology is ACSM's number one 2016-2017 fitness trend. The accuracy of these devices has yet to be firmly established. The objective of the study was to determine the validity of wearable devices' assessment of step count, heart rate (HR) and caloric expenditure (KCAL) during various physical activities.

METHODS: Thirty college students (19 female, 11 male) engaged in 3 activity sessions (sweeping with a broom and dustpan, climbing stairs, and walking 1/4 mile) while wearing an Apple Watch Sport, Fitbit Charge HR, Accusplit Hip Pedometer, and iPhone 6 Plus. Step counts from devices were compared to those objectively recorded using a tally counter. Subjects also completed a treadmill graded exercise test during which HR and KCAL were reported by an Apple Watch Sport, Fitbit Charge HR, and Polar T-31. Values were compared to those from a six-lead ECG and metabolic analyzer. HR was recorded at rest and during each stage. KCAL was determined at the end of the protocol.

RESULTS: Correlations between objective step counts and from the devices were: walking (.08 to .84), stair climbing (.12 to .90), and sweeping (.12 to .70). No device

was accurate across all activities. The most accurate devices for activities were: walking (Apple Watch, $r=.84$); stair climbing (iPhone, $r=.90$); sweeping (Fitbit, $r=.70$). During the treadmill test, correlations between HR assessed via ECG and devices were: Apple Watch (.76 to .99), Polar T-31 (.72 to .94), and Fitbit (.19 to .98). Heart rate accuracy across the session was highest in the Apple Watch. KCAL from neither the Apple Watch ($r=.63$) nor Fitbit ($r=.48$) had a high correlational value to that from the metabolic analyzer.

CONCLUSIONS: Fitness-related values provided by wearable devices had varying levels of accuracy when compared to objective step counts, HR and KCAL assessed by calibrated scientific equipment. Accuracy of step counts varied by activity and was higher across activities in the iPhone. HR reported from wearable devices, similarly, had varying levels of accuracy, with the Apple Watch being most accurate across a graded exercise test. Fitness-related information from wearables that are not medical devices and should be considered as estimates and used for motivation. Further validation of these devices should include a variety of physical activity modalities.

2671 Board #191 June 2 9:30 AM - 11:00 AM
Validity Of The Diagnostix™ 2100 And Fitbit Charge HR™ In Assessing Heart Rate

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The importance of exercise intensity is an important factor when maximizing the health benefits that result from exercise. New innovations in consumer based activity trackers and electronic healthcare monitoring devices have been able to quantify the level of exercise intensity based on heart rate (HR) values. However, there is limited research assessing the validity of these devices. **PURPOSE:** To assess the validity of the Fitbit Charge HR (FB) and ACSC Diagnostix 2100 Fingertip Pulse Oximeter (PO) in assessing heart rate during exercise in comparison to the heart rate from an electrocardiogram (EKG).

METHODS: Healthy college students ($n=30$, 18 females) performed 1 min of standing rest, 10 min of the standard Bruce Protocol test on a treadmill, and a 2 min cool-down walk. Each participant simultaneously wore the FB on the right wrist, the PO on the right index finger, and had 10 electrodes placed on their chest for the 12-lead EKG. HR was recorded from each device every minute. Absolute differences between the 3 HR monitors were compared using repeated measures ANOVA. Pearson r correlation coefficients and Standard Error of Estimate (SEE) were calculated to determine the relationships between each HR monitor vs. EKG.

RESULTS: Repeated measures ANOVA indicated a significant difference in HR between the 3 monitors, $F(2,58)=16.876$, $p<0.001$. Post hoc tests indicated a significant difference between EKG and FB (132.1 ± 13 vs. 120.5 ± 13.7 bpm, $p<0.001$), and EKG and PO (132.1 ± 13 vs. 121.9 ± 15.5 bpm, $p<0.001$). The correlation between the EKG and FB was $r=0.64$, $p<0.001$, SEE 10.2 bpm, whereas the correlation between EKG and PO was $r=0.63$, $p<0.001$, SEE 10.2 bpm.

CONCLUSIONS: Large absolute differences and modest correlation values do not indicate a strong agreement between the FB or PO vs. EKG. Therefore, the extent of each device's validity to monitor HR is questionable when compared to the gold standard EKG.

2672 Board #192 June 2 9:30 AM - 11:00 AM
Validity of the Fitbit® Distance Traveled Feature Among Multiple Speed Trials

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A science review by Delago (2014) suggested that the distance-traveled feature on Fitbit® was an accurate measurement. However, as speed increased the accuracy of the Fitbit® decreased, meaning the faster the pace, the greater the error for distance measured. Whereas a systematic review conducted by Evenson et al. (2015) reported only one study that measured the distance-traveled feature. This study concluded that the Fitbit® over-estimated at lower speeds and underestimated at faster speeds. **PURPOSE:** To examine whether the fitness device, Fitbit® Charge, provides an accurate measurement of the distance-traveled feature at various speeds and to expand on the research regarding the distance-traveled feature. **METHODS:** Twenty-eight healthy students from a Division III college participated in this study. A repeated measure ANOVA experimental design compared the Fitbit® distance-traveled output under three dependent variable speeds of 2.5mph (76.1m/min), 4.5mph (120.7m/min), and 6mph (160.9m/min) to a Quinton MedTrack ST55 treadmill distance-traveled measurement. All participants completed a six-minute trial for each of three different speeds on a treadmill while wearing the Fitbit® Charge. Following each six-minute trial, the distance-traveled was compared between the treadmill and the Fitbit® output. A repeated measure ANOVA analysis was used to test for significant differences ($p < .05$) among the three speeds between the Fitbit® and the treadmill. **RESULTS:**

Results did not detect significant differences in distance-traveled between the Fitbit® Charge compared to the treadmill at 2.5mph ($F(1,27) = 0.67$, $p = .42$), 4.5mph ($F(1,27) = 2.45$, $p = .13$), or 6mph ($F(1,24) = .66$, $p = .43$) speeds. **CONCLUSION:** It seems reasonable to conclude that the distance-traveled feature on the Fitbit® Charge is valid when compared to treadmill output at these three speeds. Future research could look at a wider range of speeds to ensure further accuracy. IRB# 1516-0099

2673 Board #193 June 2 9:30 AM - 11:00 AM

Measuring Acceleration of a Trampoline Circus Act during Training and In-Show Using Wearable Technology

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Circus performance acts incorporate a variety of unique movements. Professional artists are often performing these acts in multiple shows a day and/or week on top of completing regular training of the acts. However, there is limited understanding of the mechanical demands of the acts. The emergence of wearable technology has allowed for measuring some mechanical aspects of these highly complicated acts.

PURPOSE: Compare acceleration profiles of a trampoline circus act recorded during training and in-show. **METHODS:** Seven acrobats (1.75 ± 0.05 m; 78.83 ± 4.49 kg; 28.93 ± 3.3 years) performed 3 training acts on separate days and 2 show acts on one day. Following the completion of the show, participants reported their rating of perceived exertion (1-10 scale). Tri-axial accelerations were measured using a commercial accelerometer system (Hexoskin, Carre Technologies Inc, Montreal, CA) with the accelerometer located on the lateral aspect of the right hip. Average resultant acceleration (AVG) was calculated each trial during training (3 trials) and show (2 trials). Time based acceleration data were also classified into 5 ranges: $0 \leq$ Very Low < 0.1 g; $0.1 \leq$ Low < 0.3 g; $0.3 \leq$ Moderate < 0.6 g; $0.6 \leq$ High < 1 ; $1 \leq$ Very High ≤ 16 g. Relative time spent in each range was averaged during training and in-show. Dependent variables were compared using paired-sample t-tests and a repeated-measures ANOVA. **RESULTS:** AVG was significantly higher during training vs. in-show (0.525 ± 0.12 g vs. 0.467 ± 0.098 g; $p=0.030$, effect size= 0.53). RPE was significantly lower during training vs. in-show (2.757 ± 0.53 vs. 3.429 ± 1.10 ; $p=0.027$). RM ANOVA revealed no interaction between acceleration ranges and environment ($p>0.05$), and no main effect for environment ($p>0.05$). Time spent in acceleration ranges was influenced by level ($p<0.05$) such that there was a both a linear and cubic trend across bin levels. **CONCLUSION:** The lower AVG may reflect that the show environment promotes less intense movements to maintain synchronization with co-artists. Wearable technology may be useful for analyzing show movements in a way to better develop effective training programs.

Supported by Cirque Du Soleil

2674 Board #194 June 2 9:30 AM - 11:00 AM

Equivalence Of Self-report And Accelerometer Measures Following A Physical Activity Intervention.

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The International Physical Activity Questionnaire (IPAQ) is a validated and widely used self-report physical activity (PA) measure, however findings about validity have been somewhat equivocal.

Purpose: This study evaluated the agreement of the IPAQ measure with a novel and objective activity monitoring method known as Sojourns Including Posture (SIP). The SIP method is based on the same bout detection method as the more established Sojourn method but incorporates data from the ActivPAL to provide more robust information about transitions between Sedentary and Light activity. The aim was to investigate differences between self-reported moderate (MPA), vigorous (VPA), and sedentary (SED) minutes to SIP data, to inform whether participants were able to accurately self-report PA and SED time.

Methods: A sample of 93 inactive adults (53% female; 42 ± 9.1 mean age) participated in this study. Participants received a wearable device to track PA. Post-intervention, individuals wore accelerometers for 1 week, and self-reported PA and SED via the IPAQ. Minutes of MPA, VPA, and SED from each measure were compared using Pearson correlations, equivalence testing, and Bland-Altman plots, with the SIP method as the criterion.

Results: The overall Pearson correlation between the measures was low to moderate ($r = 0.37$, $P < .05$). The mean MPA via IPAQ was 96.9 ± 87.8 minutes per day compared to 57.3 ± 24.4 minutes per day measured by SIP. Mean VPA from the IPAQ was 8.99 ± 6.76 minutes, while the SIP method reported 14.44 ± 9.51 minutes. The mean SED via the IPAQ was 456.6 ± 156.93 minutes compared to 546.13 ± 104.42 minutes measured by SIP. Equivalence testing demonstrated that the MPA, VPA, and SED methods were

not equivalent at the $\pm 10\%$ equivalence zone. A Bland Altman plot was constructed to visualize the MPA data using 95% limits of agreement that are between -121.1 and 200.4. More data points trended below the mean of 39.65, suggesting proportional bias that self-report overestimated activity.

Conclusions: This study provides some support for the use of the IPAQ, but confirms the common observation in self-report instruments with participants tending to overestimate their participation in MPA and underestimate sedentary time. The use of measurement error modeling and calibration methods may be needed to address this error in future studies.

2675 Board #195 June 2 9:30 AM - 11:00 AM

Validation of Three Wearable Fitness Trackers for Measuring Physical Activity in College Students

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Many wearable fitness trackers have a function measuring physical activity such as energy expenditure but the accuracy of the measures is unclear. **PURPOSE:** The aim of the study was to validate the energy expenditure estimation of three fitness trackers: LT, FB, and AW for treadmill walking and running. **METHODS:** The participants of the study were 30 college students (17 males and 13 females) from a public university in Pennsylvania. All participants completed six trials of 10-minute walking and running activities on a treadmill at speeds of 54, 80, 107, 134, 161, & 188 m²min⁻¹. Participants were wearing all the fitness trackers and connected to indirect calorimetry during the exercise protocol. All devices provided caloric expenditure while the indirect calorimetry was used as a criterion measure. Resting Metabolic Rate was collected along with a familiarization trial prior to the execution of the exercise protocol. Two-way ANOVA with repeated measures and Pearson Correlation were used to compare the caloric expenditure estimates between the criterion and three fitness trackers. **RESULTS:** There were no significant differences in energy expenditure estimates between the criterion and AW (mean difference 4.6 kcal, $p > 0.05$), nor criterion and LT (mean difference 0.8 kcal, $p > 0.05$). However there was a significant difference between the criterion measure and FB (mean difference 18.2 kcal, $p = 0.001$). Pearson correlation coefficients (r): the criterion of indirect calorimetry-derived activity energy expenditure yielded the strongest positive correlations with activity energy expenditure estimated from the AW at all speed levels (range from .55 to .85, all $ps < 0.01$). FB was positively correlated to the criterion measure at five speed levels (range from .46 to .67, $ps < 0.05$). No positive correlation was found between the criterion and LT measures (range from -.40 to .26). **CONCLUSION:** AW and FB demonstrated a moderate to high level of validity on measuring physical activity while LT had a low level of validity.

2676 Board #196 June 2 9:30 AM - 11:00 AM

Accuracy of Activity Monitors During Treadmill Tests

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A number of monitors that provide estimates of physical activity have flooded the market recently. These monitors, worn at the hip, wrist, arm or around the chest, claim to measure step count, heart rate and/or energy expenditure. **PURPOSE:** To compare physical activity estimates among several of the most popular new monitors during physical activity performed at different intensities. **METHODS:** Forty-six participants were fitted with four physical activity monitors. Subjects walked, jogged and ran on a treadmill at 3, 5, and 7 mph, each for 3 minutes. Heart rate, step count, and rate of perceived exertion (RPE) were recorded during the last minute of each stage from each device that assesses that variable. Actual step count was recorded via a hand-held clicker device. Step count from all monitors was compared to the step count from the clicker. Individual two-way t-tests were used to check for significant differences. **RESULTS:** The results of this study are mixed. For stages 1 (3 mph) and 2 (5 mph), the wrist and arm worn monitors produced significantly different ($p < .05$) step counts than the clicker, while the waist worn monitor produced non-significant differences. For stage 3 (7mph), both wrist worn monitors produced non-significant differences in comparison to the clicker, while the arm and waist worn devices produced significant difference ($p < .05$). **CONCLUSIONS:** The four physical activity monitors produced conflicting results. The waist worn monitor was accurate at the slower speeds, but inaccurate at the higher speed. The wrist worn monitors were inaccurate at the slower speeds, but accurate at the high speed. The arm band monitor was inaccurate under all conditions. Caution should be used when electing to utilize physical activity monitors to estimate physical activity.

2677 Board #197 June 2 9:30 AM - 11:00 AM

Assessing Physiological Function During a High-Altitude Hike Using Real-time Monitoring

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Assessing the physiological responses to exercise at high altitude in real time or using cloud-based data storage has important implications for remote monitoring of human health and well-being in challenging environments. **Purpose:** To determine the feasibility of using real-time monitoring to assess the cardiovascular responses to a simulated climb for military operations. **Methods:** Seventy-four male (age = 21.9 \pm 2.2 yrs, height = 1.78 \pm .02 m, weight = 78.2 \pm 9.7 kgs) sea level (SL) residents volunteered to participate in this study after giving informed consent and completing the Army Physical Fitness Test. Subjects were flown from SL to high altitude (HA) and completed a 5.9-km hike with a 35-pound rucksack that began at 3239 m and finished at 3840 m the morning after arrival at HA. They were instructed to complete the course as fast as possible. Heart rate (directly from ECG), breathing rate and depth, and step count (cadence) were assessed using a shirt with built-in sensors (Carre Technologies inc., Hexoskin). In 73 out of 74 of the subjects, the Hexoskin was effective at collecting all of the hike data. For analysis, the 5.9 km course was divided into four equal segments (Segment 1 = 0-25%, 2 = 25-50%, 3 = 50-75%, 4 = 75-100%) based on step count. Elevation gain for each of the segments was determined from topographical maps (Segment 1 = 123 m, 2 = 178, 3 = 142 m, and 4 = 262 m). Average and maximal heart rates were calculated for each of the segments. **Results:** Average heart rates were 140.1 \pm 18.1 bpm, 161.9 \pm 5.8 bpm, 159.2 \pm 6.4 bpm, and 161.5 \pm 6.2 bpm respectively for the four segments corresponding to 74.5%, 86.1%, 84.6%, and 85.9% of estimated heart rate max. The heart rates reflected the elevation gain except for Segment 4 which had the greatest elevation gain but similar heart rates to Segment 3. Further analysis of the Hexoskin data indicate that subjects had more stops during this segment (73% of all stops occurred in Segment 4) which resulted in an overall lower average. **Conclusions:** These results suggest that real-time monitoring for multiple variables simultaneously (heart rate, ECG, step count) in the field is a viable means of assessing physiological function and simulating a military operation with a 610 m elevation gain results in relatively high heart rates that generally reflect elevation gain.

2678 Board #198 June 2 9:30 AM - 11:00 AM

Accuracy of Smart Phone Application to Monitor Heart Rate

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Smart phones applications to monitor heart rate are very popular. The application examined in this study has millions of installs, with one application boasting of 35 million plus users (application store info). However, there is limited research available on the validity of these applications. An earlier study found a camera-based application to be accurate (McCurley, et al., 2013), but the study examined a single smart-phone platform. **PURPOSE:** The purpose of this study was to examine the accuracy of a popular heart rate application on two smart phone platforms while resting and during moderate exercise. **METHODS:** The same heart rate monitor application was chosen for two different technology platforms. The application was required to be free and allow multiple heart rate readings per day. Participants were split into two groups based on technology platform. Both groups were monitored using electrocardiograph (ECG) and the smart phone application seated pre-exercise and during an exercise session on an elliptical machine. Measurements were recorded every minute. Data were analyzed using correlations and t-tests between platforms. All data were analyzed for both seated and exercise heart rate averages. **RESULTS:** For technology platform 1, heart rate while seated correlation for the application was $r = 0.98$ (11% missing data) and for platform 2 was $r = 0.60$ (21% missing data). For platform 1, heart rate during exercise correlation for the application was $r = 0.30$ (44% missing data) and for platform 2 was $r = 0.20$ (6% missing data). There was not a significant difference in heart rate while seated, t -test (-1.33), $p = .197$ nor exercise heart rate, t -test (-1.54), $p = .142$ when comparing means of the two platforms. **CONCLUSIONS:** Smart phone applications to monitor heart rate appear to be fairly accurate, particularly at rest. Although these should not be used as a replacement for constant heart rate monitoring tools, they may be useful to allow home monitoring or a quick check of heart rate,

particularly when the individual is not moving. Introducing movement reduced the accuracy of the applications and care should be taken when interpreting readings taken during exercise.

2679 Board #199 June 2 9:30 AM - 11:00 AM
The Validity Of A Novel, Low-cost, Wearable Physical Activity Monitor In A Laboratory Setting

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 (No relationships reported)

Low-cost, consumer-grade, wearable physical activity monitors are increasingly popular for personal use and may provide a more accurate measure of physical activity than subjective methods (e.g., self-report) while being less expensive than research-grade accelerometers. Because of their popularity in individuals wishing to monitor their personal physical activity behavior and their potential merits in a research setting, assessments of the validity of these devices is warranted. **PURPOSE:** To assess the validity of a novel, low-cost, wearable physical activity monitor (Movband 3) relative to established measures physical activity intensity during treadmill exercise. **METHODS:** Participants ($N = 19$) completed four, ten-minute treadmill stages (1.5, 3.0, 4.0, 6.0 MPH) while wearing the Movband 3 on their wrist and the previously-validated Actigraph GT1M monitor around their waist. During each treadmill stage, relative oxygen consumption (VO_2 ml/kg/min) and heart rate (beats/min) were recorded via indirect calorimetry and telemetry monitoring, respectively. The relationship between Movband counts and Actigraph counts, VO_2 , and heart rate were then assessed via Pearson's correlation analyses. The relationship between miles traveled as reported via the Movband and actual miles traveled on the treadmill was assessed via correlation and tests of agreement as established by Bland and Altman.

RESULTS: There were large, positive effect sizes for the associations between Movband counts and Actigraph counts ($r = 0.72$), VO_2 ($r = 0.59$), and heart rate ($r = 0.63$). There was also a large, positive association between Movband miles and actual miles traveled ($r = 0.97$). These correlations would support the validity of the Movband. However, the difference (Δ) between Movband miles and actual miles was greater than a null hypothesis of zero ($\Delta = 0.3 \pm 0.4$ miles, $t = 8.4$, $p < 0.001$) and there was a significant positive association between Δ and the mean of the Movband and treadmill miles ($\beta = 0.54$, $p < 0.001$). This indicates a lack of agreement.

CONCLUSIONS: There was evidence to support the validity of the Movband 3 for the assessment of physical activity intensity in a laboratory setting. However, while this device is associated with measures of exercise intensity it does not provide an accurate measure of miles traveled.

E-34 Free Communication/Poster - Muscle Adaptations, Atrophy, and Hypertrophy

Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2680 Board #200 June 2 11:00 AM - 12:30 PM
Differentiating Swelling and Hypertrophy Following Repeated Bouts of Resistance Exercise

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 (No relationships reported)

Previous studies have examined the swelling response following a single bout of exercise; however, no study has looked at the muscle swelling response across several bouts of resistance exercise.

PURPOSE: To examine the muscle swelling response over an 8-day period consisting of four separate traditional resistance exercise bouts.

METHODS: Nine untrained males visited the lab on nine occasions. Visit 1 consisted of one repetition maximum (1RM) testing. Participants then visited the lab for eight consecutive days separated by 24 hrs. During visits 2, 4, 6, and 9 participants performed 4 sets of 10 repetitions of biceps curls (or time matched rest on control arm) at 70% of their 1RM. Muscle thickness (MTH) was measured at 50, 60 and 70% the distance from the acromion process to the lateral epicondyle before and after exercise. During Visits 3, 5, 7, and 8 there were measures of MTH taken but no exercise.

RESULTS: There was an interaction ($p < 0.003$) for MTH at all sites. MTH at the 50% site increased from 3.1 (0.2) to 3.4 (0.2) cm immediately following the first exercise bout, returning back near baseline by visit 4 pre [3.2 (0.2) cm]. Similar increases were noted immediately post exercise on visit 4 [3.5 (0.1) cm], 6 [3.4 (0.1) cm], and 9 [3.5 (0.2) cm]. MTH at the 60% site increased from 3.3 (0.3) to 3.7 (0.3) cm following

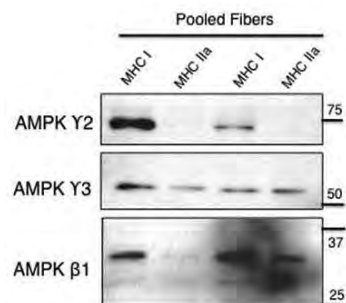
the first exercise bout, decreasing near baseline by visit 4 pre [3.4, (0.3) cm]. Similar increases were noted immediately post exercise on visit 4 [3.8 (0.3) cm], 6 [3.8 (0.3) cm], and 9 [3.8 (0.3) cm]. MTH at the 70% site increased from 3.6 (0.4) to 4.1 (0.4) cm following the first exercise bout, decreasing near baseline by visit 4 pre [3.8 (0.3) cm]. Similar increases were noted immediately post exercise on visit 4 [4.2 (0.4) cm], 6 [4.2 (0.3) cm], and 9 [4.2 (0.3) cm]. The control arm displayed a slight baseline shift (non-significant at most time points $p > 0.05$). Differences between the exercise and control arm were only observed immediately post exercise, except at the 50% site during visit 6.

CONCLUSIONS: Resting levels of MTH do not appear to change appreciably beyond what occurs following the first naïve bout of resistance exercise. We suggest that naïve resistance exercise appears to produce a baseline shift in MTH, which may represent the threshold needed to be surpassed in order to assume real muscle growth has occurred.

2681 Board #201 June 2 11:00 AM - 12:30 PM
AMPK Subunit Isoform Expression Differs Between Human Skeletal Muscle Fiber Types

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 (No relationships reported)

AMP-activated protein kinase (AMPK) is an energy-sensing regulator of cellular metabolism that is activated during acute exercise and mediates long-term adaptations through initiation of gene expression programs. Previous studies on AMPK in human skeletal muscle have analyzed protein expression and activation in whole muscle biopsy samples, though more recent studies show AMPK protein expression is highly dependent on myosin heavy chain (MHC) fiber type. Additionally, transgenic animal studies indicated AMPK regulates exercise-induced MHC fiber type conversion. **PURPOSE:** Evaluate methods of detecting human skeletal muscle fiber type-specific expression for all known AMPK subunit isoforms. **METHODS:** Individual fibers from a tissue sample (biopsy) of the vastus lateralis were mechanically isolated under a microscope. Each fiber was partitioned with tweezers such that portions were available for both fiber typing (SDS-PAGE) and protein quantification (western blotting). Analyses of signaling kinases from single fibers present challenges regarding detection of protein from small sample sizes. To address this technical issue, we pooled several fibers (10-20) of the same type together following fiber type identification. **RESULTS:** AMPK of subunit isoform $\gamma 2$ (regulatory subunit) and $\beta 1$ (scaffolding subunit) expression is noticeably elevated in MHC I vs. MHC IIa fibers (Figure 1). This concurs with previous results for $\beta 1$, but represents the first fiber type-specific identification of $\gamma 2$. **CONCLUSIONS:** AMPK expression is detectable through our fiber type-specific method. Moreover, subunit isoform concentrations appear to differ between MHC I and MHC IIa fibers in human skeletal muscle, thus emphasizing key metabolic signaling differences between fiber types. These pilot methodological studies support future larger scale investigations of AMPK subunit isoform adaptations in single fibers at rest and in response to acute and chronic stimulations.



Western blot of AMPK subunit isoforms $\gamma 2$, $\gamma 3$ and $\beta 1$. Each lane is loaded with 10-21 fibers of the same type (MHC I or MHC IIa as identified by SDS-PAGE).

2682 Board #202 June 2 11:00 AM - 12:30 PM
Effects Of Resistance Training During 8-week Bed-rest On Intramuscular-fat And Muscle-tissues Of The Thigh Muscle Groups

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We know that muscle tissue size is inversely associated with the amount of intramuscular fat (Akima et al. 2015). In prolonged bed-rest, atrophy of lower-limb muscle occurs, implying that an increase of intramuscular fat may occur in parallel. Successful countermeasures, such as resistance training, may also affect the amount of intramuscular fat. Given that muscles atrophy at different rates in disuse (Belavý et al. 2009), the adaptation in intramuscular adipose tissues may also muscle specific. **PURPOSE:** The purpose of this study was to quantify the effect of exercise during 8-week bed-rest on intramuscular fat and muscle tissue in individual thigh muscle groups. **METHODS:** Twenty-one men were randomized to either 8-week bed-rest with resistance exercise (TR-group, n = 13) or no exercise (CTR-group, n = 8). The training was performed 3 days a week and consisted of bilateral leg press, single and double leg heel raises, and back and forefoot raise. Axial images of the mid-thigh were taken before and after the bed-rest using magnetic resonance imaging. Intramuscular fat cross-sectional area (CSA) and muscle tissue CSA were measured in quadriceps femoris (QF), adductors (AD) and hamstrings (HM). We calculated the percent change of intramuscular fat CSA between before and after the bed-rest. **RESULTS:** After bed-rest, muscle tissue CSA in CTR was significantly decreased compared to before bed-rest in all muscle groups (p < 0.05), whereas muscle tissue CSA did not change in the TR-group. Intramuscular fat CSA in individual muscles did not change after bed-rest in either group (QF: CTR 7.3 ± 20.6 % vs. TR -38.0 ± 31.4 %, AD: CTR -3.8 ± 19.7 % vs. TR -34.2 ± 26.1 %, HM: CTR -9.6 ± 26.8 % vs. TR -33.6 ± 30.1%). However, for intramuscular fat of all muscle groups pooled a significant difference between the groups was observed with a reduction of intramuscular fat in the TR group (CTR 1.0 ± 13.9 % vs. TR -36.2 ± 28.2 %, P=0.004). **CONCLUSION:** Resistance training during 8-week bed-rest reduces thigh muscle atrophy and results in a reduction in intramuscular fat. No evidence was seen on the impact of bed-rest itself, in inactive subjects, on intramuscular fat in the thigh muscle groups.

2683 Board #203 June 2 11:00 AM - 12:30 PM
Influence Of Dpp-iv And Cd26+ T-cells On Il-6 Following Doms Protocol In College-aged Participants

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(No relationships reported)

PURPOSE: To determine the influence of delayed onset muscle soreness (DOMS) on the relationship between dipeptidyl peptidase IV (DPP-IV), CD26+ T-cells, and interleukin 6 (IL-6) over time.

METHODS: Six college-aged participants (male n=3, female n=3) underwent an established bicep brachii DOMS protocol. Blood was collected on the DOMS induced arm via venipuncture to measure local plasma DPP-IV activity, plasma IL-6, and CD26+ activated T-cells. Plasma DPP-IV activity was measured on the contralateral arm via finger stick. DOMS was assessed with a soreness assessment scale and an algometer. All measurements were taken before, immediate post, 3, 24, and 48 hours post completion of the DOMS protocol.

RESULTS: Participants reported significantly increased soreness at 24 and 48 hours post (both p<0.05). This was supported by a decrease in pressure sensitivity at 24 hours post (p<0.05). IL-6 was significantly increased 166.1±124.3% immediately post and 164.9±91.26% 3 hours post before returning to baseline by 24 hours post. DPP-IV significantly increased 9.9±5.7% at 24 hours post and 9.3±9.6% at 48 hours post from baseline, but was not increased in the contralateral arm. No significant change in CD26+ activated T-cells over time was measured.

CONCLUSION: Following DOMS, inflammatory IL-6 may be hydrolyzed by the local release of the myokine, DPP-IV. Overall, this interaction of IL-6 and DPP-IV appears to be localized to the site of damaged muscle fibers and does not appear to be influenced by the activation of CD26+ T-cells.

2684 Board #204 June 2 11:00 AM - 12:30 PM
Exercise-Induced Muscle Damage Reduces Critical Torque and Impulse Above End Test Torque

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Exercise-induced muscle damage (EIMD) has been shown to reduce endurance exercise performance. However, the mechanism(s) underlying this reduction remain unclear. **PURPOSE:** This study sought to examine the effects of EIMD on critical torque (CT) and impulse above critical torque (IACT). **METHODS:** Eight participants performed a 5-minute all-out isometric knee extension test with a duty cycle of 3:2 (3 seconds of contraction followed by 2 seconds of rest) prior to and 48-hours following EIMD. EIMD was induced by performing electrically stimulated eccentric knee extensions (in sets of 10) until maximal voluntary isometric strength (MVC) was reduced by 40%. The magnitude of EIMD was assessed 48-hours following eccentric exercise by changes in MVC and ratings of quadriceps muscle soreness (using a 100mm VAS scale). Surface EMG and near-infrared spectroscopy (NIRS) were collected from the vastus lateralis and vastus medialis, respectively during the CT test to assess muscle activation and microvascular circulation. **RESULTS:** MVC decreased 22% from baseline (p = 0.006) and soreness increased from 2.1 ± 1.9 mm to 50.4 ± 31.5 mm (p = 0.002) confirming EIMD occurred. CT was declined from 61.6 ± 17.8 Nm to 52.0 ± 14.1 Nm (-16%; p = 0.005) post EIMD. IACT declined 31% (p = 0.0006) post EIMD. No changes were observed in EMG assessed muscle activation between bouts (p ≥ 0.28) and NIRS assessments of tissue saturation (p > 0.05) and deoxyhemoglobin (p > 0.05). **CONCLUSIONS:** CT was significantly impacted by EIMD. CT has been shown to be a strong predictor of endurance exercise performance—thus the previously observed decrements in endurance performance following EIMD may be attributed to a decline in CT. Interestingly, EIMD affected IACT to a much greater extent than CT (-31% vs. -15%). IACT is thought to represent a finite energy store, likely anaerobic in nature, that can be used to perform exercise above CT. Our findings indicate EIMD significantly reduces this energy store—potentially through impairments in excitation-contraction coupling.

2685 Board #205 June 2 11:00 AM - 12:30 PM
Myogenic And Atrophic Signaling In The Progression Of Cancer-cachexia

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(No relationships reported)

Cancer is a major public health problem in the U.S. and the world. In 2013 there were an estimated 1,660,290 new cases of cancer in the U.S. Severe weight and muscle loss in cancer (cancer-cachexia [CC]) is accepted as a common effect of many cancers, and is directly responsible for 20-40% of cancer-related deaths. The mechanisms that control the development of CC are not well understood. In order for muscle wasting to occur, there must be either a decrease in myogenic factors or an increase in catabolic factors. Most investigations of CC focus on the post-cachectic state and do not examine the progression of the condition. **PURPOSE:** The purpose of this study is to determine the roles of classical myogenic factors (Pax7, MyoD and Myogenin; markers of satellite cell content and regulators of myocyte proliferation and differentiation, respectively), and catabolic factors (Atrogin and MuRF; E3 ubiquitin ligases regulating ubiquitin-mediated protein degradation) in the onset of CC. **METHODS:** : 1x10⁶ Lewis Lung Carcinoma cells (LLC) or Phosphate Buffered Saline (PBS, control) were injected into the hind-flank of normal wildtype C57BL6/J mice at 8 wks of age, and tumor allowed to develop for 1, 2, 3, or 4 wks, gastrocnemius muscle weights were measured to assess CC. MyoD, Myogenin, Atrogin, MuRF, and Pax7 were analyzed using RT-PCR for all 5 groups (1, 2, 3, 4 wk LLC and PBS). Data were analyzed by one-way ANOVA, Student-Newman-Keuls test was used to determine differences among means, significance was set at P<0.05. **RESULTS:** Gastrocnemius muscle weights were only lower than PBS control at 4 wk post tumor-implantation. Pax7 was ~30% lower at all timepoints following tumor implantation. MyoD and Myogenin were ~50% lower in wks 1 and 2 post-tumor implantation, and returned to baseline for wks 3 and 4. Atrogin was ~3.5-fold greater in wk 4, while MuRF was ~2.3-fold higher in wk 3 and ~3.8-fold in wk 4 post-tumor implantation. **CONCLUSIONS:** Our data suggest a reduction in satellite cell content shortly after tumor implantation in mice which is tied to an early reduction in markers of myogenic differentiation and proliferation though muscle loss is not evident until 4 wk post tumor implantation; while MuRF and atrogin mediated protein degradation does not seem to be altered until later in tumor progression. Supported by Arkansas Bioscience Institute

2686 Board #206 June 2 11:00 AM - 12:30 PM
Effects Of Sleep Deprivation And Sleep Recovery On Muscular Igf-1 And Muscle Regeneration
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Sleep deprivation (SD) increase catabolic hormone concentrations and decrease growth factors, which may impair the muscle regeneration. **PURPOSE:** Evaluate the influence of SD on the muscle regeneration, cellular proliferation and muscular insulin-like growth factor-1 (IGF-1) concentration after cryolesioning in rats. **METHODS:** Forty male rats, Wistar, 3 month, were distributed into 4 groups: Control (CTL), submitted to SD for 96h (SD96), CTL plus sleep recovery period (CTL+R), submitted to SD for 96h plus 96h of sleep recovery (SD96+R). Previously, the animals were submitted to cryolesioning of *Tibialis anterior* (TA) from left leg. After 3 days of recuperation, SD96 and SD96+R groups were sleep deprived for 96h by modified multiple platform method, following of sleep recovery for 96 h to SD96+R group. TA of both legs were excised (intact and injured) to histopathologic analysis (with HE, 40x), PCNA (western blot) and muscular IGF-1 (ELISA) analysis. The data were analyzed by one way ANOVA. **RESULTS:** The concentration of IGF-1 in intact leg was reduced in SD96 compared to CTL (356±27 vs 816±105 ng/dL respectively; $P<0.05$), and the basal values were reestablished in SD96+R group (776±69 ng/dL). In injured leg, the concentration of IGF-1 increased in all groups, but with less magnitude in SD96 compared to CTL (1442±256 vs 3851±249 respectively; $P<0.001$) and SD96+R compared to CTL+R (1605±260 vs 2307±182 ng/dL respectively; $P<0.001$). PCNA protein not change with SD, but injury increased its concentration proportionally in all groups when compared to intact leg (CTL - 1.88±0.22 vs 0.46±0.13 AU respectively; SD96 - 2.4±0.6 vs 0.62±0.12 AU respectively; CTL+R - 1.68±0.35 vs 0.55±0.08 AU respectively; SD96+R - 1.4±0.13 vs 0.71±0.05 AU respectively; $P<0.05$ for all). The qualitative histopathologic analysis showed a delay in process of muscle regeneration, with higher amounts of fibrous tissue, inflammatory process and muscle atrophy in SD96+R group compared to CTL+R. **CONCLUSION:** SD reduced muscular IGF-1 concentration and delayed the muscle regeneration stimulated by cryolesioning in TA of rats. Supported by CEPID/SONO-FAPESP (#98/14303-3), CNPq, CAPES, and FAPESP (#2011/15962-7; 2013/00152-5)

2687 Board #207 June 2 11:00 AM - 12:30 PM
Effects Of Muscle Specific Pgc-1a Overexpression At The Onset Of Muscle Regeneration
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 (No relationships reported)

Peroxisome proliferator-activated receptor- γ coactivator-1 α (*PGC-1 α*) is a transcriptional activator shown to stimulate mitochondrial biogenesis. Impaired muscle regeneration is associated with down-regulation of *PGC-1 α* . However, in healthy muscle *PGC-1 α* expression is unaltered. Therefore, the role of *PGC-1 α* at the onset of skeletal muscle regeneration needs further elucidation. **PURPOSE:** To examine the effects of overexpression of *PGC-1 α* on gene expression of lactate dehydrogenase (*LDH*), *TNF- α* , and myogenesis markers *MyoD* and *Myogenin* at the onset of muscle regeneration. **METHODS:** 23 C57BL/6 (WT) and 24 Transgenic (A1) mice were used for this study, with A1 mice overexpressing the protein *PGC-1 α* . Mice were injected with either PBS or Bupivacaine (MAR) at 12 weeks of age. *Tibialis anterior* (TA) muscle and tibia were excised 3-days post injection. Tissue was immediately frozen for gene expression analysis using RT-qPCR. **RESULTS:** There was no difference between TAmass/Tibia length ratio in any mice 3-days post injection. *PGC-1 α* gene expression was 13-fold greater in the A1-PBS group compared to the WT-PBS group ($p<0.05$). The A1-MAR group however, expressed approximately 4-fold less *PGC-1 α* compared to the A1-PBS group 3-days post injection ($p<0.05$). In WT mice, *MyoD* gene expression was 1.5 fold greater in the MAR group compared to the PBS group ($p<0.05$), with no difference between A1 mice. There was a main effect of MAR to increase *Myogenin* gene expression in both WT and A1 mice. There was a main effect of genotype to decrease *LDH-A* expression ~50% in both A1 groups ($p<0.05$). There was a 4-fold increase in *LDH-B* expression in the A1-PBS group compared to the WT-PBS group ($p<0.05$). In WT mice, there was no effect of MAR on *LDH-B* gene expression. However, in A1 mice there was a 50% decrease in the A1-MAR group compared to the A1-PBS group ($p<0.05$). *TNF- α* increased approximately 2-fold as a main effect of genotype in both A1 groups ($p<0.05$). **CONCLUSION:** A surplus of mitochondria may result in more ROS production and higher levels of *TNF- α* , resulting in altered expression of *MyoD*. With *TNF- α* possibly activating *NF- κ B*, a nuclear

factor shown to negatively regulate myogenesis. The differential response in *LDH-B* expression suggests *PGC-1 α* is involved in altering glycolytic energy metabolism at the onset of muscle regeneration.

2688 Board #208 June 2 11:00 AM - 12:30 PM
Reliability and Comparison of Measurements of the Tibialis Posterior Cross-Sectional Area Via Ultrasound Imaging
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 (No relationships reported)

PURPOSE: The tibialis posterior is a key muscle in controlling the medial longitudinal arch. Being able to assess the strength, activity and size of the muscle is crucial in understanding its role in controlling the functions of the foot. Difficulties exist in directly imaging this muscle due to the depth of its origin within the leg. This study's purpose was to evaluate techniques used to image the TP muscle size using ultrasound. **METHODS:** 10 legs of 5 healthy college students were imaged via ultrasound (12ML probe, GE Logiq P6) and the cross-sectional area and thickness of the TP was recorded. To measure the TP the probe was held at the 30% and then the 50% point from the knee joint line to the inferior tip of the lateral malleolus. Subjects inverted their foot and videos of the contraction cycle were recorded. 2 separate still-shots of the muscle at rest were saved from the recorded videos to make size measurements. This process was performed on both anterior and posterior sides of the leg. To assess reliability intraclass correlation coefficients (ICC) were calculated. A correlation was performed to compare anterior to posterior measurements. **RESULTS:** Excellent reliability was seen when comparing repeated measurements for anterior and posterior area and thickness measurements at the 30% point (ICC>0.96). There was a strong significant correlation between anterior and posterior measurements at the 30% mark ($r=0.91$, $p<0.001$). There was a non-significant weak correlation between anterior and posterior measurements at the 50% ($r=0.31$, $p=0.19$). The means and standard deviations of the cross-sectional area from the posterior view TP were 4.35 ± 0.49 cm² (30%) and 3.78 ± 0.47 cm² (50%). While the anterior view cross-sectional areas were 4.18 ± 0.49 cm² (30%) and 3.42 ± 0.46 cm² (50%). **CONCLUSION:** Repeated measurements showed excellent reliability. At the 30% point, the anterior and posterior measurements were highly correlated, thus either position could be used to image the TP. The anterior view, at the 50% should generally not be used because portions of the TP were often hidden behind bone which decreased accuracy of the measurement.

2689 Board #209 June 2 11:00 AM - 12:30 PM
Thigh Muscle Architecture Changes During a Soccer Season in Previously Injured and Non-injured Female Athletes
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Very little research has investigated muscle morphological and architectural characteristic changes on the individual thigh muscles during a competitive season in previously injured and non-injured collegiate athletes. Such research may provide important insight into sport-induced anatomical changes, which could have a significant impact on muscle performance and injury risks. **PURPOSE:** To examine the influence of competitive women's college soccer participation on thigh and hamstring muscles' morphological and architectural characteristics. **METHODS:** Eighteen soccer players (Previously injured n=8, age=20.43±0.90 yrs; Non-injured n=10; age=20.31±1.38 yrs) volunteered to participate in the study. Participants reported a total of 4 times separated by 4 weeks during the season and underwent ultrasound testing to assess changes in muscle thickness (MT; cm), subcutaneous tissue thickness (ST; cm), pennation angle (PA; °), and echo intensity (EI) of the rectus femoris (RF), vastus medialis (VM), vastus medialis oblique (VMO), vastus lateralis (VL), vastus intermedius (VI), and biceps femoris (BF) muscles and thigh circumference measures using a tape measure. A 3-way (dominant side of the leg x injury history x time) ANOVA with repeated measure was used to analyze each variable. When interactions were present, Tukey-Kramer multiple comparison post-hoc tests were used. **RESULTS:** MT of the RF, VI, VM, and VMO muscles increased between 4.4 and 14.5% at week 4 and 8 during the season ($P<0.02$) regardless of the dominant side of the leg or injury history. EI of RF, VL, and VM muscles decreased between 3.1 and 8.1% at week 4 and 8 during the season ($P<0.01$). **CONCLUSION:** These results indicated that, muscle size and quality had improved in non-injured athletes but had diminished in those who were previously injured. Because no time-related differences in thigh circumference measures were observed it is possible that these measures may not be sensitive enough for detecting morphological changes. Given the relationship between muscle size and quality, it is possible that these

unique morphological and architectural adaptations over time may influence athletic performance and/or potential risks of musculoskeletal injuries; however, future studies are needed to test these hypotheses.
Supported by NRI Grant 15-060

2690 Board #210 June 2 11:00 AM - 12:30 PM
Muscle Volume Is A Critical Determinant Of Rowing Performance In Olympic Rowers

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BACKGROUND: Rowing races challenge rowers to combine high sprint and endurance capacity. Muscle morphology is an important determinant of sprint and endurance capacities and as such may also be a critical determinant of rowing performance.

PURPOSE: To determine how much of the rowing performance of Olympic rowers is explained by sprint and endurance capacity and by muscle morphology.

METHODS: 18 elite rowers (12 male, 6 female and 17 competed in different disciplines at the 2016 Olympics) performed a maximal incremental rowing test to obtain $\dot{V}O_{2max}$, reflecting the endurance capacity. Sprint capacity was assessed by a 30-second Wingate cycling test and maximal isometric knee extension torque. Morphology of m. vastus lateralis (volume, physiological cross-sectional area (PCSA), fascicle length and pennation angle) was derived from a 3D ultrasound reconstructed voxel array. 13 rowers completed a 2000m time trial on a rowing ergometer to assess rowing performance. Coefficients of determination were obtained from multiple and single regression analyses.

RESULTS: Rowing performance was largely explained by absolute maximal oxygen uptake combined with peak power output obtained during the Wingate test ($R^2=0.98$, $p<0.001$). Muscle volume largely explained rowing performance ($r^2=0.85$, $p<0.001$) and was strongly related to Wingate peak power output ($r^2=0.82$, $p<0.001$), $\dot{V}O_{2max}$ ($r^2=0.65$, $p<0.0001$) and maximal isometric knee extension torque ($r^2=0.60$, $p<0.001$). Less variance in rowing performance was explained by PCSA ($r^2=0.68$, $p<0.001$) and fascicle length ($r^2=0.43$, $p<0.05$) and none by pennation angle ($r^2=0.00$, $p=0.774$).

CONCLUSION: Rowing performance of Olympic rowers is excellently explained by $\dot{V}O_{2max}$ and Wingate peak power output ($R^2=0.98$). Muscle volume, of all morphological properties, is the most important determinant of rowing ergometer performance, and endurance and sprint capacity in Olympic rowers.

Funding: Technologiestichting STW

2691 Board #211 June 2 11:00 AM - 12:30 PM
Effects Of Time-of-day Specific Resistance Training On Muscle Strength And Muscular Il-6-associated Signaling In Male Rats

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PURPOSE: Muscle mass and strength play an important role in athletic sports and health promotion. Although resistance training (RT) is known to be effective for muscle mass improvement, the optimal daily timing of RT and feeding has not yet been determined. The purposes of the present study are to investigate the best daily timing of RT for the muscle hypertrophy in male rats.

METHODS: In study I, SD rats were divided into Control (C, non-exercise), Early (E, beginning of active phase, 8:00) and Late (L, end of active phase, 17:00). Rats of exercise groups (E and L) were asked to perform RT by climbing for 10 weeks in beginning and end of active phase respectively. Climbing strength and weight of flexor hallucis longus (FHL) and flexor digitorum profundus (FDP) was determined after 10 weeks training. In study II, rats were divided into E (Early) and L (Late) groups and were performed an acute RT by climbing. FDP muscle samples were obtained 2, 6 and 24 hours after RT.

RESULTS: In study I, we observed that 10 weeks RT improve muscle strength, muscle mass and myofiber cross sectional area (CSA), but these training effects do not show any significant difference between E and L groups. In study II, acute RT in the evening induced more plasma testosterone/cortisol and IL-6, and muscular IL-6 associated signaling such as phosphorylation of STAT1 and STAT3 compared to training in the morning.

CONCLUSIONS: we suggest that resistance exercise-induced IL-6 signal in skeletal muscle is not the main source of 10 weeks resistance training adaptation.

2692 Board #212 June 2 11:00 AM - 12:30 PM
Characterization of Protein Metabolism in Undifferentiated and Differentiated Murine Muscle Tissue

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The emergence of cell culture experiments have greatly expanded the understanding of skeletal muscle physiology. However, there is a paucity of data regarding the behaviors of cells grown in culture at various stages versus in vivo. This preliminary set of studies was designed to assess alterations of anabolic responses between undifferentiated and differentiated muscle tissue.

Purpose: Determine if there is a disparity in fractional synthesis rates (FSR) between C2C12 myoblasts and myotubes.

* 100

Methods: C2C12 cells were plated at 200,000 cells per T25 flask and 600,000 cells per T75 flask with 5 mL and 12 mL DMEM (respectively) supplemented with 20% Fetal Bovine Serum and 1% gentamycin. Cells were cultured in an environment at held at a constant 37°C and 5% CO₂. Once cells reached confluence, media was changed to DMEM supplemented with 2% horse serum 1% gentamycin, 5% HEPES, 0.75% transferrin, and 0.75% insulin. Myoblasts were plated after the 4th passage. Deuterium oxide was applied 24 hours prior to harvest of the cells at a level of 4%. Media containing deuterium oxide was reserved for analysis. Cells were washed with multiple applications of PBS. Norris buffer was then applied to the flasks at 100 uL for T-25's and 300 uL for T-75's. Flasks were then placed on ice for 5 minutes. Cells were harvested and deposited into centrifuge vials. Vials were spun at 14,000 G for 30 minutes to separate cytosolic and myofibrillar fractions. The supernatant (containing the cytosolic fraction) from the vial was decanted into another vial and saved for analysis. 2H-alanine and plasma enrichment was determined by GC-MS and FSR was calculated by:

Results: Preliminary data demonstrates that differentiated murine myotubes have ~76% FSR of the undifferentiated murine myoblasts ($P < 0.005$).

Conclusion: Future investigators must be aware of the ratio of undifferentiated cells and differentiated myotubes as this ratio could confound results as myoblasts are still present even at later stages of differentiation.

2693 Board #213 June 2 11:00 AM - 12:30 PM
Partial or Complete Unloading of Skeletal Muscle Leads to Specific Alterations of Anabolic Signal Transduction

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(No relationships reported)

Consequences of disuse atrophy of skeletal muscle observed during spaceflight on astronaut health and performance are a focal point of space research. Decrements of both muscle mass and protein synthesis rates have been observed with exposure to varying muscle loading environments (1G > partial loading > 0G), and most of the reduced muscle mass can be attributed to diminished rates of synthesis. However, specific mechanisms behind unloading-dependent reductions of protein synthesis are not well defined. **PURPOSE:** To determine whether or not alterations of anabolic signal transduction was responsible for the changes previously observed in fractional synthesis rates with specific gravitational loading paradigms. **METHODS:** Female BALB/cByJ were normalized by bodyweight and assigned to normal cage ambulation (1G), partial weight bearing suspension titrated to approximately 33% bodyweight (G/3), partial weight bearing titrated to 16% bodyweight (G/6) and full unloading of hind limbs (0G) in specially designed cages. All mice were subjected to that loading environment for 21d prior to tissue harvest, and monitored daily. Immunoblotting of the gastrocnemius (n=23) was carried out to analyze alterations of anabolic signal transduction. Although numerous signaling intermediates were assessed, the focus of this abstract will be on ribosomal protein S6 kinase (p70-S6K). This important protein has served as a marker of protein synthesis signal transduction as well as the anabolic capacity in skeletal muscle. **RESULTS:** Regardless of loading paradigm, no differences were detected among groups for the activation of p70-S6K (as indicated by the phospho: total protein content). Total protein content, however, was ~27% lower than control in 0G and G/6 ($P=0.008$) with G/3 not being different from control ($P>0.05$). **CONCLUSION:** In combination with previous data (unpublished

observations), ambulation at G/3 is sufficient to maintain anabolic signaling capacity when compared to G/6 or 0G, suggesting that a threshold level of stimulus is necessary to maintain anabolic capacity in muscle. These results may have important implications towards the development of strategies designed to counter the effects of partial/complete unloading on skeletal muscle based on how the anabolic capacity of muscle is affected.

2694 Board #214 June 2 11:00 AM - 12:30 PM
Age-Based Developmental Comparison of Phase Angle and Ultrasound-Derived Echo Intensity

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Phase angle, determined from resistance and reactance via bioelectrical impedance analysis (BIA), provides an indication of cellular function and hydration. Ultrasound-derived echo intensity (EI) is often used to evaluate the relative variation in the composition of underlying tissue. Assessment of these non-invasive methods may allow for characterization of age-based developmental changes related to body composition. **PURPOSE:** To examine phase angle and EI amongst children, adolescents, and adults. **METHODS:** A total of 36 male children (n=11; age=12.7±1.4y), adolescents (n=13; 16.7±1.0), and adults (n=12; 25.8±3.8y) were compared. Whole body (PhA_{WB}) and leg (PhA_{DL}) phase angle were determined using 50kHz BIA. Greyscale analysis was used to determine EI from ultrasound-derived images of the cross-sectional area of the vastus lateralis. Phase angle and EI between age-based developmental groups were compared by 1-way ANOVA, while stepwise linear regression was used to evaluate relationships between these measures and the potential influence of age and body mass index (BMI). **RESULTS:** Significant differences were demonstrated between age-based developmental groups for PhA_{WB} (p<0.001), PhA_{DL} (p=0.002), and EI (p<0.001). Post-hoc analysis showed lower phase angle (p<0.05) in children (PhA_{WB} =5.4±0.6°; PhA_{DL} =5.9±0.8°) compared to adolescents (PhA_{WB} =6.4±0.8°; PhA_{DL} =6.8±0.9°) and adults (PhA_{WB} =6.9±0.6°; PhA_{DL} =7.2±0.7°). EI was greater (p<0.001) in children (57.2±10.6 au) compared to adolescents (40.0±6.8 au) and adults (41.4±7.9 au). PhA_{WB} was identified as the strongest predictor variable for EI ($r^2=0.211$; p=0.005), while age and BMI were identified as the strongest predictor variables for PhA_{WB} ($r^2=0.442$; p<0.001) and PhA_{DL} ($r^2=0.384$; p<0.001), respectively. **CONCLUSION:** Phase angle and EI appear to distinguish changes in body composition between childhood and adolescence; however, further developmental changes were not apparent into adulthood. Each measure was found to be uniquely influenced by other factors, including age and BMI. Longitudinal evaluation of phase angle and EI amongst children and adolescents may provide much needed insight into the process of maturation.

2695 Board #215 June 2 11:00 AM - 12:30 PM
Association Between Sleep Duration and Mid-Thigh Muscle Composition: The AGES-Reykjavik Study

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Age-related changes in sleep are broadly documented and complaints of sleep difficulties are more common among older adults. Although sleep disorders are viewed as a health threat in several physiological systems, it is unclear how high lean mass and muscle attenuation, markers of sarcopenia, are affected by sleep.

PURPOSE: This study aimed to examine the association between 24-hour sleep duration and mid-thigh muscle composition.

METHODS: 2,438 men and 3,326 women aged 66 to 96 years, residents in the Reykjavik area (Iceland), were included in this cross-sectional study. Mid-thigh muscle area (cm²) and muscle attenuation (Hounsfield units, HU) were assessed with a four-row detector computed tomography system. The muscle attenuation was used as an indicator of muscle fat infiltration; lower HU indicates greater fat infiltration. Sleep and nap habits were assessed using a questionnaire. Total 24-hour sleep duration was estimated as the sum of nighttime sleep hours and daytime nap hours. Statistical analysis was performed using multivariable linear regression.

RESULTS: We found that after adjustment for age and body mass index (BMI) long sleep duration (>8 h/day) was negatively associated with thigh lean area in both men (B=-2.2, 95% confidence interval (CI)=-4.0, -0.4) and women (B=-2.9, 95% CI=-3.8, -1.0) and with muscle attenuation (B=-1.0, 95% CI=-1.5, -0.4) only in women.

After adjustments for all relevant covariates (including age, BMI, health and lifestyle factors) the association between long sleep duration and thigh lean area was attenuated and became non-significant. In women, the associations between long sleep duration and muscle attenuation were significant in both the age and BMI- and the full-adjusted model. In men these associations were not significant. No associations were observed for short sleep duration (<6 h/day) and both muscle parameters.

CONCLUSIONS: Long sleep duration, particularly in old women, is associated with thigh muscle attenuation. Whether optimization of sleep can ameliorate age-associated intramuscular adipose tissue warrants further studies.

Supported by Intramural Research Program of the NIH, NIA; the AGES-Reykjavik Study is funded by NIH Grant N01-AG-12100, the NIA Intramural Research Program, Hjartavernd, and the Althingi.

2696 Board #216 June 2 11:00 AM - 12:30 PM
Analysis of B-mode Ultrasound Changes in Vastus Lateralis Muscle Following the Transcutaneous Vacuum Treatment

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 (No relationships reported)

PURPOSE: We reported in a previous study (ACSM's 62th Annual Meeting) that the transcutaneous vacuum (dermal suction) increased range of motion of voluntary movement and induced the smoothness of movement. No study has reported that transcutaneous vacuum improved the gliding function and flexibility of muscle and fascia. This study aimed to show that fascial gliding occurs during transcutaneous vacuum treatment and to investigate whether the transcutaneous vacuum treatment improved fascial gliding function of the vastus lateralis muscle using ultrasound.

METHODS: Seven volunteers (age: 21-60) participated in this study. Transcutaneous vacuum treatment (vacuum and rolling) was applied to both left and right vastus lateralis muscle. Deep fascial motion when the knee joint was moved passively from 0 to 45 degree was measured by B-mode ultrasound before and after treatment. Deep fascial motion during this treatment was measured for five volunteers. Measurement was performed at the deep fascia between the vastus lateralis and vastus intermedius muscles. Data were statistically evaluated using two-way ANOVA (subject, [left or right] side, treatment effect [before or after treatment]) and post hoc test.

RESULTS: Motion of deep fascia (mean ± SD, mm) before treatment was 26.8 ± 7.57, the same as the result of the previous study (28.5 ± 4.3). Motion of deep fascia after transcutaneous vacuum treatment was 32.2 ± 7.39, the same as the motion after myofascial release treatment of the previous study (32.4 ± 4.0; Ichikawa et al., 2015). There was no interaction between either side (left or right). However, the treatment effect was significant, and motion after was longer than motion before (F=28.78, p<.01, effective size = 2.19, power = 1.000) analysed by ANOVA. Deep fascial motions during treatment were 5.6±2.35 mm superficial layer and 6.3 ± 2.19 deep layer.

CONCLUSIONS: In this study, the effects of transcutaneous vacuum treatment on improvement of fascial gliding function, and fascial gliding during transcutaneous vacuum were demonstrated. Transcutaneous vacuum provided mild myofascial stimulation without requiring articular movement. We concluded that transcutaneous vacuum treatment effectively improved fascial gliding function and increased range of joint motion and flexibility of muscle and fascia.

2697 Board #217 June 2 11:00 AM - 12:30 PM
Effects Of Different Exercise Regimen On The Disease Phenotype In Mdx Mouse Model Of DMD

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PURPOSE: Effects of exercise on the disease phenotype in neuromuscular disease mouse models is not systematically evaluated. Therefore, we have designed a preclinical trial in the mdx mouse model of Duchenne muscular dystrophy to specifically investigate the effects of forced downhill and horizontal treadmill exercise as well as voluntary wheel exercise. We assessed effects of exercise intervention on the muscle function and pathology using a comprehensive set of phenotyping measures. **METHODS:** This study involved a group of 12 week old wild-type BL10 (dystrophin sufficient) mice and a group of mdx (dystrophin deficient) mice. Each group was

divided into 4 exercise regimen groups (n=5): No exercise, downhill treatment (DT), horizontal treatment (HT), and voluntary wheel exercise (VW). The groups were subjected to exercise 3x per week for 13 weeks. Skeletal muscle function (grip strength) was evaluated at 12, 17, and 25 weeks of age and cardiac function was evaluated using echocardiography at 25 weeks of age.

RESULTS: Exercise intervention did not show a change in bodyweights of the BL10 mice. However, these mice showed significant improvement in hindlimb (HL) but not forelimb (FL) grip strength in comparison to non-exercised group. Analysis of the serum showed that the creatine kinase (CK) levels in the VW group significantly increased compared to the non-treated group. All three exercise interventions showed significant decreases in body weight at 25wks of age of mdx mice. Dystrophin deficient mdx mice showed different effects on muscle function depending on the exercise regimen. DT exercise was significantly detrimental to HL grip strength, while VW exercise showed significant improvement on HL grip strength over time. Evaluation of cardiac function (% ejection fraction and fraction shortening) showed that HT and VW but not DT interventions showed significant improvement. Analysis of CK levels showed that the VW group significantly increased compared to the non-treated group.

CONCLUSIONS: Our study demonstrates that type of exercise intervention significantly affects dystrophin deficient skeletal and cardiac muscle function. Our study highlights that mild but not strenuous (DH) exercise regimen show benefits in DMD muscle therefore caution must be taken when prescribing exercise regimes to DMD patients.

2698 Board #218 June 2 11:00 AM - 12:30 PM
Cancer-cachexia Upregulates Autophagy Machinery

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Cancer is associated with severe weight and muscle loss (cancer-cachexia). Cancer-cachexia is the most common manifestation of the advanced malignant disease, leading to death. Underlying mechanisms of cancer-cachexia are not well understood. Muscle wasting is associated with an imbalance of protein turnover favoring protein breakdown. Autophagy is a mechanism for protein breakdown that has not been adequately studied throughout the progression of cancer-cachexia. **PURPOSE:** Assess autophagy machinery and flux throughout the progression of cancer-cachexia. **METHODS:** 1x10⁶ Lewis Lung Carcinoma cells (LLC) or Phosphate Buffered Saline (PBS, control) were injected into the hind-flank of C57Bl6/J mice at 8 weeks age, and tumor allowed to develop for 1, 2, 3 or 4 weeks. Muscle size was assessed by muscle wet weights. Immunoblot was utilized to measure protein content of Beclin1, LC3, LC3 2:1 ratio and p62. A One-Way ANOVA was utilized to detect statistical significance with a Student-Newman-Keuls post hoc analysis to delineate differences between groups significance was set at P=0.05. **RESULTS:** Protein content of Beclin1 and total LC3 increased by 2 fold 4 weeks following tumor implantation when compared to the PBS control group. There was no difference in the protein content of p62 or the LC3 2:1 ratio throughout the progression and cancer-cachexia. **CONCLUSIONS:** Our results indicate autophagy machinery is dramatically upregulated 4 weeks following tumor implantation suggesting autophagy may be a key regulator of cancer-cachexia. Autophagy flux does not appear to be influenced by cancer-cachexia; however, steady rates of autophagy flux with an increase in autophagy machinery may suggest an increase in protein/organelle breakdown via autophagy. Mechanisms behind the upregulation of autophagy machinery in cancer-cachexia are not fully understood; however, energy stress instigated by mitochondrial degeneration may be involved. Funded by Arkansas Bioscience Institute

2699 Board #219 June 2 11:00 AM - 12:30 PM
Estimation of Critical Torque Using Neuromuscular Electrical Stimulation of the Quadriceps in Humans.

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Critical torque (CT) is an integrative measure/concept that represents the “critical” or upper boundary of steady-state work that can be performed without leading to exhaustive fatigue. While this concept has been observed across multiple voluntary exercise modalities, it has not been tested using neuromuscular electrical stimulation (NMES). **PURPOSE:** The purposes of this study were 1) to determine if NMES exercise results in hyperbolic work-duration pattern that plateaus at the end of exercise and 2) determine if NMES exercise performed below CT results in no fatigue. **METHODS:** Participants (n = 9) were tested. Following familiarization, participants

completed 2 identical testing sessions each consisting of four separate 5-minute NMES bouts separated by 20 minutes of rest. The NMES protocol consisted of 3-seconds of stimulation, followed by 2-seconds of rest, for 60 total isometric contractions. Current and pulse duration (200- μ s) were held constant among all tests. Initially 100 Hz NMES was used. During the second test a frequency that elicited a torque value below the end test torque during the 100 Hz test (under CT) was used. The third and fourth tests were at 50 Hz and 25 Hz, applied in a random order. The second testing session was performed 2-7 days later. **RESULTS:** End-test torque (ETT) was calculated as the mean of the last 6 contractions expressed relative to peak torque. Torque values did not differ over the final 6 contractions within each exercise bout—100 Hz (p = 0.49), 50 Hz (p = 0.15), 25 Hz (p = 0.31), and under CT (p = 0.15). Torque declined from 93 \pm 18% to 22 \pm 7% of peak torque at 100 Hz, from 60 \pm 24% to 22 \pm 8% at 50 Hz, and from 29 \pm 13% to 20 \pm 6% at 25 Hz. These ETT values did not differ from each other (p > 0.05). Initial torque and ETT for the under CT bout did not differ (12 \pm 8% vs 11 \pm 5% of peak torque; p = 0.48), but ETT was lower than the ETT values from the 100, 50, and 25 Hz bouts (p < 0.05). **CONCLUSIONS:** Intermittent isometric NMES results in a hyperbolic work-duration relationship similar to what is observed during voluntary isometric exercise. NMES exercise above CT declined to a similar torque value regardless of stimulation frequency, while exercise under CT showed no declines in torque. These findings suggest the NMES exercise protocol can be used to determine CT.

2700 Board #220 June 2 11:00 AM - 12:30 PM
The Effect of Myostatin SNP on Muscle Fiber Properties in Thoroughbred Horses during Training Period

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PURPOSE: Variants of the myostatin gene (MSTN) have been shown to have an influence on muscle hypertrophy phenotypes in a wide ranges of mammalian species. Recently, a thoroughbred horse with a C-Allele at the g.66493737C/T single nucleotide polymorphism (SNP) has been reported to be suited to short distance racing. In this study, we examined the effect of the MSTN SNP on muscle fiber properties in young horses during a training period. **METHODS:** To investigate the effect of the MSTN SNP on muscle fiber before training, several mRNA expressions were relatively quantified in biopsy samples from the middle gluteal muscle of 24 untrained male thoroughbred horses (1.5-year old, C/C: n = 8, C/T: n = 8, T/T: n = 8) using real-time RT-PCR analysis. Furthermore, the remaining muscle samples were used for immunohistochemical analysis to determine the number of satellite cells (SC), as well as the population and area of each fiber type. All measurements were reevaluated in biopsy samples of the same horses after a 5-month period of conventional training. **RESULTS:** As compared to values before training, although there were not significant differences, cross sectional areas of all muscle fiber types increased (12-17%) in all SNP groups after training. Although the expressions of MSTN mRNA decreased in all SNP groups, a significant decrease was found in only the C/C group after training. However, the expressions of mRNA related to SCs activation and proliferation (HGF, Pax7, MyoD, and Myogenin) were identical among all SNP groups after training. While, expression of VEGFa, PGC1 α , and SDHa mRNAs, which relate to the biogenesis of mitochondria and capillaries, was significantly higher (54-82%) in the T/T group than the C/C group after training. **CONCLUSION:** It is suggested that hypertrophy of muscle fiber is directly associated with a decrease in MSTN mRNA expression in the C/C group, and that increased expressions of VEGFa, PGC1 α , and SDHa in the T/T group might be indirectly caused by the MSTN SNP. These results indicate that the C/C and T/T groups with the MSTN SNP have an advantage in short and long distance races, respectively.

2701 Board #221 June 2 11:00 AM - 12:30 PM
Muscle Regeneration after Anterior Cruciate Ligament Reconstruction - Effects of Strength Training Regime and Different Autocrafts

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Quadriceps muscle atrophy is regularly observed after anterior cruciate ligament reconstruction (ACL-R) **PURPOSE:** To test the hypothesis that muscle regeneration after ACL-R can be augmented by quadriceps strength training with eccentric overload (CON/ECC+) **METHODS:** Biopsies from the vastus lateralis muscle were

obtained from 37 recreational athletes (25±4 yrs, 181±7 cm, 83.5±15 kg) after 12 weeks (wks) of regular rehabilitation following ACL-R (quadriceps tendon autograft, n=22 or semitendinosus tendon autograft, n=15) and again after 12 wks with 2x/wk either conventional (CON/ECC, n=16) or CON/ECC+ (n=21) supervised leg press training (random assignment). Immunohistochemical analyses were used to determine myosin heavy chain (MyHC) I, II and hybrid fibers to quantify fiber type specific satellite cells (SCs, Pax7+) and active SCs (Pax7+/MyoD+). Magnetic resonance imaging was performed to measure quadriceps cross sectional area (CSA) **RESULTS:** After 12 wks of one-legged quadriceps strength training CSA was significantly (p=0.000) increased with a significantly (p=0.003) greater increase after CON/ECC+ compared to CON (81.7±13.1 to 96.3±14.7 cm² vs. 78.5±12.1 to 87.0±11.8 cm²). MyHC I fiber number significantly (p=0.002) increased only after CON/ECC+ (35.7±17.1 to 41.7±15.8 %). The change was significantly (p=0.022) different from CON/ECC (36.6±13.0 to 35.1±10.4 %). MyHC I/II hybrid fibers showed a significant (p<0.001) similar decrease after CON/ECC+ (7.1±6.5 to 4.0±4.5 %) and CON/ECC (7.7±4.9 to 4.8±3.6 %). MyHC II fiber number did not change significantly. While no significant change in SC content was observed (SCs related to MyHC I or II fibers 0.15±0.08 and 0.14±0.07 before, 0.14±0.09 and 0.14±0.07/fiber after training) the number of active SCs per biopsy section was significantly (p=0.007) greater after training (2.42±2.09 vs. 1.08±1.38) without significant difference between the training regimes. No significant differences occurred with regard to the different autografts **CONCLUSION:** Strength-training induced muscle regeneration after ACL-R lead to an increase in activated SCs and a decrease in MyHC I/II hybrid fibers. After CON/ECC+ the gain in muscle mass was greatest and was accompanied by a significant increase in MyHC I fibers. Supported by the Dietmar Hopp Foundation (23011193)

2702 Board #222 June 2 11:00 AM - 12:30 PM
Thigh Muscle Cross-sectional Area by pQCT: Precision of Two Software Programs

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(No relationships reported)

Scans performed by pQCT produce images with voxels, each with a density value that is the average of all the tissue densities contained within the voxel. Software programs differentiate between bone and soft tissues within the human limb using contour/peel modes and threshold ranges. Subtle calculation differences of voxel partial volumes by software may lead to variations in tissue density and area values. **PURPOSE:** The purpose of the investigation was to compare the precision of two software programs, Stratec v6.00 (STC) and ImageJ (IMJ), for thigh muscle cross-sectional area (mCSA) in college age men. **METHODS:** pQCT scans (XCT 3000, Stratec) performed at the 50% femur site for 10 male subjects (18-30 years) on 3 different days, were used to measure femur mCSA using STC and IMJ. Loops were created within STC with thresholds set at -100, 40, and 710 to separate and calculate air, subcutaneous fat, bone, and muscle. Contmodes 3 and 31 were used to delineate bone from muscle. Filter F01F06U01 was used to smooth the image, incorporating intramuscular fat (IMAT) into mCSA. IMJ thresholds and filters for IMAT were similarly set. Intraclass correlation coefficients (ICC), coefficient of variation % (CV%), and least significant change (LSC) were calculated across trials to determine the precision for each method. The relationship between the two methods was determined by Pearson's r. **RESULTS:** The ICCs for STR and IMJ were 0.995 and 0.996, respectively. CVs were 2.5% for STR and 2.44% for IMJ. The LSCs for STR and IMJ were 10.955 cm² and 10.833 cm², respectively. High positive correlations (r=0.999, p<0.001) were found between methods. Repeated measures ANOVA showed significant differences between STR and IMJ, with IMJ having a significantly higher mCSA than STR (p=0.032). There was a significant trial effect with trial 1 being higher than trial 3 (p=0.05). **CONCLUSION:** The two software programs had similar precision values for mCSA, however, there was a small but significant mean difference between STR and IMJ. The higher trial 1 mean compared to trial 3 for both methods may be attributed to technical error. Both programs appear equally capable of deriving mCSA with IMAT included. ImageJ may be advantageous, as it does not require expertise for loop creation or user-created equations to derive mCSA, both being possible sources for human error.

2703 Board #223 June 2 11:00 AM - 12:30 PM
Regional Differences in Musculoskeletal Adaptation Following 16-Weeks of High-Intensity Functional Training.

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(No relationships reported)

High-Intensity Functional Training (HIFT) continues to gain traction in the fitness world; however, many questions remain about its effect in musculoskeletal adaptations. **PURPOSE:** We sought to investigate what musculoskeletal regions of interest (ROI) were affected following a 16-week HIFT program among a group of recreationally active adults. **METHODS:** Nine men (34.2±9.12 yrs, 1.78±0.05 m, 91.5±17.7 kg) and 17 women (36.3±7.84 yrs, 1.63±0.07 m, 68.5±12.8 kg) completed 16-weeks (2-5 sessions · wk⁻¹) of HIFT. Prior to training (PRE; < 2 weeks), measures of bone mineral density (BMD), bone mineral content (BMC), and lean mass (LM) were collected in the arm, leg, and axial (skeletal measures only) regions via dual-energy X-ray absorptiometry. Post-testing (POST) measurements were collected within two weeks following the conclusion of the 16-wk training program. **RESULTS:** Analysis of variance with repeated measures revealed a significant ROI x time interaction for LM (F = 436.967, p < 0.001, η² = 0.95), where greater improvements were observed in the legs (133.2%) compared to the arms (50.9%). A tendency was noted for changes in BMC across ROI's (F = 2.86, p = 0.067, η² = 0.11), where improvements occurred in the legs (1.6%, p = 0.002) but not the arms (0.14%, p = 0.689) or axial region (-0.48%, p = 0.167). **CONCLUSION:** Our data suggests that a 16-wk HIFT intervention focusing on general physical preparedness is particularly beneficial for stimulating adaptations in lower limb BMC and lean mass.

2704 Board #224 June 2 11:00 AM - 12:30 PM
Effects of Doxorubicin Treatment and Exercise on Skeletal Muscle Function and Myogenic Regulatory Factors

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(No relationships reported)

Doxorubicin (DOX) is used to treat a wide range of cancers, but its use is limited due to its toxicities. DOX treatment causes myotoxicity leading to skeletal muscle dysfunction and impairments in activities of daily living for cancer patients. Maintenance and repair of skeletal muscle involves myogenic regulator factor (MRF) signaling, and evidence suggests that DOX inhibits MRF expression. Exercise, however, attenuates many of the toxicities associated with DOX treatment, and including exercise with DOX treatment may have a positive effect on MRF expression. **PURPOSE:** To determine the effects of exercise and DOX treatment on skeletal muscle function and MRF expression. **METHODS:** Male rats were randomly assigned to sedentary+saline (SS), sedentary+DOX (SD), treadmill+DOX (TMD), resistance training+DOX (RSD), or combined endurance and resistance training+DOX (COMD). DOX groups received 1 mg/kg DOX daily for 12 consecutive days and SS received 0.9% NaCl at an equivalent volume as a placebo. TMD then trained on a motorized treadmill 5 days per week for 2 weeks, RSD animals were then housed in cages where food and water were progressively raised to force a bipedal stance for 2 weeks, and COMD rats were then housed in raised cages and treadmill trained for 2 weeks. Sedentary rats were restricted to normal cage activity during this time period. Twenty-four hours after the activity intervention, grip strength (GS) was measured, and the soleus was extracted and analyzed for expression of the primary MRFs MyoD and Myf5 using Western blotting. **RESULTS:** SD had a 29% lower GS than SS (p < 0.05), but this significant GS decline was not observed in TMD, RSD, or COMD (-10%, -5%, -2% vs. SS, respectively, p>0.05). MyoD expression was 61% lower in SD when compared to SS, but none of the activity interventions attenuated this decline (-56%, -65%, -65% vs. SS in TMD, RSD, and COMD, respectively, p < 0.05 for all comparisons). A similar Myf5 decline was observed with SD, TMD, RSD, and COMD expressing 44%, 40%, 65%, and 56% lower Myf5 than SS, respectively (p<0.05). **CONCLUSIONS:** Activity interventions protected against the DOX-induced reduction in GS, but this does not appear to be the result of changes in MRF expression suggesting that exercise-induced protection against DOX myotoxicity may not be due to mitigating decreases in primary MRF expression.

E-35 Free Communication/Poster - Musculoskeletal Mechanics and Modeling

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2705 Board #225 June 2 9:30 AM - 11:00 AM
Regional Differences in Bone Mineral Density in Male Collegiate Runners with Different Foot-strike Patterns
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(No relationships reported)

There are two main running foot-strike patterns; heel striking (HEEL) and mid-foot striking (MID). Given that people who run with different gait patterns likely experience different loading profiles, it would be of interest to analyze regional differences in bone mineral density (BMD) in order to characterize foot-strike specific injury risk. **PURPOSE:** To investigate the differences in hip and foot BMD of male collegiate runners with different foot-strike patterns. **METHODS:** Thirteen NCAA D1 athletes were recruited for the study (Age: 20±1 yrs; Height: 179 ± 5 cm; Weight: 70 ± 6 kg; Body Fat: 10.8 ± 4 %). Ground Reaction Force (GRF) data was collected with an instrumented treadmill while the subjects ran at two different paces; threshold pace (TP: 5:00 min/mi) and long-slow distance pace (LSD: 6:58 min/mi). Femurs and foot bones of the left (L) and right (R) leg were scanned with dual-energy x-ray absorptiometry (DXA). Foot-strike patterns were categorized based on the presence of an initial impact transient in the GRF profile and confirmed with video analysis. DXA scans were used to analyze BMD of the femoral neck, first metatarsal, and the average of metatarsals 2-5. Three separate 2x2 Analyses of Variance were used to determine the effects of foot-strike pattern (HEEL, MID) and side (L, R) on regional DEXA data. Data are presented as Mean±SD. **RESULTS:** A significant interaction indicated that BMD of the first metatarsals were affected by foot-strike pattern and leg side (F = 12.60, p = 0.004). Post-hoc testing, however, failed to show significant differences during follow-up testing (Table 1). Bone mineral density (mean±SD) of the first metatarsals from the left and right side in the heel and mid-foot strike groups.

	Foot-Strike Pattern	
Leg Side	Heel n=7	Mid n=6
Left	0.641±0.095	0.564±0.127
Right	0.640±0.098	0.606±0.128

CONCLUSION: Although foot-strike pattern and leg side both appear to affect BMD of the first metatarsal, the exact nature of this effect is not known.

2706 Board #226 June 2 9:30 AM - 11:00 AM
Individuals with Sacroiliac Joint Dysfunction Display Fewer Muscle Synergies When Walking
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(No relationships reported)

Sacroiliac joint (SI) joint dysfunction is present in 15-30% of individuals with low back pain. Pain in the SI joint often disturbs typical gait patterns. One hypothesis regarding the cause of SI joint dysfunction is a lack of coactivation between the latissimus dorsi and contralateral gluteus maximus, which together provide force closure between the sacrum and ilium. Latent muscle synergies during movement can be identified with a principal component analysis on EMG signals. Components with eigenvalues (EV) greater than 1.0 significantly explain a portion of the covariance of the constituent signals.

PURPOSE: To identify differences in muscle synergies during walking between individuals with SI joint dysfunction and healthy controls. **METHODS:** Six individuals diagnosed with SI joint dysfunction (4 right side) and six age-matched controls walked at 1 m/s on a dual-belt force treadmill Bertec. Muscle activity was recorded with wireless electrodes (Noraxon) for tibialis anterior, medial gastrocnemius, biceps femoris, rectus femoris, gluteus maximus (GM), internal obliques, erector spinae, and latissimus dorsi (LD) bilaterally. The EMG signals during 10 strides were bandpass filtered between 10-490 Hz and rectified. Each stride began at right heel strike and was resampled to 1000 time points, then averaged at each time point. Principal component analysis (PC) was performed on each individual's averaged EMG data and on the group ensemble EMG (averaged across individuals at each time point).

RESULTS: Individuals with SI joint dysfunction exhibited fewer muscle synergies than healthy controls (mean EV for the 5th PC (range): SI = 0.89 (0.74-1.02), control = 1.04 (0.9-1.10)). The first PC for the ensemble EMG for controls included a contribution from contralateral GM and LD (Pearson r with 1st PC of ensemble EMG: right GM = -0.20, left LD = -0.22, left GM = 0.29, right LD = 0.25), whereas this synergy was absent from left LD to right GM for individuals with SI joint dysfunction (right GM = -0.11, left LD = 0.05, left GM = 0.36, right LD = 0.37).

CONCLUSION: Individuals with SI joint dysfunction exhibit fewer synergies than healthy controls when walking. Our results support the hypothesis that individuals with SI joint dysfunction do not exhibit a synergy between contralateral gluteus maximus and latissimus dorsi when walking.

2707 Board #227 June 2 9:30 AM - 11:00 AM
Vest-borne Loads Increase Bending Moments at the Distal Tibia
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Tibial stress fractures are a substantial issue among active duty military personnel. Previous research found that walking with heavy loads increased joint moments and contact forces to a greater degree than the relative increase in load. However, the effect of added load on tibial bending remains unclear. **PURPOSE:** Determine the relationship between added load and tibial bending moment (M_{bend}) while walking with heavy loads. **METHODS:** 26 active duty male volunteers (20.7 ± 3.3 yrs; 1.77 ± 0.87 m; 85.3 ± 13.9 kg) walked on a treadmill for 10 minutes unloaded and with each of five vest-borne loads (15, 25, 35, 45 and 55 kg) while force and motion data were collected. pQCT scans were used to obtain volunteers' mid-distal tibial geometry (38% from distal end). A musculoskeletal model was used to estimate muscle forces necessary to match joint moments. At the instant of peak tibia axial force (75.5 ± 1.9% of stance phase), M_{bend} at the mid-distal tibia were calculated as the product of joint reaction and muscle forces and their respective moment arms and summed to create a total moment. Vest-borne loads were expressed as a percentage of body mass. **RESULTS:** M_{bend} caused by muscle were consistently greater in magnitude and opposite in direction from moments caused by joint reaction forces. Total moments caused bending in the concave posterior direction placing the anterior tibia in tension. Moments were correlated with added loads when normalized to body mass (Figure 1) as well as when moments were expressed as increases relative to the unloaded condition (all p < .01). For each 10% increase in added load, M_{bend} increased 8.3% relative to unloaded walking. **CONCLUSION:** At this injury prone site on the tibia, the increase in bending moment with added loads was linear and slightly less than proportional to the loads added.

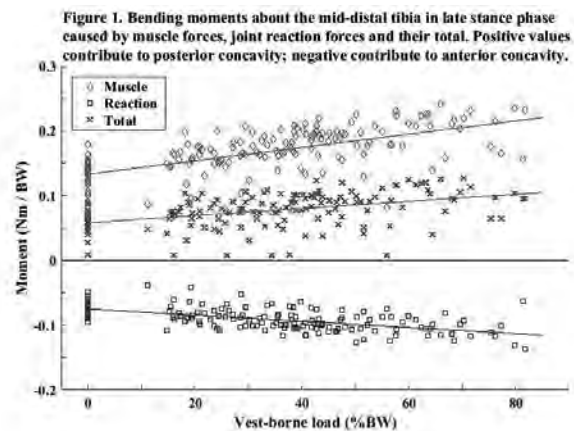


Figure 1. Bending moments about the mid-distal tibia in late stance phase caused by muscle forces, joint reaction forces and their total. Positive values contribute to posterior concavity; negative contribute to anterior concavity.

2708 Board #228 June 2 9:30 AM - 11:00 AM
Peak Patellofemoral and ACL/PCL Forces While Performing the Forward Lunge Exercise With Varying Techniques

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(No relationships reported)

PURPOSE: To compare peak patellofemoral and ACL/PCL forces among varying lunging techniques involving lunging with a long and short stride both on flat ground and up to a 4 inch platform. **METHODS:** Sixteen male and female subjects (mean bodyweight 678N, 69.1 kg mass; 175.9 cm height; 28.9 years old) using bodyweight only performed a forward lunge with a long stride (shank vertical at bottom position) and a short stride (1/2 the long stride distance) on flat ground and up to a 4 inch platform. Force platform and video data were collected and input into a biomechanical model, and peak patellofemoral and ACL/PCL were calculated as a function of knee angle. A One-Way Repeated measures ANOVA assessed significant differences among lunging techniques ($p < 0.05$). **RESULTS:** Peak patellofemoral force occurred between 79°-96° knee angles and was significantly greater ($p < 0.001$) with a short stride lunge on flat ground (1668±479N) and up to a 4 inch platform (1553±580N) compared to lunging with a long stride lunge on flat ground (1193±512N) and up to a 4 inch platform (1061±523N), but no significant differences in peak patellofemoral force were found between the two short stride lunges ($p = 0.99$) and between the two long stride lunges ($p = 0.99$). Peak ACL force occurred between 7°-12° knee angles and was not significantly different ($p = 0.70$) among any of the lunging techniques. Peak PCL force occurred between 62°-83° knee angles and was significantly greater ($p < 0.001$) with a long stride lunge on flat ground (554±220N) and up to a 4 inch platform (609±265N) compared to lunging with a long stride lunge on flat ground (402±114N) and up to a 4 inch platform (458±145N), but no significant differences in peak PCL force were found between the two short stride lunges ($p = 0.99$) and between the two long stride lunges ($p = .99$). **CONCLUSIONS:** Lunge technique variations did affect peak patellofemoral and cruciate ligament forces. Compared to a long stride lunge, lunging with a short stride, which caused the knees to translate forward approximately 8 cm beyond the knees at bottom lunge position, resulted in greater peak patellofemoral force but less PCL force. Lunging technique variations did not affect peak ACL force. There were no patellofemoral or PCL differences in peak force between the two long stride lunges or between the two short stride lunges.

2709 Board #229 June 2 9:30 AM - 11:00 AM
Slope of Time-to-maximum Intensity of the Mechanomyograph in the Calf Muscles During Incremental Electrical Stimulation

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(No relationships reported)

PURPOSE: In previous analysis of the mechanomyogram (MMG) obtained during incremental electrical stimulation using the von Tscherner "intensity analysis" suggested a possible decrease in time-to-maximum total intensity (TTMax) for the soleus with increasing stimulus intensity. In the present study, the slopes of TTMax were analyzed for the medial gastrocnemius (MG) and soleus (SOL) muscles. **METHODS:** 9 (7M, 2F) moderately active college-aged (21-28 y, mean = 22 ± 2 y) persons with measurable H-reflexes participated. The tibial nerve was stimulated in increments of 5V from 10-100 V with with a 10-second rest interval between stimuli. To minimize the interference of the H-wave contraction on the MMG, data from 50 to 100V were analyzed. Normalized MMG (NormMMG) data were subjected to the intensity analysis, and total intensity (sum of the intensities over the set of 11 Cauchy wavelets for each sample in time), the peak total intensities, and corresponding TTMax were determined. The slopes of the TTMax by NormMMG were determined, and correlation coefficients were analyzed. In addition, the TTM data for the SOL and MG were compared using the paired t-test. It was hypothesized that the slopes of the TTMax data would be negative and greater for the MG. **RESULTS:** TTMax was significantly different between SOL and MG ($p < 0.001$). There was a significant negative correlation between TTMax_SOL and NormMMG_SOL [-0.335 ($p < 0.001$, CI: -0.501 to -0.145); range: -0.961 to 0.878]. The correlation between TTMax_MG and NormMMG_MG was not significant [0.117 ($p = 0.252$, CI: -0.804 to 0.310); range: -0.679 to 0.936]. Overall, slopes varied among participants and muscles. **CONCLUSIONS:** The hypothesis that TTMax intensity would decrease with increasing stimulus (i.e., would reflect the rate of muscle shortening, Vmax) was not supported. Variation among muscles and participants suggest that there may be information in the MMG TTMax that reflect other characteristics of the muscle fiber recruitment (muscle composition, motor unit depth, etc.). Further study is warranted.

ACSM May 30 – June 3, 2017

2710 Board #230 June 2 9:30 AM - 11:00 AM
A Bi-Kinetic Technique To Assess Fatigue

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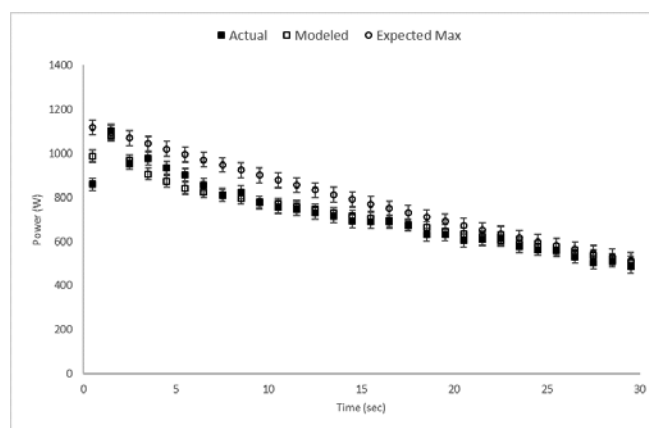
(No relationships reported)

Fatigue during maximal cycling is often quantified as relative change in torque (T) or power (P) as Fatigue Index (FI). FI however, does not account for changes in cadence (C) which impacts both P and FI. We investigated a method, Bi-Kinetic cycling, to quantify fatigue and account for changes in C. We then tested the validity of our results by using rested and fatigued T-C relationships to predict P throughout a Wingate test. **PURPOSE:** To evaluate fatigue using Bi-Kinetic cycling and develop a P model for short term maximal trials.

METHODS: Four cyclists completed six 25s maximal Bi-Kinetic cycling trials. For the first 18s C was held constant at 90, 125, or 160 rpm. C was then changed to one of the other values for the final 7s. The 6 C combinations produced three T-C relationships representing fatigue states resulting from pedaling at 90, 125, and 160rpm. Linear regression of T-time data was used to estimate the T that would have been produced during the C transition period. Slopes of the fatigued T-C relationships were compared to the rested state. Rates of changes in maximum T and C with respect to time (dTmax/dt and dCmax/dt) were evaluated. dTmax/dt and dCmax/dt were used to model the T-C relationship as a function of time and C and thereby predict P during a Wingate test. Finally, those T-C relationships were used to determine optimized maximum P throughout the Wingate test.

RESULTS: Slopes of the rested and fatigued T-C relationships differed ($p < 0.05$). dCmax/dt was significantly influenced by the fatiguing cadence ($p < 0.05$) but dTmax/dt was not. Modeled P was highly correlated with actual P during the Wingate test ($p < 0.001$, $r^2 = 0.96$). Maximum optimized P was greater than actual P during most of the Wingate test.

CONCLUSIONS: We used Bi-Kinetic cycling to quantify fatigue while accounting for C. Our results show that fatigue is influenced by C. Our model accurately predicted P during maximal fatiguing exercise. The constant load Wingate test results in less than optimal P.



2711 Board #231 June 2 9:30 AM - 11:00 AM
Bilateral Correlations between Peak Ground Reaction Forces and Bone Mineral Density in Male Collegiate Runners

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Overuse injuries are prevalent in distance runners due to the repetitive nature of the sport. Some runners exhibit speed dependent asymmetries in their running mechanics, which may play into the fact that these injuries often occur unilaterally. Analyzing correlations between ground reaction forces (GRF) and bone mineral density (BMD) may help elucidate whether the risk of overuse injuries differs between legs.

PURPOSE: To investigate the bilateral correlations between peak GRF at two different speeds and left and right femoral neck BMD in male, NCAA Division I distance runners.

METHODS: Fifteen male collegiate runners participated in this study (Age: 20 ± 1 year; Height: 179 ± 9 cm; Weight: 70 ± 15 kg; Body Fat: 10.75 ± 4 %). Ground reaction forces (N) were collected with Noraxon SciFit (Scottsdale, AZ) instrumented treadmill as participants ran at two different speeds; threshold pace (TP: 19.3 km/hr or 5:00 min/mi) and long-slow distance pace (LSD: 13.8 km/hr or 6:58 min/mi). The femoral necks were scanned with dual-energy x-ray absorptiometry (DXA) using Norland Elite (Fort Atkinson, WI). Peak stance-phase GRF of the left and right leg

Denver, Colorado

were extracted from the TP and LSD condition. Femoral neck BMD (g/cm³) values for right and left leg were extracted from the DXA scans. Bivariate correlations were used to analyze the correlations between femoral neck BMD and peak GRF at the two running speeds. Separate correlation analyses were run for the left and right leg.

RESULTS: During the LSD condition, peak GRF and BMD data were correlated only for the right leg (Right: $r = 0.539, p = 0.03$; Left: $r = 0.412, p = 0.127$). Similarly, peak GRF and BMD were correlated only for the right leg during the TP condition (Right: $r = 0.53, p = 0.042$; Left: $r = 0.506, p = 0.054$).

CONCLUSIONS: Peak stance-phase GRF of the right leg were positively correlated with BMD of the right femoral neck, regardless of running speed. The fact that significant correlations between peak GRF and BMD data were only observed on one side suggests that side-to-side differences could influence the risk of sustaining unilateral overuse injuries in runners.

2712 Board #232 June 2 9:30 AM - 11:00 AM
Motor Units Discriminated From High-density, Surface Electromyography Require Careful Scrutiny.

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High-density, surface electromyography (EMG) allows concurrent recording of motor unit (MU) activity by increasing the recording area and the number of recording sites. The recorded signal comprises overlapping MU action potentials, some of which can be identified with a decomposition algorithm. However, such analyses often produce results that contradict the classical findings on motor unit discharge characteristics. **PURPOSE:** To evaluate the quality of the interspike intervals (ISIs) extracted from a high-density surface EMG recording by a decomposition algorithm. **METHODS:** Muscle activity was recorded using high-density, surface EMG (4x8 grid with a 10 mm interelectrode distance) in 10 persons with multiple sclerosis during steady, isometric dorsiflexor contractions on their less-affected limb. The target force was 10% of maximum. Custom Matlab software was used to perform a convolution kernel compensation model and a blind-source separation algorithm to discriminate individual MUs from EMG recordings. The discharge times (DT) from the discriminated MUs were used to calculate the ISIs ($ISI = DT_n - DT_{n-1}$). For each MU, the average ISI, average coefficient of variation for ISI (ISI_{CV}), kurtosis for the distribution of ISIs, and skewness for the distribution of ISIs was calculated. ISIs outside of the range of 25 ms - 400 ms were deemed inaccurate and removed from the data and the same analyses were repeated. Data are reported as mean [95% CI]. **RESULTS:** The ISIs ($n = 33,980$; 303 [285-321] per MU) of 113 MUs were examined. Before removing ISIs that did not meet the inclusion criteria (25 - 400 ms), the average ISI was 136 ms [123 - 151 ms], the average ISI_{CV} was 72% [50 - 95%], the average kurtosis was 53.5 [39.1 - 67.8], and the average skewness was 4.4 [3.5 - 4.3]. On average, 3.34% (range 0 - 31%) of the ISIs per MU were outside the acceptable range. After ISI removal, the average ISI was 120 ms [114 - 125 ms], the average ISI_{CV} was 28% [26 - 31%], the average kurtosis was 11.0 [8.9 - 13.2], and the average skewness was 1.95 [1.70 - 2.20]. Most removed ISIs were <25 ms. **CONCLUSION:** The findings quantify the extent to which MU discharge times extracted from high-density, surface EMG recordings with an automatic decomposition algorithm can be confounded by discrimination errors.

2713 Board #233 June 2 9:30 AM - 11:00 AM
Blood Flow Restricted Exercise Alters Motor Unit Recruitment And Firing Rate

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(No relationships reported)

Purpose: Despite suggestions that low-intensity (LI) blood flow restricted exercise (BFRE) may be as effective as high intensity (HI) resistance exercise for the purpose of enhancing the recruitment of type II motor units (MU); individual MU acute response to LI BFRE has never been observed and/or reported. Recently, the decomposition of the surface electromyographic (EMG) signals introduced new analysis methods to assess single MU properties. Through these methods we aimed to observe LI BFRE effects on the behavior of the individual MU.

Methods: Eight men (26.0 ± 3.8 yrs) performed 5 sets of 15 reps of knee extensions at 20% 1RM (with and without BFR). BFR condition was set at 60% of the individual absolute arterial occlusion value. Torque was determined during pre- and post-exercise maximal voluntary contractions (MVC). Surface EMG activity was recorded from the vastus lateralis (VL) at pre- and post-exercise time point measurements. In each of these time points, isometric voluntary contractions were performed, matching

trapezoidal target-force trajectories at 40% pre-MVC. Resulting surface EMG signals were decomposed and MU recruitment threshold, firing rates and MU action potential (MUAP) amplitudes were further analyzed.

Results: Torque only decreased after the LI BFRE condition (-20.5%; $p < 0.05$). In the regression lines between MU recruitment threshold and firing rate, LI BFRE induced higher decrements in the linear slope coefficient (-165.1% ± 120.4, $p < 0.05$) when compared to LI condition (-44.4 ± 33.1, $p < 0.05$). Also, the MU firing rate vs. MUAP amplitude relationship had a notable shift to higher firing rate and MUAP amplitude values after the BFRE condition, reinforcing the evidence that new MUs with higher MUAP amplitude are recruited and MUs with similar MUAP amplitudes are activated at higher firing rates.

Conclusion: LI BFRE induced a significant change in the MU recruitment pattern, with higher-threshold and lower-firing rate MUs being recruited earlier to compensate muscle failure. Moreover, there were strong evidences about an elevated firing rate in similar MUAP amplitude after LI BFRE condition.

Acknowledgements: The authors would like to express their gratitude to Dr. Paola Contessa (Delsys Inc., Natick, USA), for all the invaluable assistance, comments and support.

2714 Board #234 June 2 9:30 AM - 11:00 AM
The Effect of Real-Time Haptic Feedback on Kinesthetic Awareness and Motor Skill Performance

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Reported Relationships: J.T. Shattuck: Intellectual Property; Jo Shattuck (owner).

PURPOSE: Kinesthetic awareness is an individuals' knowledge of their own body position and movements in space. Sensory integration is the process of combining inputs from proprioceptive receptors in muscles, mechanoreceptors in skin, and visual motor/visual spatial systems is critical to motor skill acquisition. We proposed that kinesthetic awareness training (KAT): the addition of haptic feedback in real time, to introduce secondary discriminatory system information into kinesthetic processing. We hypothesized that input will reinforce proprioceptive skills by merging a non-native input with native proprioceptive and visual system information, and subsequently cause an increase in accuracy in a single session of motor skill practice. **METHODS:** We assessed torso angle, a crucial control element that are common to many multi-joint, complex actions. Three subjects (19.7 ± 0.58 yrs) performed static and dynamic torso control movements with and without real-time haptic feedback. A wearable mini motion-capture-feedback device with embedded accelerometer, magnetometer, gyroscope and proximity sensors recorded continual positional data in 8 axes. The device provided haptic feedback (vibrations via tiny motor) when the target parameters were achieved. After 5 repetitions of practice, alternating sets with and without real-time haptic feedback were measured, (2 sets of 5 and 10 repetitions). **RESULTS:** We analyzed posture control in 2 conditions in the beginning and end of a training session. An ANOVA was performed on normalized differences from the target means was significant in the initial training sets, ($p < 0.01, F = 4.2$), and not significant in the final sets, ($p = 0.09, 4.00$). The results suggest a significant learning effect with KAT training after 30 repetitions. **CONCLUSION:** The results of this study suggests KAT training with haptic feedback could be a valuable teaching tool for improving somatosensory proprioception and kinesthetic awareness. Further investigations should examine if the KAT training leads to neural adaption and improved motor performance.

2715 Board #235 June 2 9:30 AM - 11:00 AM
A 6-week Strength Training Increases Muscle Size in Patients with Chronic Ankle Instability: MRI Analysis

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(No relationships reported)

Patients with chronic ankle instability (CAI) have shown strength deficits in ankle and hip musculature. Little is known whether strength deficits are associated with muscle size in this patient population, and if strengthening can improve muscle size.

PURPOSE: To examine the effect of a 6-week ankle and hip strength program on peroneus longus (PL) and gluteus medius (GM) muscle size in CAI patients.

METHODS: 14 CAI subjects in a strength group (22±1 yrs, 173±9 cm, 73±12 kg, 82±8% FAAM ADL, 58±13% FAAM Sports, 3.7±1.5 ankle sprains) completed a series of 5 ankle and hip strength exercises (isometric, concentric, and eccentric contraction with theraband) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22±2 yrs, 177±9 cm, 75±12 kg, 81±9% FAAM ADL, 56±12% FAAM Sports, 5.9±3.3 sprains). A Siemens Trio MRI scanner with a large flex coil was used to acquire images using a 3D multi-slice spiral gradient echo sequence with TE: 7.48 ms, TR: 17 ms, slice thickness: 5 mm. Images were acquired

at pre- and post-intervention. Axial cross-sectional area (CSA) from each muscle was segmented using Analyze 12.0 software. PL muscle belly was consistently defined at 15th/96 slices (7.5 cm) from the superior head of the fibula. GM muscle belly was defined at 15th/64 slices (7.5 cm) from the superior greater trochanter of the femur. ANCOVA analyses (covariate: pre-intervention value) were used to detect group x time differences.

RESULTS: ANCOVA analyses confirmed between-group differences in PL ($F_{1,25}=36.232$; $p < .05$) and GM CSA ($F_{1,25}=13.389$; $p < .05$) over time. The strength training resulted in a 5% increase in PL (pre: 6.0 ± 1.31 cm², post: 6.3 ± 1.3 cm²; $p < .05$) and a 5.7% increase in GM CSA (pre: 47.7 ± 6.7 cm², post: 50.4 ± 6.6 cm²; $p < .05$). No changes were detected in PL (0.7% reduction; pre: 6.96 ± 1.7 cm², post: 6.91 ± 1.6 cm²; $p > .05$) and GM CSA (0.6% increase; pre: 47.5 ± 7.9 cm², post: 47.7 ± 7.8 cm²; $p > .05$) in the control group.

CONCLUSIONS: Relative to the control group, a 6-week strength program is beneficial in increasing ankle evorator and hip abductor muscle size. As muscle size is proportional to strength, increased muscle size would result in greater muscle strength, which can have positive effects on movement and dynamic stability during functional movement.

2716 Board #236 June 2 9:30 AM - 11:00 AM
Influence of Body Position on Maximum Ankle Torque under Volitional Fatigue Conditions

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(No relationships reported)

Many studies have investigated the reliability of measuring isometric ankle strength using isokinetic dynamometer. However, hip position and body position may influence the participant's ability to generate torque during the test. **Purpose:** To investigate the effect of body position on isometric ankle plantarflexor (PF) and dorsiflexor (DF)-strength measurement in pre and post fatigued conditions. **Methods:** Fifteen healthy subjects (age: 20.5 ± 1.5 yrs) participated. Subjects required a total 2 of visits with a week period between visits. Subjects were initially assigned one of two test positions (seated and supine). The order of test positions were randomized and counterbalanced. Subjects performed the Bruce protocol on a treadmill until they reached volitional exhaustion. Before and after the Bruce protocol, subjects performed a total of 3 maximum voluntary isometric contractions (MVIC) in PF and DF directions. Data were analyzed using peak torque in each direction from the 3 trials of the MVIC. Separate two-way analysis of variance with repeated measures was used to assess the effect of fatigue (pre-fatigue and post-fatigue) and test position (seated and supine) for PF and DF. **Results:** There were significant differences between both pre and post-fatigue (PF; pre: 103.1 ± 17.2 Nm vs post: 82.4 ± 14.4 Nm, p -value $<.001$, DF; pre: 21.7 ± 4.9 vs post: 18.3 ± 6.3 , p -value $<.001$) and supine and seated positions (PF; supine: 84.7 ± 15.6 Nm vs seated: 101.5 ± 18.8 Nm, p -value $<.001$, DF; supine: 17.9 ± 5.4 vs seated: 22.2 ± 5.6 , p -value $=.026$) for PF and DF torques. There was no significant interaction between time and position for any variables. **Conclusions:** Body position affected isometric ankle PF and DF strength but fatigability was not influenced by body position. Specifically, subjects were able to produce more torque in the seated position compared to supine position. This may be due to the subjects ability to stabilize the back and hip against the seat back. Further, this suggests that these two positions should not be interchanged when testing individuals in pre- and post-fatigue situations.

2717 Board #237 June 2 9:30 AM - 11:00 AM
Strength and Proprioceptive Training Increases Muscle Size in Patients with Chronic Ankle Instability: MRI Analysis

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(No relationships reported)

Chronic ankle instability (CAI) is related to strength deficits in ankle and hip musculature. Rehabilitation training improves muscular strength, but it is unclear whether strength gain results from an increase in muscle size or neuromuscular efficiency.

PURPOSE: To examine the effect of a 6-week ankle and hip strength and proprioceptive program on peroneus longus (PL) and gluteus medius (GM) muscle size in patient with CAI.

METHODS: 15 CAI subjects in a rehab group (23 ± 2 yrs, 178 ± 8 cm, 76 ± 9 kg, $83 \pm 7\%$ FAAM ADL, $56 \pm 10\%$ FAAM Sports, 4.7 ± 2 ankle sprains) completed a series of 10 ankle and hip strength and proprioceptive exercises (theraband, wobble board, ankle

disk, etc.) 3 times/week for 6 weeks under supervision. 14 CAI subjects participated in a control group (22 ± 2 yrs, 177 ± 9 cm, 75 ± 12 kg, $81 \pm 9\%$ FAAM ADL, $56 \pm 12\%$ FAAM Sports, 5.9 ± 3.3 sprains). A Siemens Trio MRI scanner with a large flex coil was used to acquire images using a 3D multi-slice spiral gradient echo sequence with TE: 7.48 ms, TR: 17 ms, slice thickness: 5 mm. Images were acquired at pre- and post-intervention. Axial cross-sectional area (CSA) from each muscle was segmented using Analyze 12.0 software. PL muscle belly was consistently defined at 15th/96 slices (7.5 cm) from the superior head of the fibula. GM muscle belly was defined at 15th/64 slices (7.5 cm) from the superior greater trochanter of the femur. ANCOVA analyses (covariate: pre-intervention value) were used to detect group x time differences.

RESULTS: ANCOVA analyses confirmed between-group differences in PL ($F_{1,26}=39.087$; $p < .05$) and GM CSA ($F_{1,26}=22.965$; $p < .05$) over time. The rehabilitation intervention resulted in a 3.9% increase in PL (pre= 5.9 ± 1.5 cm², post= 6.1 ± 1.5 cm²; $p < .05$) and a 5.1% increase in GM CSA (pre= 42.0 ± 7.1 cm², post= 44.2 ± 7.3 cm²; $p < .05$). No significant changes were detected in PL (0.7% reduction; pre= 6.96 ± 1.7 cm², post= 6.91 ± 1.6 cm²; $p > .05$) and GM CSA (0.6% increase; pre= 47.5 ± 7.9 cm², post= 47.7 ± 7.8 cm²; $p > .05$) in the control group.

CONCLUSIONS: Relative to the control group, a 6-week strength and proprioceptive program is effective in increasing muscle size of ankle and hip musculature. As muscle size is proportional to muscular strength, increased muscle size might have a positive impact on dynamic functions at the ankle and hip.

2718 Board #238 June 2 9:30 AM - 11:00 AM
Sex-Specific Responses to Fatiguing Exercise Can Be Explained by Electromechanical Efficiency

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PURPOSE: It is well known that muscle fatigue is manifested uniquely between men and women. Electromechanical efficiency has been used to examine various aspects of muscle function, but has not been applied to examine sex-specific fatigue responses. Therefore, the purpose of the present study was to examine electromechanical efficiency between men and women during a fatiguing task. **METHODS:** Twenty-two resistance-trained men and women performed 50 submaximal (65% of concentric peak torque), concentric muscle actions of the dominant forearm flexors at $60^\circ \cdot s^{-1}$. Concentric peak torque was determined prior to and immediately after the fatiguing protocol. Surface electromyographic and mechanomyographic signals were simultaneously recorded from the biceps brachii muscle and electromechanical efficiency was calculated as the ratio of mechanomyographic amplitude to electromyographic amplitude. An independent samples t -test was used to compare the percent decreases in concentric peak torque between the men and women. Polynomial regression analyses were used to examine the composite patterns of responses for electromechanical efficiency for the men and women. In addition, to allow for the comparison of slope coefficients, composite electromechanical efficiency values were natural log transformed and fitted with a linear model. **RESULTS:** Concentric peak torque decreased to a greater extent in the men (30.5%) compared to the women (22.3%). In addition, electromechanical efficiency decreased for both the men (quadratic, $p = 0.016$, $r = -0.919$) and women (quadratic, $p = 0.006$, $r = -0.605$), but the natural log transformed slope coefficients indicated that the decrease was greater ($p = 0.026$) for the men (-0.009) than the women (-0.003). **CONCLUSION:** Like concentric peak torque, electromechanical efficiency decreased for both the men and women, but the decrease was greater for the men. These findings indicated that men exhibited decreased electromechanical efficiency compared to their female counterparts which may have contributed to the greater decrease in concentric peak torque for the men. Thus, electromechanical efficiency may provide additional insight regarding the potential mechanisms mediating sex-specific responses to fatiguing exercise.

2719 Board #239 June 2 9:30 AM - 11:00 AM
MMAX Normalisation of Voluntary EMG Removes the Confounding Influences of Electrode Location and Body Fat.

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The evoked maximal M-wave (M_{MAX} peak-to-peak [P-P]) is frequently used to normalise surface electromyography (sEMG) during voluntary contractions. However, it is unknown if M_{MAX} normalization: (i) accounts for the variation in electrode position over a muscle, potentially removing the need for precise and yet imperfect electrode placement between measurement sessions; and (ii) removes the documented influence of body fat on sEMG amplitude during voluntary contractions.

PURPOSE: The first aim of the study was to assess the influence of electrode positioning on sEMG measurements, using multiple recordings sites over the vastus lateralis (VL), during maximum voluntary contractions (MVCs) and evoked M_{MAX} , and examine if any site differences in these parameters were proportional. The second aim was to investigate if M_{MAX} normalization removes the confounding influence of body fat, quantified by skin-muscle distance (SMD), on sEMG during MVCs.

METHOD: Young healthy males completed both experiments. Experiment 1 (n=10; 22 ± 2 y; 1.78 ± 0.07 m; 73.6 ± 5.0 kg) involved simultaneous sEMG measurements from 8 different VL sites during knee extension isometric MVCs and twitch contractions. Experiment 2 (n=41; 24 ± 2 y; 1.76 ± 6 m; 69 ± 6 kg) involved the same contractions with sEMG recordings from one location over the VL, vastus medialis and rectus femoris, and measurements of SMD at each sEMG site using B-mode ultrasonography. **RESULTS:** Experiment 1 demonstrated that absolute sEMG at maximal voluntary torque (EMG_{MVT}) differed between the VL recording sites (P<0.001) with lower values at more proximal sites (P<0.030). However, when EMG_{MVT} was normalised to M_{MAX} P-P between sites no differences were found (P=0.929). Experiment 2 showed that absolute EMG_{MVT} was negatively related to SMD (P<0.001, r= -0.786) but when EMG_{MVT} was normalised by M_{MAX} P-P the relationship with SMD was not significant (r= -0.007, P=0.966).

CONCLUSION: The present study suggests voluntary sEMG and M_{MAX} P-P amplitude vary proportionally across the surface of the VL muscle and that normalising voluntary sEMG to M_{MAX} P-P removes the confounding influence of body fat. Therefore, M_{MAX} P-P normalisation is recommended to overcome the issues of both sensor re-positioning between test sessions and variable body composition between participants.

2720 Board #240 June 2 9:30 AM - 11:00 AM
H-Reflex Plasticity Following Cast Immobilization Of Distal Radius Wrist Fractures

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 (No relationships reported)

The Hoffmann (H)-reflex has been used as a recovery marker in disuse-immobilization models. The data is limited on the effects of forearm immobilization on the H-reflex, especially in clinical populations. **PURPOSE:** To determine H-reflex changes following a distal radius wrist fracture requiring cast immobilization. **METHODS:** Five fracture (FX) patients (4 W; 1 M; age: 45.2±18.9 yrs; ht: 164.1±7.0 cm; wt: 64.4±4.9 kg) and five uninjured age-matched controls (CON) (4 W; 1 M; age: 44.6±17.3 yrs; ht: 171.5±5.5 cm; wt: 68.9±8.8 kg) were enrolled. FX group was measured four times up to 12-weeks post fracture; the CON group was tracked over the same period, with measures taken at least three weeks apart. H_{max} and M_{max} were elicited in the flexor carpi radialis (FCR) of each arm via stimulation of the median nerve (0.5 ms pulse) under a 10% maximal voluntary contraction (MVC). A recruitment curve was built using 0.5 mA increments. Measures included wrist flexion (WF) torque (dynamometer), peak electromyography (EMG) amplitude normalized to M_{max} , grip strength, range of motion (ROM; goniometry), muscle thickness (MT; ultrasound), and function via Patient-Rated Wrist Evaluation (PRWE). **RESULTS:** In the fractured limb, $H_{max}:M_{max}$ amplitude ratio (23.0±16.1 to 23.1±12.0%) did not change over time (p > 0.05), but $H_{max}:M_{max}$ stimulation ratio significantly decreased: 70.5±2.9% to 63.1±4.5% (p < 0.05). WF increased during recovery (6.4±1.2 to 8.5±2.3 Nm; p < 0.05), but normalized EMG during MVC showed a decreasing trend from 18.3±6.4 to 13.8±9.6% M_{max} (p = 0.054). Time main effects were also evident for MT (2.7±0.5 to 3.2±0.5cm; p < 0.05), grip strength (6.0±6.8 to 19.6±8.5kg; p < 0.001), wrist ROM (87.9±18.7 to 119.4±20.5°; p < 0.05), and PRWE (84±24 to 28±32 score; p < 0.001), all reflecting incomplete recovery up to 12-weeks post fracture. No significant differences were shown for the uninjured arm of FX group or in any measures for CON, except WF MVC (24.7±7.2 to 22.0±6.9Nm; p < 0.05). **CONCLUSION:** Although peak amplitude of the H-reflex did not change during recovery, decreased intensity needed to evoke H_{max} could reflect changes to the excitability of spinal circuitry after wrist fracture. These data have important therapeutic implications for understanding how the nervous system is impacted after wrist fracture and cast immobilization.

2721 Board #241 June 2 9:30 AM - 11:00 AM
Comparison of Lower Extremity Muscle Activity in Sliding Lunges versus Standard Lunges

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 (No relationships reported)

Lunges are a functional exercise used in lower body neuromuscular training programs. Lunges are typically performed on the floor stepping forward, sideways, or backwards, but can be performed on a slide board or with foot sliders. Sliding allows partial weight bearing and may improve stability. Differences in neuromuscular challenges, specifically hip and knee muscle activity, between sliding and standard lunges are unknown. **PURPOSE:** To compare hip and knee muscle activity between sliding and

standard reverse lunges (RL) and side lunges (SL). **METHODS:** Sixteen healthy active subjects performed 3 types of RLs and SLs: slide board (SB), foot sliders (FS), and standard lunges (ST). After skin preparation, surface electrodes were placed over the muscle bellies of the gluteus maximus (GMX), ipsi- and contra-lateral gluteus medii (iGM, cGM), vastus lateralis (VL), and vastus medialis (VM). Muscle activity of the weight bearing leg was measured at 1000 Hz with a wireless EMG system. Lunges were performed at a standardized tempo (44 bpm) and subject specific standardized length. Maximum voluntary isometric contractions (MVIC) were used to normalize peak EMG (pEMG) and average EMG (aEMG) to percent MVIC for 4 lunges of each subject all conditions. One-way repeated measures ANOVAs (α=0.05) were used to determine differences between the 3 lunge types for SL and RL. **RESULTS:** RL cGM aEMG was greater for ST (22 ± 21%) versus FS (16 ± 17%), p = .012. RL VM aEMG was lower for SB (30 ± 12%) versus FS (34 ± 14%), p = .016. SL VL aEMG was greater for ST (230 ± 150%) versus SB (198 ± 121%), p = .049. SL GMX aEMG was greater for ST (192 ± 137%) versus SB (159 ± 123%) and FS (162 ± 103%), p = .001 and .035. SL VM aEMG was greater for ST (135 ± 14%) versus SB (26 ± 11%) and FS (25 ± 9%), p = .009 and .004. SL iGM pEMG was greater for ST (79 ± 44%) versus SB (52 ± 32%) and FS (50 ± 37%), p = .019 and .003. SL cGM pEMG was greater for ST (79 ± 41%) versus SB (59 ± 34%), p = .027. SL VM pEMG was greater for ST (92 ± 46%) versus SB (63 ± 28%) and FS (60 ± 18%), p = .031 and .01. **CONCLUSION:** Hip and knee muscle activity is similar for RL with minor differences in cGM and VM based on lunge type. Standard SL had consistently greater peak and average muscle activity compared to sliding lunges. Sliding SL may require different neural control which could be important in rehabilitation settings.

2722 Board #242 June 2 9:30 AM - 11:00 AM
Change Of Lower Limb Muscle Strength Of Older OA Adult After 24 Weeks Tai Chi Intervention

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The incidence of knee osteoarthritis (OA) increases with age. Epidemiological studies have shown a high prevalence of knee OA among older Chinese. Tai Chi exercise as a traditional Chinese practice has long been used to enhance fitness. Research increasingly shows that many OA signs and symptoms, such as reduced joint mobility, pain, and increased joint stiffness, can be ameliorated by Tai Chi exercise. However, the lower limb joint torque of OA patients were less reported after long term Tai Chi exercise. **PURPOSE:** To determine whether the Tai Chi exercise intervention would improve lower limb joint power of OA older adult or not. **METHODS:** 20 older women (65ys - 79ys, Kellgren-Lawrence 3 grade, having no lower limb surgery, no orthopedic problems of the hip, knee, or ankle, no neurological disease, no regular exercise.) with clinically diagnosed knee OA were recruited in this study, 9 finished this at last. Participants practiced Tai Chi exercise which include eight Tai Chi forms of 24 forms Yang Style 24 weeks, 3 times/week, 1 hour/time. Hip, knee and ankle extensor/flexor muscle peak torque of older adult before and after intervention were tested by Contrax (Swissland) at 90°/s angular velocity. A paired Student's t test was used to compare pre-post differences. Written informed consent was received from all participants.

RESULTS: The hip, knee and ankle peak extensor torque were 38.67 ± 15.08N·M, 51.28 ± 13.77N·M and 10.06 ± 1.36N·M, the peak flexor torque were 27.41 ± 8.97N·M, 47.02 ± 9.88N·M, and 19.89 ± 6.75N·M before training. The hip, knee and ankle peak extensor torque were 26.81 ± 16.08N·M, 48.71 ± 6.91N·M and 26.4 ± 22.11N·M, the peak flexor torque were 23.84 ± 7.57N·M, 48.28 ± 9.09N·M, and 26.81 ± 10.00N·M after training. The hip/knee extensor/flexion torque did not change after training (p > 0.05), the ankle extensor/flexor torque increased after training (p_e = 0.05, p_f = 0.007). **CONCLUSIONS:** 24 weeks Tai Chi training will help OA older adults to improve the strength of ankle joint and it was related to the characteristics of Tai Chi movement.

2723 Board #243 June 2 9:30 AM - 11:00 AM
Electro- Or Traditional-acupuncture Immediately Increases Flexibility, But Does Not Affect Kinesthesia And Muscle Activation

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Although acupuncture is a common pain relief treatment, it may also be effective in range of motion, joint position sense, and muscle function. **PURPOSE:** To examine the immediate effects of electro- and traditional-acupuncture on hip flexion range of motion (HROM), knee joint position sense (KJPS), and maximal voluntary isometric contraction (MVIC) and central activation ratio (CAR) in quadriceps. **METHODS:** Fifty healthy adults participated in this randomized controlled laboratory study. Baseline measurements (HROM, KJPS, MVIC, and CAR) were obtained before a

treatment. An acupuncturist performed three physical examinations (SLR test, Thomas test, and hip abduction manual muscle test) to determine one of three acupuncture options (option A: SP9, SP10, and SP11; option B: ST34, ST36, and GB 42; option C: GB33, GB34, and GB27). Afterwards, one of three treatments (control: no treatment, n=16; electro-acupuncture, n=19, and traditional-acupuncture, n=15) was randomly assigned to each participant for 15-min. Measurements were assessed at baseline, 0-, 20-, and 40-min post treatment. At each time point, HROM was measured using a goniometer on a supine position. KJPS on two knee flexion angles (15° and 45°) were randomly assessed. Quadriceps MVIC and CAR were measured on a dynamometer with superimposed bursts (knee locked at 90°). To test treatment effect over time, 3 × 4 mixed model ANOVAs and Tukey-Kramer post hoc tests were performed ($p < 0.05$). **RESULTS:** Either electro- (4.2°, $p < 0.0001$) or traditional-acupuncture (5.8°, $p < 0.0001$) immediately increased HROM ($F_{6,141} = 4.27, p < 0.001$) at 0-min post treatment. There was no difference between acupuncture types ($p = 0.41$). Regardless of treatments (time main effect: $F_{3,141} = 12.57, p < 0.0001$), quadriceps MVIC was reduced at 0- (5.2 %, $p < 0.001$), 20- (5.0 %, $p < 0.001$), and 40-min post treatment (7.1 %, $p < 0.0001$), compared to the baseline values. KJPS ($F_{6,141} = 1.81, p = 0.10$) and CAR ($F_{6,141} = 0.42, p = 0.87$) did not change at any time point. **CONCLUSIONS:** A single session of electro- or traditional-acupuncture treatment is beneficial for flexibility but not for kinesthesia and muscle activation. Changes in blood flow volume, overlap between actin and myosin filaments, and viscoelastic properties of muscle-tendon units may explain an increase in flexibility.

2724 Board #244 June 2 9:30 AM - 11:00 AM
Effects of Marijuana Use on Lower Extremity Isokinetic Strength and Core Endurance

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(No relationships reported)

Marijuana use among athletes is becoming more widely reported, particularly as more states legalize the drug. Anecdotal, supporters suggest that marijuana aids in recovery and improves performance. Unfortunately, the effect of marijuana use on muscle function is not currently understood. **Purpose:** To determine whether muscle strength and endurance are altered by marijuana use. **Methods:** All participants were physically active, defined by at least 150 minutes of moderate-intensity exercise per week via the I-PAQ Short Format, and were either marijuana users (MU, $n = 10$, mass = 81.4 ± 20.0 kg; ht = 1.75 ± 0.08 m; age = 25 yrs ± 6 yrs) or non-marijuana users (NU, $n = 15$, mass = 73.5 ± 13.5 kg; ht = 1.80 ± 0.08 m; age = 25 yrs ± 6 yrs). Marijuana use habits were quantified through the Marijuana Use Measure. MU were described as those consuming marijuana products at least once a week for the past 6 months and NU were described as not having used any form of marijuana in the past 12 months. Hip ($90^\circ \cdot s^{-1}$), knee ($30^\circ \cdot s^{-1}$), and ankle ($30^\circ \cdot s^{-1}$) isokinetic strength was assessed in the dominant leg of each participant using a Biodex dynamometer. Leg dominance was determined by asking which leg the person would choose to kick a ball with for maximum velocity and distance. Core endurance (back extension, left side plank, right side plank, and trunk flexion) was also assessed by holding the position until failure. The time it took to reach failure for each condition for each participant was recorded. All conditions were randomized across participants and groups to avoid any order effects. A single factor MANOVA ($\alpha < 0.05$) was used to determine differences between groups.

Results: There were no statistically significant differences between groups for any strength or core endurance measures ($\lambda^* = 0.657$; $DF = 10, 15$; $F = .730$; $p = .687$). **Conclusion:** Marijuana use in a healthy, young, active population does not appear to enhance or suppress core endurance or lower extremity strength. It is possible that exercise may be mediating potential detrimental effects of marijuana use. Future research should also focus on inactive populations using marijuana to assess if exercise is providing a protective effect.

2725 Board #245 June 2 9:30 AM - 11:00 AM
Comparison of Electromyographic Responses Across Handle Types During Seated Row Exercise

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(No relationships reported)

Handle design and wrist position can affect the muscular performance during resistance exercises. **Purpose:** This study compared the electromyographic (EMG) responses during seated row exercise in the Latissimus Dorsi (LD), Biceps Brachii (BB), and Flexor Carpi Radialis (FCR) using a cylindrical handle versus a MAG® handle. **Methods:** Ten males (aged 21.1 ± 1.4 years) with prior resistance training experience (6.3 ± 1.9 years) performed the exercise protocol on a cable machine. Participants completed a one-repetition maximal lift (1-RM) followed by one set at 85% 1-RM until failure, using both handle types in randomized order. Root mean square EMG (EMG_{RMS}) recordings from the BB, LD, and FCR were normalized to

the 1-RM values. **Results:** Two-way repeated measures ANOVA was used to analyze differences between handle types and EMG activity. EMG_{RMS} values (%) are presented in the table below:

	Cylinder	MAG(R)
Biceps Brachii	66.6 ± 8.9	72.9 ± 2.6*
Latissimus Dorsi	86.6 ± 13.3	84.2 ± 4.6
Flexor Carpi Radialis	57.9 ± 4.1	67.3 ± 4.3

* Sign. Diff. ($p < 0.001$)

The 1-RM lifts were significantly greater ($p < 0.003$) with the MAG® handle (115.2 ± 17.4 kg) versus the cylindrical handle (112.5 ± 17.6 kg). However, there were no significant differences between handles for the total number of repetitions completed (cylindrical 11.9 ± 3.67 ; MAG® 11.2 ± 2.4). **Conclusions:** These findings showed significantly higher maximal lifts and greater EMG activity in the BB using the MAG® handle. Possible mechanisms for these differences may be related to actin and myosin overlap of the forearm flexors, grip comfort and differences in handle contact surface area.

2726 Board #246 June 2 9:30 AM - 11:00 AM

Effect of Movement Speed on Pattern Matching for a Continuous Activity with Visual Feedback

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(No relationships reported)

Providing visual feedback (VF) during a task is a common strategy to enhance patient success. However, the speed of the targeted movement may impact one's ability to use feedback toward matching a desired outcome. **Purpose:** 1) To determine the effect of target pattern speed on matching the movement pattern of a continuous activity with VF. 2) To determine if different speeds produce different task normalized muscle activation patterns. **Methods:** Ten young healthy subjects were recruited. Participants completed a non-resisted continuous wrist flexion (FLEX) and extension (EXT) activity. The task involved matching wrist angular motion with a target sine wave (0.7 or 1.0 Hz). VF of wrist movement and the target pattern were provided concurrently on a monitor. An electrogoniometer captured wrist movement while EMG was used to record forearm muscle activation. Five 20s trials with 2min rest periods were completed at each target speed. Cross-correlation (CC) was used to calculate temporal lag between movement and target patterns. Discrete Fourier Transformation (DFT) was used in calculating pattern frequencies to determine movement-target speed. Muscle activation on/off time (ON, OFF), total activation time (TAT), total movement time (TMT), and total co-contraction time (TCoT) were calculated to assess movement characteristics. Paired samples t-tests compared variables between the tested speeds. **Results:** Different wrist movement speeds and muscle activity (TMT and TAT) were found for each target speed ($p < .05$). Further analysis revealed movement and target patterns were similarly matched regardless of target speed, and wrist movement lagged behind target patterns by a similar amount at each speed (0.7 Hz, .007s; 1.0 Hz, .013s). Muscle activation in early EXT was similar between speeds for EXT ON (.03s) and FLEX OFF (.01s). At the start of FLEX, EXT OFF (.04s; $p < .05$) and FLEX ON (.07s; $p < .05$) occurred later at 0.7 Hz. No differences between speeds for TCoT were found. **Conclusions:** Despite lagging behind the target, movement speed did not alter one's ability to match target patterns. Furthermore, movement characteristics were similar between speeds, except for activation during initial FLEX. Greater elastic energy stored during wrist EXT at the higher speed may have delayed agonist activation during early wrist FLEX.

2727 Board #247 June 2 9:30 AM - 11:00 AM

Acute Effects of Unilateral Static Stretching On Handgrip Strength in the Stretched and Non-Stretched Limb

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Scientific Abstract:

Previous research has demonstrated that an acute bout of static stretching can reduce force and power output from the muscles undergoing the stretching treatment. Although the mechanism for this effect remains unclear, evidence has been presented for both neural inhibition and a decrease in musculotendinous stiffness. To further investigate the presence of a neural inhibitory mechanism, the current study focused on the impact of stretching just one limb on both the stretched limb and the contralateral non-stretched limb. It was reasoned that any decrease in force output from the non-stretched side could only be accounted for by neural inhibition as no mechanical adaptation would have occurred.

PURPOSE: To observe the effects of an acute bout of unilateral static stretching on handgrip strength and to discern whether a neural cross-over inhibitory effect is present to cause a decrease in force output and associated electrical activity from the non-stretched limb. **METHODS:** Thirty participants (15 males, 15 females) performed maximum voluntary unilateral handgrip contractions of both limbs before and after stretching the finger flexors of the strength-dominant side only. Each trial was assessed for peak force and associated muscle activity (iEMG), as well as rate of force generation values. **RESULTS:** Peak force ($p = 0.002$) and associated iEMG ($p = 0.000$) decreased by 4.2% and 6.5% respectively in the stretched limb only. However, rate of force generation was significantly impaired in both the stretched (-15.2%; $p = 0.000$) and non-stretched limbs (-9.4%; $p = 0.006$) one-minute post-stretch, and remained similarly depressed for both limbs 15 minutes later. **CONCLUSION:** We conclude, therefore, that acute stretching negatively impacts rate of force generation more than peak force. Moreover, a reduced rate of force generation from the non-stretched limb indicates the presence of a cross-over inhibitory effect through the nervous system, which provides additional evidence for a neural mechanism.

E-36 Free Communication/Poster - Physical Activity and Health in Adults

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2728 Board #248 June 2 11:00 AM - 12:30 PM

The Epidemiological Evidence of Cardiometabolic Disease Risk Factors in College-Aged Subjects: A Cross-Sectional Investigation

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PURPOSE: The purpose of this 5-year cross-sectional investigation was to collect basic body composition and fitness data on college-aged males and females to determine cardiometabolic disease risk throughout the college years. **METHODS:** A total of 3,388 college aged males ($n = 1919$) and females ($n = 1469$) age 18 - 25yrs participated in this investigation. Subjects performed the following tests: height; weight; body composition; muscular strength and endurance; cardiopulmonary function; flexibility; waist and hip circumferences; and resting blood pressure. **RESULTS:** Females demonstrated a significant increase, from 18-19 yrs to 20-25 yrs, respectively, in weight (67.1 to 70.8 kg), % body fat (27.9 to 30.4%), waist (80.5 to 83.3 cm) and hip (95.1 to 98.9 cm) measurements, fat mass (19.9 to 24.3 kg), BMI (24.4 to 25.8 kg-m²), diastolic blood pressure (75.8 to 77.4 mmHg), waist-to-height ratio (0.48 to 0.51), and total overweight and obese status (33.9 to 39.1%). These subjects demonstrated a significant decrease, from 18-19yrs to 20-25yrs, respectively, in sit-and-reach (15.4 to 14.6 in.) and total push-ups (15.2 to 13.3). Males demonstrated a significant increase, from 18-19yrs to 20-25 yrs, respectively, in weight (80.8 to 85.3 kg), % body fat (15.1 to 17.6%), waist-to-hip ratio (0.88 to 0.90), waist (85.9 to 89.4 cm) and hip measurements (97.3 to 99.7 cm), waist-to-height ratio (0.48 to 0.50), fat mass (13.3 to 17.1 kg), BMI (25.1 to 26.3), total overweight and obese status (38 to 48.5%), diastolic blood pressure (76.7 to 79.3 mmHg), and right (49.1 to 51.1 kg) and left (46.8 to 48.3 kg) grip strength. These subjects demonstrated a significant decrease, from 18-19yrs to 20-25 yrs, in sit-and-reach (14.5 to 13.9 in), total sit-ups (52.7 to 50.9), and total push-ups (33.6 to 32.1). All data was analyzed using independent sample t-tests (SPSS, v. 23; $p < 0.05$). **CONCLUSIONS:** We have demonstrated that there is a continuous decline in basic health and fitness outcomes in college-aged students that may lead to the development of co-morbid conditions and the development of cardiometabolic diseases such as diabetes, hypertension, and cardiovascular disease.

2729 Board #249 June 2 11:00 AM - 12:30 PM
Physical Activity and Perceived Stress Among Student Physical Therapists

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(No relationships reported)

Physical activity is often suggested for managing stress. However, it is not known if there is a relationship between perceived stress and physical activity among student physical therapists.

Purpose: To determine the percentage of student physical therapists that meet the national recommended guidelines for aerobic and muscle strengthening physical activity and to describe the relationship between physical activity, perceived stress levels, and time spent in sedentary activities.

Methods: Doctor of Physical Therapy Students ($n=113$) were grouped according to their year in the academic program as Grad I's, Grad II's, and Grad III's. Perceived Stress Scale and Exercise Activities Scale were combined in a questionnaire to describe student physical therapist's perceived stress levels and to determine the average amount of aerobic and muscle strengthening physical activity performed on a weekly basis. Sedentary activities questions were also included in the questionnaire. Data were analyzed for mean perceived stress levels, percentages of student who met the exercise activity guidelines and the mean time spent in sedentary activities. **Results:** Perceived stress was lower for the Grad III's (9.1 ± 4.2) compared to Grad I's (15.1 ± 6.1 $p < .05$) and Grad II's (18.79 ± 8.4 $p < .05$). Perceived stress was lower for the Grad I's compared to Grad II's ($p < .05$). Perceived stress was higher in Grad II's among all physical therapy students. Aerobic physical activity guidelines were met by 65% of Grad I's, 54% of Grad II's, and 93% of Grad III's. Muscle strengthening activity guidelines were met by 33% of Grad I's, 25% of Grad II's, and 72% of Grad III's. Time spent in sedentary activities was lower for Grad III's (867 ± 765 min) compared to Grad I's (2884.4 ± 1531.1 min, $p < .05$) and Grad II's (3741.5 ± 2092.3 $p < .05$). There was a negative correlation between perceived stress and meeting the aerobic ($r_{pb} = -.326$, $n = 113$, $p < .001$) and muscle strengthening ($r_{pb} = -.326$, $n = 113$, $p < .001$) physical activity guidelines for all cohorts. **Conclusion:** Student physical therapists in this Doctor of Physical Therapy program experiencing higher levels of perceived stress also demonstrate overall decreased physical activity and increased sedentary levels. In addition, perceived stress and activity levels appear to fluctuate during their education.

2730 Board #250 June 2 11:00 AM - 12:30 PM

Association of Physical Activity and Sedentary Behavior with Hyperuricemia

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(No relationships reported)

PURPOSE: The purpose of this study was to identify the associations of sedentary behavior and physical activity level with hyperuricemia in South Korean men and women. **METHODS:** This study includes 161,064 healthy men and women with completed health examination between March 2011 and December 2013. Physical activity level and sitting time were assessed by a validated Korean version of International Physical Activity Questionnaire Short Form (IPAQ-SF). The presence of hyperuricemia was determined by examining serum uric acid (SUA) concentration (≥ 7 mg/dL). Multivariable logistic regression analysis was conducted to investigate the associations of sedentary behavior and physical activity level with hyperuricemia. **RESULTS:** Participants who spent ≥ 10 hours/day was more likely to have hyperuricemia than participants spending < 5 hours/day (Odds Ratio [OR]=1.10, 95% confidence interval [CI]=1.05-1.16) after adjusting for age, sex and risk factors of hyperuricemia. Participating in health enhanced physical activity (HEPA) defined as 'vigorous-intensity activity on at least 3 days achieving a minimum Total physical activity of at least 1500 MET-minutes/week or 7 more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum Total physical activity of at least 3000 MET minutes/week' was associated with decreased prevalence of hyperuricemia, compared to in active group, defined as 'not meet physical activity criteria' (OR=0.92, 95% CI= 0.87-0.96). In gender stratified analyses, sitting time ≥ 10 hours/day was associated with increased prevalence of hyperuricemia (OR=1.09, 95% CI= 1.04-1.15) compared to sitting time < 5 hours/day, and participating in HEPA was associated with decreased prevalence of hyperuricemia (OR=0.91, 95% CI= 0.87-0.96) compared to the minimal activity in men, but it was not significantly associated with prevalence of hyperuricemia in women (sitting time, OR=1.27, 95% CI= 0.97-1.67; HEPA, OR=0.91, 95% CI= 0.77-1.39). **CONCLUSIONS:** This study identified that the prevalence of hyperuricemia was associated by decreased physical activity and prolonged sedentary behavior, especially in men. Thus, participating in regular physical activity and reducing sedentary time are recommended to reduce the prevalence of hyperuricemia.

2731 Board #251 June 2 11:00 AM - 12:30 PM

Associations Between Impaired Fasting Glucose, Hypertriglyceridemia, And Hyperinsulinemia In US Adults: 2007-2012 Nhanes

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(No relationships reported)

PURPOSE: Examine the gender stratified associations between combinations of impaired fasting glucose and hypertriglyceridemia and the odds of hyperinsulinemia using a nationally representative sample of U.S. adults. **METHODS:** Study sample included male ($n=3109$) and female ($n=3433$) adult (≥ 20 years of age) participants in the 2007-2012 National Health and Nutrition Examination Survey. Hyperinsulinemia

was defined using the 75th percentile of fasting insulin as the cutoff value. Logistic regression analysis was used to examine the associations among impaired fasting glucose, hypertriglyceridemia, and hyperinsulinemia. Logistic regression models were adjusted for age, race, moderate-intensity physical activity (MIPA), and waist circumference (WC). **RESULTS:** Demographic adjusted analyses revealed significantly greater odds of hyperinsulinemia in euglycemic men (OR 3.09, 95% CI 1.96-4.85) and women (OR 3.13, 95% CI 2.12-4.63) with hypertriglyceridemia ($P < 0.0001$ for both). Additionally, women with impaired fasting glucose and normal triglycerides had significantly greater odds of hyperinsulinemia (OR 5.62, 95% CI 3.61-8.75, $P < 0.0001$). A similar relationship was not revealed in men (OR 1.09, 95% CI 0.23-5.13, $P = 0.92$). Following adjustments for MIPA and WC, the odds of hyperinsulinemia in euglycemic men (OR 2.42, 95% CI 1.45-4.05) and women (OR 1.49, 95% CI 1.01-2.18) with hypertriglyceridemia were attenuated, but remained statistically significant ($P < 0.05$ for both). However, the odds of hyperinsulinemia in women with impaired fasting glucose and normal triglycerides were no longer statistically significant ($P = 0.12$). **CONCLUSION:** Our findings revealed greater odds of hyperinsulinemia in euglycemic men and women with hypertriglyceridemia regardless of MIPA or WC.

2732 Board #252 June 2 11:00 AM - 12:30 PM
Association Of Resistance Exercise With The Incidence Of Hypercholesterolemia In Men

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Hypercholesterolemia is a significant risk factor for cardiovascular disease. Although the beneficial effects of aerobic exercise (AE) are well-documented, evidence for the effects of resistance exercise (RE) on the development of hypercholesterolemia is still scarce. **PURPOSE:** To examine the associations of RE, independent of and combined with AE, with the risk of developing hypercholesterolemia in men.

METHODS: Men, aged 18-83 years (mean age 46), who received comprehensive preventive examinations at the Cooper Clinic in Dallas, Texas, were included in this study. Baseline RE, AE, and meeting the 2008 US Physical Activity Guidelines (RE ≥ 2 days/week; AE ≥ 500 MET-minutes/week) were determined by self-reported frequency and minutes of exercise. Hypercholesterolemia was defined as total cholesterol of ≥ 240 mg/dL or physician-diagnosed hypercholesterolemia during follow-up examinations. Hazard ratios (HRs) and 95% confidence intervals (CIs) were calculated using Cox proportional hazards regression.

RESULTS: Among 7,317 participants, 1,430 men (20%) developed hypercholesterolemia during a median follow-up of 4 years. Individuals meeting the RE guidelines had a 13% lower risk of developing hypercholesterolemia (HR 0.87; 95% CI 0.77 to 0.996) after adjustment for potential confounders and AE. In addition, after full adjustment, less than 1 hour/week and 2 sessions/week of RE were associated with 32% and 31% lower risks of hypercholesterolemia (HR 0.68; 95% CI 0.54 to 0.86 and HR 0.69; 95% CI 0.54 to 0.88), respectively, compared to no RE. Higher levels of RE did not show additional benefits. Further, meeting guidelines for both RE and AE lowered the risk of hypercholesterolemia by 21% (HR 0.79; 95% CI 0.68 to 0.92), compared to meeting neither of the guidelines. **CONCLUSIONS:** Even less than 1 hour/week and 2 sessions/week of RE, independent of AE, were associated with significantly lower risk of developing hypercholesterolemia in men. This finding suggests that RE should be added to habitual physical activity to prevent hypercholesterolemia.

2733 Board #253 June 2 11:00 AM - 12:30 PM
Health Behaviors and Dietary Supplement Use among Military Personnel: A Latent Class Analysis

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(No relationships reported)

Dietary supplements (DS) are commonly used to increase muscle mass and/or lose weight, even though many are ineffective and linked to adverse events. DS use is particularly common among military personnel and athletes, correlating with both health-promoting and risky/deleterious behaviors. Latent class analysis (LCA) identifies and classifies people into separate groups based on combinations of categorical responses. **PURPOSE:** To extend the current literature focused on individual relations among DS use and health behaviors, the present study used LCA to: (1) characterize military personnel with respect to health behaviors related to the performance triad, and (2) describe differences in body building (BB) and weight loss (WL) DS use across the classes constructed in (1). **METHOD:** Data from the 2011 DoD Health Related Behaviors Survey of Active Duty Military Personnel for 39,877 service members were assessed. Variables related to diet, activity and sleep were used in a sample weighted LCA to identify a best-fitting model and number of classes, and then relate class membership to BB and WL use. **RESULTS:** The best-fitting model identified four latent classes: 1) Balanced: balanced performance class (30%), characterized by healthy diet, high-to-moderate activity, and adequate sleep; 2) Active: highly active class (31%), characterized by poor diet, very high activity, and low-to-moderate sleep; 3) Unhealthy: weak performance class (34%), characterized by poor diet, low activity, and moderate-poor sleep; and 4) Inconsistent: careless responding class (5%), characterized by extreme and inconsistent responses. BB and WL supplements were most prevalent in the Active class (BB: 38%; WL: 37%) and least prevalent in the Unhealthy class (BB: 22%; WL: 28%). Females were less likely to use BB (17% female vs. 37% male) but more likely to use WL (23% female vs. 20% male) supplements. Class membership and WL/BB use also varied by military service branch. **CONCLUSION:** Among military personnel, BB and WL use are related to distinct patterns of positive and deleterious health behaviors. Educational DS campaigns should be tailored towards these latent classes of health behaviors. BB and WL use may be more common among individuals who engage in otherwise healthy behaviors than among those who engage in deleterious behaviors.

2734 Board #254 June 2 11:00 AM - 12:30 PM
Characterizing the Relationship between Physical Activity and Osteoporosis in the Greater Philadelphia Hispanic Population

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The Hispanic population in the United States has increased 9-fold since 1960, and currently accounts for 20% of the total population. While the incidence of osteoporosis in this population is similar to the national average, the literature exploring the connection between physical activity and osteoporosis incidence in Hispanic Americans is limited. **PURPOSE:** To determine the relationship between physical activity and osteoporosis in the Philadelphia Hispanic population. **METHODS:** 49 postmenopausal Hispanic women were recruited from community centers in the greater Philadelphia area. Surveys obtained self-reported osteoporosis status, which was used to separate women into healthy and osteoporosis groups. Both groups were queried regarding their physical activity level and type in childhood, adulthood, and late adulthood. Subject characteristics, fractures, nutrition, and socioeconomic status were also obtained. **RESULTS:** Groups (healthy $n = 25$, osteoporosis $n = 24$) were similar in height, weight, and age of menopause, but the osteoporosis group (67.6 \pm 10.0 yr) was older than the healthy group (73.8 \pm 6.2 yr). The osteoporosis group reported 25 total fractures (9 at hip), versus 8 in the healthy group (0 at hip). In both groups, activity levels decreased with aging from 3.2 hr/wk during childhood to 2.3 hr/wk during late adulthood. Physical activity levels at all stages of life were 33-37% higher in the healthy group (Fig 1). Impact exercise was more widely practiced in the healthy group at all stages. The osteoporosis group reported more meals containing starch, but fewer meals containing meat, vegetables, fruit, and dairy. Education level was lower in the osteoporosis group. **CONCLUSION:** The results display a positive relationship between increased physical activity and bone health in Hispanic women. This study suggests more education may encourage better habits, potentially reducing osteoporosis incidence in this Hispanic American population.

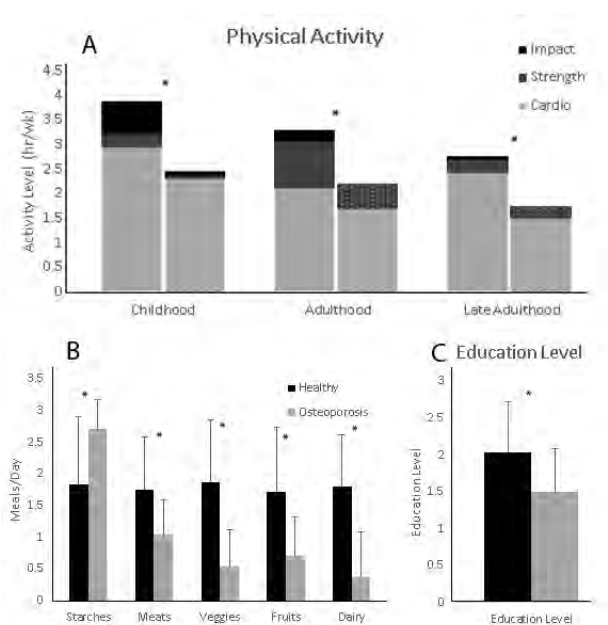


Figure 1. A. Summary of physical activity during childhood, adulthood, and late adulthood shown in bars with solid bars for healthy and dotted bars for osteoporosis group. B. Nutritional breakdown by number of meals/day containing each element. C. Education status – 1 indicates 9th grade, 2 indicates 12th grade, 3 indicates 2 year college, and 4 indicates 4 year college. Bars represent means+standard deviation. Significant difference $p<0.05$ denoted by *.

2735 Board #255 June 2 11:00 AM - 12:30 PM
Healthy Lifestyle Behaviors Related to Cardiovascular Risk among Young Adults

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Purpose: Participation in healthy lifestyle behaviors is associated with decreased risk for CVD across the lifecourse. Examining clustering of healthy lifestyle behaviors among young adults at increased risk due to elevated BMI could provide insight into CVD preventive interventions that could be implemented during this developmental transition. **Methods:** Young adults (ages 18-35) enrolled in a healthy body weight clinical trial (n=210; % female=79.5%; M age=22.1 ±3.9; M BMI=31.4±3.7) completed surveys: demographics, the International Physical Activity Questionnaire (IPAQ) and the Population Assessment on Tobacco and Health (PATH) questions. **Healthy Lifestyle Behaviors included:** 1) meeting guidelines for moderate-to-vigorous physical activity (MVPA; >150 minutes); 2) never cigarette user 3) never e-cigarette user; 4) low sedentary behavior (<4 hours/day). Participants were scored for the presence of up to 4 healthy lifestyle behaviors. **Results:** Participants reported engaging in 122.7±103.6 minutes/week of MVPA and 8.5±3.4 hours/day of sedentary behavior. Approximately 6.2% met criteria for MVPA, 60.9% reported never smoking cigarettes, 83.2% reported never using e-cigarettes, and 17.6% had low sedentary behavior time. In terms of clustering of healthy lifestyle behaviors, 11.0%, 29.9%, 50.5%, 7.6%, 1.1% had 0, 1, 2, 3, 4 healthy behaviors, respectively. The distribution of number of health behaviors varied little by age, gender or BMI status (overweight vs. obese). **Conclusions:** Young adults with elevated BMIs are at increased risk for CVD, given their weight status. Results indicate that few were engaging in the maximum number of recommended health behaviors to mitigate risk. Understanding healthy lifestyle and CVD risk behavior is essential for both prevention and intervention efforts. Recommendations are for future studies to assess health behaviors to identify young adults at risk such that targeted multi behavior interventions can be implemented. **Funding source:** NIH/NIDDK #DK100916

2736 Board #256 June 2 11:00 AM - 12:30 PM
Effects Of Changes in Depressive Symptoms and Cardiorespiratory Fitness on All-cause Mortality: The HUNT Study

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PURPOSE: Depression and cardiorespiratory fitness (CRF) are positively and negatively associated with mortality, respectively. Studies examining the relationship between depressive symptoms (DS) and mortality seldom account for the possible effect of CRF. We investigated the independent and combined associations of changes in DS and CRF with all-cause mortality. **METHODS:** 14 799 participants (mean age 63 years, 51.8% women) from the second (1995-97) and third (2006-08) wave of the Nord-Trøndelag Health Survey (HUNT) were included. DS were measured with the validated Hospital Anxiety and Depression Scale (HADS-D). A HADS-D score ≥8 indicated high DS. CRF was estimated (eCRF) using a validated non-exercise model. eCRF above median value indicated high eCRF. Change in HADS-D score was classified into persistently high DS, increased DS, decreased DS, and persistently low DS. Change in eCRF was classified into persistently high eCRF, increased eCRF, decreased eCRF and persistently low eCRF. Deaths were ascertained using The Norwegian Cause of Death Registry. **RESULTS:** During a mean follow-up period of 7.2 years after baseline (HUNT3), 1101 all-cause deaths (7.4%) were registered. A multivariate analysis adjusted for baseline age, sex, marital status, education, physical activity, body mass index, smoking status, alcohol consumption, ischemic heart disease, cancer, stroke/brain hemorrhage, hypercholesterolemia, diabetes, systolic blood pressure and change in eCRF; showed having persistently low DS was associated with a 29% risk reduction of all-cause mortality (hazard ratio (HR) 0.71; 95% CI 0.55-0.91) compared to persistently high DS. Persistently high eCRF independently predicted lower risk of all-cause mortality (HR 0.62; 95% CI 0.50-0.77), compared to persistently low eCRF. In the combined analyses, test for trend ($p<0.001$) suggests a linear relationship between the worst (persistently high DS and persistently low eCRF) and the best (persistently low DS and persistently high eCRF) combinations of DS and eCRF. **CONCLUSION:** Maintaining low levels of DS and maintaining high levels of eCRF are associated with a lower risk of all-cause mortality in middle aged and older people.

2737 Board #257 June 2 11:00 AM - 12:30 PM
New Get-up Test As an Indicator Of Sarcopenia, Sarcopenic Obesity, And Cardiovascular Disease Risk Factors

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PURPOSE: To investigate the associations of get-up test time with sarcopenia, sarcopenic obesity (SO), and cardiovascular disease (CVD) risk factors. **METHODS:** This cross-sectional study included 269 older adults (56% female) aged ≥65 years (mean age 72, ranged 65-95). The get-up test was newly developed as a physical function test in which the participant should lie down to the floor and back up to standing as fast as possible, and categorized into three tertiles (fast, moderate, and slow) based on the get-up test time in seconds. Sarcopenia was defined as low appendicular lean mass index (men, ≤7.23 kg/m²; women, ≤5.67 kg/m²) plus either slow gait speed (≤0.8 m/s) or weak handgrip strength (men, <30 kg; women, <20 kg), according to the European Working Group on Sarcopenia in Older People. SO was defined as the coexistence of sarcopenia and obesity based on % body fat (men, ≥25%; women, ≥30%) using Dual Energy X-Ray absorptiometry. **RESULTS:** Mean (SD) get-up test time was 7.2 (3.2) seconds, and 29 (11%) and 27 (10%) older adults had sarcopenia and SO, respectively. Each one second increase (slow) in get-up test time was associated with unfavorable sarcopenia variables and CVD risk factors, specifically with 0.02 m/s slower gait speed, 0.67 kg weaker handgrip strength, 0.87% increased body fat, 0.64 mg/dl increased fasting glucose, and 0.71 kg/m² increased body mass index (all $p<0.05$) in the linear regression after adjusting for age, sex, smoking status, and alcohol intake. Compared to the fast get-up test group, odds ratios (95% confidence intervals) in moderate and slow get-up test groups were 4.42 (1.17-16.74) and 5.86 (1.60-21.41) for sarcopenia, and 4.00 (1.04-15.34) and 5.41 (1.47-19.92) for SO, respectively, in the multivariable logistic regressions. Although mostly not statistically significant, older adults in the moderate and slow get-up test groups had increased odds ratios for the prevalence of hypertension, diabetes, hypercholesterolemia, and obesity, compared to the older adults in the fast get-up

test group. **CONCLUSIONS:** This study suggests that faster get-up test physical performance in older adults is associated with lower prevalence of sarcopenia, SO, and CVD risk factors. Get-up test can be used as a significant indicator of sarcopenia, SO, and CVD risk factors in older adults.

2738 Board #258 June 2 11:00 AM - 12:30 PM
Active Transportation And C-reactive Protein In U.S. Adults

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(No relationships reported)

PURPOSE: Examine the associations between self-reported use of active transportation and elevated C-reactive protein (CRP) using a nationally representative sample of U.S. adults.

METHODS: The study sample (n=9937) included male and female adults (≥ 20 years of age) who participated in the 2007-2010 National Health and Nutrition Examination Survey. Elevated CRP was defined using the current Centers for Disease Control and Prevention and the American Heart Association recommendations. Active transportation included walking or use of a bicycle to and from work, for shopping, or to school for at least 10 minutes continuously.

RESULTS: Compared to a referent group of U.S. adults reporting no use of active transportation, analysis revealed significantly lower odds of having an elevated CRP concentration in those reporting more than two days per week (d/wk.) of active transportation (Odds Ratio [OR] 0.83; 95% Confidence Interval [CI], 0.72-0.94, $P=0.0064$). A similar relationship was not revealed in those reporting less than two d/wk. of active transportation (OR 0.87; 95% CI, 0.61-1.24, $P=0.4267$).

CONCLUSIONS: In a nationally representative sample of U.S. adults, increased use of active transportation (>2 d/wk.) was associated with significantly lower odds of elevated CRP independent of waist circumference.

2739 Board #259 June 2 11:00 AM - 12:30 PM
Impact Of Race And Non-exercise Estimated Cardiorespiratory Fitness On Incident Stroke: The Regards Study

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Routine utilization of cardiorespiratory fitness (CRF) in cardiovascular disease risk assessment is limited due to cost and the need for exercise equipment and skilled personnel. Estimated CRF (eCRF), based on non-exercise algorithms utilizing readily available clinical and self-reported data, is a promising alternative though its role as a predictor of incident stroke remains unclear, especially in an African American (AA) population. **Purpose:** To study the association between eCRF and incident stroke as well as the impact of race on the associations. **Methods:** This population-based U.S. cohort study included 24,465 participants (54.8% women, 39.6% AA, mean age 64.6 years) from the REasons for Geographic And Racial Differences in Stroke (REGARDS) study who were free of stroke at enrollment 2003-2007. Participants were telephoned every 6 months to assess potential stroke, with retrieval and central physician adjudication of medical charts of suspected strokes through March 31, 2016. Baseline eCRF in maximal metabolic equivalents (METs) was determined using non-exercise sex-specific algorithms and further grouped into age-, and sex-specific tertiles of the METs distribution. Hazard ratio (HR) and 95% confidence interval (CI) for incident stroke and its subtypes (ischemic and hemorrhagic stroke) was estimated using Cox proportional hazards regression. **Results:** After an average of 8.3 years of follow-up, 961 (3.9%) participants developed stroke (856 ischemic, 105 hemorrhagic subtype). Compared to the lower tertile eCRF, those in the middle and upper eCRF groups had 6% (HR, 95% CI: 0.94, 0.81-1.10) and 25% (HR, 95% CI: 0.75, 0.63-0.90) lower risk of developing stroke, respectively. Findings were similar findings for ischemic stroke (middle: 7% (HR, 95% CI: 0.93, 0.79-1.10) and upper 28% (HR, 95% CI: 0.72, 0.60-0.88). No association was observed, however, for hemorrhagic stroke. The pattern of the association between eCRF and stroke incidence was similar in women and men. However, eCRF was not associated with stroke among AAs. **Conclusion:** Estimated CRF using non-exercise algorithms is a useful predictor of ischemic stroke, in both men and women. The null finding in AAs has important potential public health and clinical implications regarding primary stroke prevention among different ethnicity groups.

2740 Board #260 June 2 11:00 AM - 12:30 PM

Exercise Cardiac Power And Coronary Artery Calcification In Men

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PURPOSE: Low exercise cardiac power (ECP), defined as a ratio of peak oxygen consumption with peak systolic blood pressure during exercise, is associated with adverse cardiovascular events, but the underlying mechanisms remain unclear. Coronary artery calcification (CAC) as a surrogate marker of atherosclerosis is associated with an increased risk of cardiovascular outcomes. We tested the hypothesis that lower levels of ECP may be associated with the prevalence of CAC, independent of conventional risk factors, in a cross-sectional study of 2165 (age 53 \pm 6 yrs, range 40-78 yrs) men. **METHODS:** We measured CAC using multidetector computed tomography using the Agatston coronary artery calcium score. The prevalence of CAC was defined as dichotomous variables of CAC score >0 . ECP was calculated by a ratio of peak oxygen consumption with peak systolic blood pressure and classified into quartiles. **RESULTS:** The presence of CAC was inversely associated with ECP quartiles (both, $P < .001$ for trend). After adjusting for age, BMI, SBP, HDL-C, hsCRP, glucose, heart rate, smoking, hypertension and diabetes, men in the lowest quartile of ECP had a significantly elevated odds ratios for having CAC (odds ratio (OR) 1.43, 95% CI 1.06-1.93), compared with men in the highest quartile of ECP. Each ECP unit increment as a continuous variable was associated with 4% (OR 0.96, 95% CI 0.93-0.99) lower prevalence of CAC after adjusting for established risk factors. **CONCLUSIONS:** Our findings demonstrate that lower levels of ECP are associated with the prevalence of coronary artery calcification, which could contribute to increased risk of cardiovascular events.

2741 Board #261 June 2 11:00 AM - 12:30 PM

Isotemporal Substitution Models For Associations Between PA And Health Outcomes In Overweight/obese Adults

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(No relationships reported)

PURPOSE: Purpose: To examine the effects of reallocating sitting time to moderate- or vigorous-intensity physical activity on health outcomes in a population-representative sample of overweight/obese Korean adults. **METHODS:** Data were retrieved from a subsample (N=1,420; Age=52.35 \pm 16.64yrs; BMI=27.57 \pm 2.37) of the KNHANES 2014. Time spent on moderate-intensity physical activity (MPA), vigorous-intensity physical activity (VPA), and sitting (ST) were measured utilizing the GPAQ. Health outcomes were 1) the metabolic syndrome (having 3+ risk components: elevated fasting glucose, central obesity, systemic hypertension, elevated triglycerides, and low HDL-C, defined according to AHA/NHLBI criteria), and 2) self-reported health measured by the EuroQol-5D Questionnaire (EQ5D; count variable). Age-group-specific (i.e., middle-age vs. older adults) Logistic and Poisson regression models were used to determine the associations when substituting a specific amount of ST with an equal amount of MPA, and VPA, respectively on metabolic and self-reported health outcomes. Analyses were adjusted for gender, smoking, drinking, education, and household incomes. **RESULTS:** In middle aged (30-64yrs), replacing ST with an equal amount of time in VPA was significantly associated with reduced odds for self-reported health problems (OR=0.86, 95%CI:0.76-0.98). Similarly, in older adults (65+yrs), substituting sitting time with MPA was significantly associated with lower odds for self-reported health problems (OR=0.96, 95%CI:0.92-0.99). In opposite, replacing ST with MPA or VPA was not associated with the metabolic syndrome. **CONCLUSIONS:** Substituting sitting time with VPA or MPA appears beneficially associated with self-reported health in overweight/obese middle-aged and elderly Korean men and women, respectively. The different associations between age groups may be explained by low participation in VPA in the older age-group. *This study was supported by NRF-2014R1A1A3049992. Corresponding: Miyoung Lee

2742 Board #262 June 2 11:00 AM - 12:30 PM

Change in Cardiorespiratory Fitness and Ideal Cardiovascular Health in the Aerobics Center Longitudinal StudyJacob L. Barber, Leanna M. Ross, Xuemei Sui, Steven N. Blair, FACSM, Mark A. Sarzynski, FACSM. *University of South Carolina, Columbia, SC.**(No relationships reported)*

PURPOSE: To examine the relationship between changes in cardiorespiratory fitness and changes in ideal cardiovascular health (CVH) score over time. **METHODS:** The association between change in fitness and change in ideal CVH score was examined in 2,555 adults who had at least two clinic visits in the Aerobics Center Longitudinal Study. Fitness was measured as duration in minutes from a maximal treadmill test. Ideal CVH score was calculated on a 14 point scale using the AHA's simple 7 criteria of smoking status, BMI, physical activity (MET-min/wk), healthy diet, total cholesterol, blood pressure, and fasting plasma glucose. Participants were grouped into categories of loss, stable, or gain, by tertiles of change in cardiorespiratory fitness and also by tertiles of change in ideal CVH score between baseline and last follow-up visit. **RESULTS:** After a mean follow up of 3.3 ± 2.4 years, the average change in ideal CVH score was 0.14 ± 1.9 and the average change in treadmill time was -0.25 ± 2.7 minutes for the total sample. After controlling for age, sex, and time between exam dates, the gain in fitness group ($n=851$) significantly ($p<0.0001$) increased their ideal CVH score by an average of 0.71 ± 1.9 , while the stable and loss of fitness groups ($n=830$ and 873 respectively) significantly ($p<0.0001$) decreased their scores by -0.07 ± 1.9 and -0.55 ± 1.9 , respectively ($p<0.0001$ for difference between groups). Change in treadmill time per year explained 6.5% of the change in ideal CVH score. For every minute increase in treadmill time per year, the ideal CVH score increased by 0.09 per year. **CONCLUSIONS:** Improving cardiorespiratory fitness during middle age is associated with higher scores and greater improvement in ideal cardiovascular health.

2743 Board #263 June 2 11:00 AM - 12:30 PM

Screen-time, Physical Activity And Bmi: Confounding By Socioeconomic Status Among Young AdultsJonathan M. Miller, Theresa L. Osypuk, Richard F. MacLehose, Katie A. Loth, Dianne Neumark-Sztainer. *University of Minnesota, Minneapolis, MN.* (Sponsor: Matthew Buman, FACSM)

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PURPOSE: Observational studies often adjust for confounding by socioeconomic status (SES) but rarely report the magnitude of confounding bias. Also, different indicators of SES may not meet the definition of a confounder for some associations. This study will determine whether different measures of SES have different confounding effects on the associations of screen time with BMI and of moderate/vigorous physical activity (MVPA) with BMI.

METHODS: In a 15 year prospective cohort study, 1830 young adults (age 25 - 36) reported height and weight (used to calculate BMI in kg/m^2), hours/day of screen time, hours/week of MVPA and nine measures of SES in 2015. SES at baseline (2000) was based on parent education and employment. BMI, screen time and MVPA were regressed with linear regression on each SES measure and a composite measure that combined young adults' income and education. Crude associations of screen time with BMI and of MVPA with BMI were assessed with linear regression. The SES measures were added individually to these models to determine the percent change in the associations (percent confounding).

RESULTS: Seven measures of SES were associated with BMI; eight with screen time; and four with MVPA. Education, income, financial strain and living with parents all confounded the association of screen time with BMI by more than 10%. No measure confounded the relationship of MVPA with BMI by more than 10%. The composite measure was significantly associated with screen time ($\beta = -0.39$, 95% CI $[-0.47$ to $-0.31]$) and BMI ($\beta = -1.29$, 95% CI $[-1.58$ to $-0.99]$), but not with MVPA. This composite substantially confounded the association of screen time with BMI (29%) but not of MVPA with BMI (3%).

CONCLUSIONS: The composite SES measure had similar properties to individual SES measures: it was associated with screen time and BMI but not with MVPA and it had substantial confounding bias effect on the association of screen time with BMI, but not on the association of MVPA with BMI. Knowing the magnitude of confounding can help assess results from other studies that do not adjust for SES. A composite measure may be useful for the varied analyses done with data from large cohort studies. However, because of the potential for over fitting models, associations with measures of SES should be carefully considered before using them to adjust for confounding.

2744 Board #264 June 2 11:00 AM - 12:30 PM

Change In Knee Extensor Strength And All-cause Mortality In Japanese Elderly Individuals: A Cohort StudyNaofumi Yamamoto¹, Hideo Miyazaki², Hiroshi Nagayama³, Mieko Shimada⁴, Naoki Nakagawa⁵, Susumu S. Sawada, FACSM⁶, Mamoru Nishimuta⁷, Yasuo Kimura⁸, Ryoko Kawakami⁹, Hidenori Asai¹, I-Min Lee, FACSM¹⁰, Steven N. Blair, FACSM¹¹, Yutaka Yoshitake¹². ¹Ehime University, Matsuyama, Japan. ²Niigata University, Niigata, Japan. ³Kyushu Otani Junior College, Chikugo, Japan. ⁴Chiba Prefectural University of Health Sciences, Chiba, Japan. ⁵SANNO University, Isehara, Japan. ⁶National Institute of Health and Nutrition, Tokyo, Japan. ⁷Toyo University, Itakura, Japan. ⁸Research Center for Fitness & Health Sciences, Tokyo, Japan. ⁹Waseda University, Tokorozawa, Japan. ¹⁰Brigham and Women's Hospital and Harvard Medical School, Boston, MA. ¹¹University of South Carolina, Columbia, CA. ¹²National Institute of Fitness and Sports in Kanoya, Kanoya, Japan. (Sponsor: Susumu S. Sawada, FACSM)

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Previous epidemiologic studies have shown that a low level of lower extremity strength is associated with a high risk of mortality among elderly individuals. However, most of these studies only measured lower extremity strength once, at baseline, and limited data are available on the association between changes in the lower extremity strength and mortality in the elderly, particularly in Asian populations. **PURPOSE:** The purpose of this study was to examine the association between changes in knee extensor strength (KES) over four years and all-cause mortality in Japanese elderly individuals.

METHODS: The participants were 338 (185 males and 153 females) physically independent, community-dwelling Japanese individuals 70 years of age at baseline. KES was measured annually from 1998 (baseline) to 2002. We included participants with KES measured at baseline and at least two more times from 1999 to 2002. We estimated the change per year in KES for each person using simple linear regression. Participants were then divided into quartiles based on the regression coefficient (first quartile, $<-3.54\%$ per year; second quartile, -3.53% to -0.82% per year, third quartile, -0.81% to 2.31% per year; fourth quartile, $>2.32\%$ per year), and were followed up for 8 years (2002-2010). The hazard ratios and 95% confidence intervals (CIs) for death across the baseline quartiles of KES trend were obtained from a Cox proportional hazards model while adjusting for sex, body mass index, smoking status, alcohol intake, medication use, functional capacity and initial KES value.

RESULTS: Forty-six (13.6%) participants died during the follow-up period. The hazard ratios for death across the quartiles of KES trend (lowest to highest) were 1.0 (referent), 0.55 (95% CI 0.25-1.21), 0.61 (95% CI 0.28-1.31), 0.33 (95% CI 0.12-0.86) (P for trend=0.033). Participants in the highest quartile had a significantly lower risk of death than those in the lowest quartile.

CONCLUSIONS: These results indicate that, among physically-independent Japanese elderly individuals, 4-year change in KES among 70-year-olds is associated with lower risk of all-cause mortality over 8 years of follow-up, independent of the KES value at baseline.

2745 Board #265 June 2 11:00 AM - 12:30 PM

Estimated Cardiorespiratory Fitness And Incident Cognitive Impairment: Results From The Regards StudyLinda Ernsten¹, Xuemei Sui², Virginia J. Howard³, Virginia G. Wadley³, Evan Thacker⁴. ¹Norwegian University of Science and Technology, K.G. Jebsen Center of Exercise in Medicine, Trondheim, Norway. ²University of South Carolina, South Carolina, SC. ³University of Alabama at Birmingham, Birmingham, AL. ⁴Brigham Young University, Provo, UT. Email: linda.ernsten@ntnu.no*(No relationships reported)*

Purpose: Clinical studies suggest that higher cardiorespiratory fitness (CRF) is associated with better global and domain-specific cognitive function. Estimated CRF (eCRF), based on non-exercise algorithms from clinical and self-reported data, is feasible and practically useful in primary care. However, whether eCRF is an appropriate predictor for increased risk for cognitive impairment in the general population remains unclear. **Methods:** This prospective study included 21,220 participants (55.9% women, 37.1% African American, mean age 64.2 years) from the REasons for Geographic And Racial Differences in Stroke (REGARDS) study without cognitive impairment and no history of stroke at baseline. Participants' global cognitive status was assessed annually with the validated Six-Item Screener

(SIS) (range from 0 to 6) where a score ≤ 4 indicates cognitive impairment. Incident cognitive impairment was defined based on the most recent SIS, obtained an average of 7.6 years after baseline. Baseline eCRF in METs was determined using non-exercise algorithms based on gender, age, body mass index, waist circumference, heart rate, physical activity, and smoking status. Baseline eCRF was further grouped into age- and sex-specific categories of the METs distribution. Logistic regression models were used to calculate odds ratio (ORs) and 95% confidence intervals (CIs) for the association between baseline eCRF and incident cognitive impairment. The multivariable analyses were adjusted for race, residence in stroke belt, education, income, alcohol use, depressive symptoms, hypertension, dyslipidemia, diabetes, atrial fibrillation, and coronary artery disease. **Results:** During follow-up, 2,300 (10.8%) of the participants experienced incident cognitive impairment. In fully adjusted models comparing with lower category of eCRF, those in the middle and upper eCRF groups had 8% (OR: 0.92, 95% CI: 0.83-1.04) and 23% (OR: 0.77, 95% CI: 0.68, 0.62-0.87) lower odds of incident cognitive impairment, respectively. **Conclusion:** Estimated CRF using non-exercise algorithms is a useful predictor of incident impairment in the general population, and the protective effect is more pronounced for those with highest eCRF.

2746 Board #266 June 2 11:00 AM - 12:30 PM
Physical Activity, Life's Simple 7, and Health-Related Quality Of Life In Older Rural U.S. Adults
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PURPOSE: The American Heart Association (AHA) has developed a new metric representing ideal cardiovascular health. The Life's Simple 7 (LS7) consists of four health behavior and three health factor metrics: 1) smoking, 2) body mass index (BMI), 3) healthy diet, 4) physical activity (PA), 5) cholesterol, 6) blood pressure, and 7) diabetes mellitus. Currently, the AHA promotes meeting all seven components of the LS7 metric, considering each component equal in terms of its impact. The aim of this study was to examine specifically the contribution of PA to the LS7 metric and its relationship to health-related quality of life (HRQOL). **METHODS:** Data for this study came from a large national survey conducted in 2015. A total of N=46,498 adults 50+ years of age and residing in a rural U.S. county were included. HRQOL was assessed using the CDC Healthy Days Index and dichotomized to represent good or poor health. A modified LS7 metric was assessed to include: 1) not smoking within past year, 2) BMI less than 25, 3) consumption of 5+ fruits and vegetables per day, 4) obtaining 150+ minutes of moderate PA per week, and not being diagnosed with 5) high cholesterol, 6) hypertension, or 7) diabetes. One set of analyses were performed with those meeting the PA metric excluded and one set with those meeting the PA metric included. Multiple logistic regression was used to compute odds ratios (ORs) and 95% confidence intervals (CIs) while adjusting for age, sex, race, and income. **RESULTS:** Prevalence of good HRQOL increased linearly (59.0%, 68.9%, 75.1%, 80.4%, 84.2%, 89.6%, & 90.0%, $p < .001$) across adult groups meeting 0 to 6 LS7 metrics, respectively. Adjusted models with those meeting PA excluded showed increased odds of reporting good HRQOL in adults meeting 1 (OR=2.16; 95% CI: 1.74-2.67), 2 (2.40; 2.01-2.88), 3 (2.61; 2.13-3.21), 4 (3.08; 2.32-4.08), and 5+ (4.56; 2.67-7.78) LS7 metrics. Adjusted models with those meeting PA included showed mostly greater odds of reporting good HRQOL in adults meeting 1 (1.71; 1.55-1.87), 2 (3.78; 3.03-4.73), 3 (4.69; 3.72-5.93), 4 (6.66; 5.01-8.86), and 5+ (6.76; 5.22-8.74) LS7 metrics. **CONCLUSIONS:** Results from this study show that the LS7 metric is a stronger predictor of HRQOL when PA is met in older rural U.S. adults. Health promotion programs should emphasize the importance of PA to the LS7 metric.

2747 Board #267 June 2 11:00 AM - 12:30 PM
Novel Predictors of Age-Related Changes in Lung Function: An Analysis of the Fels Longitudinal Study
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Smoking and air pollution exposure are modifiable predictors of age-related declines in lung function. There is some evidence to suggest that physical inactivity may be a predictor of age-related changes in lung function; however, the independent contribution of sitting time, physical activity, and cardiorespiratory fitness have not been investigated to date. **PURPOSE:** To determine the association between age-related declines in lung function with sitting time, physical activity and cardiorespiratory fitness in a population of healthy adults. **METHODS:** Data from the Fels Longitudinal Study (1999-2015) were used for analysis (n=996), with serial data available for up to five study visits. Forced expiratory volume in 1 second (FEV₁) and forced vital capacity (FVC) were measured using a metabolic cart (SensorMedics VMax). Physical activity was measured using the Baecke questionnaire and TV time was self-reported as either never, seldom, sometimes, often, and very often.

Cardiorespiratory fitness was determined by calculating VO_{2max} from a submaximal treadmill test. Data were analyzed using repeated measures hierarchical linear models in SAS. **RESULTS:** The sample was middle-aged (45.0 ± 17 years), overweight (BMI: 27.1 ± 5.6 kg/m²), and their VO_{2max} was 36.6 ± 9.8 ml/kg/min. Approximately 53% of the sample reported watching TV often and only 3% of the sample reported engaging in regular physical activity often. In models adjusted for age, BMI, physical functioning and smoking status, there was a significant TV time x sex interaction ($p < 0.0001$) when modeling FEV₁, such that higher TV time in females was associated with worse FEV₁ compared to males. A physical activity x sex interaction ($p < 0.0001$) was also observed in adjusted models of FEV₁. When TV time, physical activity and cardiorespiratory fitness were included in the same model, only the association between cardiorespiratory fitness and FEV₁ remained significant ($p < 0.001$). **CONCLUSION:** Cardiorespiratory fitness is a predictor of age-related changes in lung function. Among deconditioned adults, particularly in females, reducing sedentary time and increasing physical activity may lead to an increase in cardiorespiratory fitness and thus may attenuate the age-related decline in lung function.

2748 Board #268 June 2 11:00 AM - 12:30 PM
Adiposity Parameters As A Full Mediation Of The Influence Of Muscular Fitness And Cardiometabolic Risk Clustering In Adults From Colombia
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PURPOSE: Studies in the adult's population have shown an inconsistent association between musculoskeletal fitness (MF) and cardiometabolic risk clustering independent of adiposity. The purpose of this study was two-fold: to analyze the association between MSF and cardiometabolic risk clustering, and to determine the influence of adiposity parameters on the association between MF and cardiometabolic risk clustering in adults from Colombia.

METHODS: The cross-sectional study included a total of 886 (51.9% women) healthy children and adolescents. Standing broad-jump and isometric handgrip dynamometry were used as indicators of lower and upper body muscular fitness, respectively. Also, a MF was computed by summing up the standardised values of both standing broad-jump and handgrip strength. We assessed the following adiposity parameters: fat mass, body mass index, waist-to-height ratio and abdominal visceral fat. A MetSyn z-score was calculated for each subject from triglycerides, HDL cholesterol, fasting glucose, waist circumference, and arterial blood pressure (MAP). Linear regression models fitted for mediation analyses examined whether the association between MF and MetSyn z-score was mediated by adiposity parameters according to Baron and Kenny procedures. **RESULTS:** Findings revealed that lower levels of MetSyn z-score were associated with the best adults profiles (high MF + low adiposity) (p for trend < 0.001 in the four adiposity parameters), compared with unfit strength and obese (low MF + high adiposity) counterparts. Linear regression models suggest a full mediation of adiposity parameters in the association of MF with MetSyn z-score, for both men and women alone. **CONCLUSIONS:** Our findings seem to emphasize the importance of obesity prevention in adults, suggesting that having high levels of MF may not counteract the negative consequences ascribed to adiposity.

2749 Board #269 June 2 11:00 AM - 12:30 PM
Physical Activity and not Sedentary Time Influence on Metabolic Risk in Older Community-dwelling Women
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The risk of developing the metabolic syndrome increases by older age, where older women typically engage in less health-enhancing physical activity (PA) than men. Whether sedentary behaviors influence on metabolic risk and related components

in older adults, and if so to what extent such relationships are independent of PA behavior, remain unclear. **PURPOSE:** To examine cross-sectional associations of objectively assessed PA and sedentary behaviors on metabolic syndrome components and clustered metabolic risk in a sample of older community-dwelling women.

METHODS: Components of the metabolic syndrome including waist circumference (WC), systolic and diastolic blood pressures, fasting levels of plasma glucose, HDL-cholesterol and triglycerides were assessed in 120 community-dwelling older women (65-70 yrs). Total amount of PA (total counts per day), accumulated time spent in different intensities (sedentary, light (LPA), and moderate-to-vigorous PA (MVPA)), continuous bouts of sedentary time and breaks in sedentary time were assessed with accelerometers. Isotemporal substitution models were used to examine influence of PA and sedentary behavior on each component of the metabolic syndrome and on a clustered metabolic risk score.

RESULTS: All associations between variables of sedentary behavior and metabolic risk were lost once variation in total accelerometer counts per day was adjusted for. Replacement of a 10-min time block of MVPA with either LPA or time in sedentary behaviors was related to an increase in WC and clustered metabolic risk score (zMS) (WC: $\beta = 1.78$ to 2.19 $p < 0.01$; zMS: $\beta = 0.06$ to 0.08 , $p < 0.05$).

CONCLUSIONS: Detrimental influence of a sedentary lifestyle on metabolic health is likely explained by variations in amounts of PA rather than sedentary time per se. Given our findings, increased amounts of PA with an emphasis on increased time in MVPA should be recommended in order to promote a favorable metabolic health profile in older women.

2750 Board #270 June 2 11:00 AM - 12:30 PM

Physical Activity and Periodontal Bacteria in Saliva among Japanese Adults

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Oral red complex bacteria, including *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia*, were significantly associated with the severity of chronic periodontal disease. Previous studies indicated that engaging in physical activity is associated with lower periodontitis prevalence. However, the association between physical activity and periodontal bacteria was not clear. **PURPOSE:** To determine whether physical activity is associated with red complex bacteria among Japanese adults. **METHODS:** We studied 226 adult employees aged 20-69 years. Analysis of bacterial species in saliva was conducted using 16S rRNA gene cloning and sequencing. Physical activity was assessed using the International Physical Activity Questionnaire. Total physical activity was calculated based on intensity and duration of physical activity and divided into three categories according to the Japanese guideline as follows: none (0 METs hours/week), low (0.1-22.9 METs hours/week), and high (≥ 23.0 METs hours/week). The association between physical activity and prevalence of saliva red complex bacteria was tested with multivariate logistic regression analysis after adjusting for sex, age, smoking, alcohol use, breakfast skipping, and body mass index. Data were expressed as odds ratios (OR) and 95% confidence intervals (CI). **RESULTS:** The prevalence of red complex bacteria was 46.0% for *Porphyromonas gingivalis*, 67.7% for *Treponema denticola*, and 78.3% for *Tannerella forsythia*, respectively. Multivariate analysis showed that physical activity was not associated with red complex bacteria (*Porphyromonas gingivalis*: low, 0.79 [0.40-1.55]; high, 1.13 [0.57-2.24]; P for trend = 0.717; *Treponema denticola*: low, 1.09 [0.48-2.48]; high, 0.76 [0.33-1.75]; P for trend = 0.816; *Tannerella forsythia*: low, 1.43 [0.69-2.97]; high, 1.09 [0.52-2.29]; P for trend = 0.520). On the other hand, participants with higher physical activity tended to have a better self-reported oral health than those with lower physical activity (low, 1.85 [0.88-3.89]; high, 2.20 [1.02-4.77]; P for trend = 0.044). **CONCLUSION:** This cross-sectional study demonstrated that physical activity was not associated with periodontal bacteria, such as *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia* in Japanese adults.

2751 Board #271 June 2 11:00 AM - 12:30 PM
Met-minutes Of Activity And Telomere Length In 5,823 Men And Women: An NHANES Investigation

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PURPOSE: The primary aim was to determine the extent to which physical activity (PA) accounts for differences in telomere length in a large random sample of U.S. men and women. A secondary purpose was to assess the extent to which multiple demographic and lifestyle factors affect the relationship between PA and telomere length. **METHODS:** A total of 5,823 adults from the National Health and Nutrition

Examination Survey (NHANES) were studied cross-sectionally. Blood samples were used for DNA analysis. Employing the quantitative polymerase chain reaction method, leukocyte telomere length was compared to standard reference DNA. Individuals in the lowest sex-specific quartile were defined as having short telomeres. PA was indexed using MET-minutes, calculated using self-reported frequency, intensity, and duration of participation in 62 physical activities. Age, gender, race, education, smoking, body mass index, and alcohol use were controlled statistically. **RESULTS:** Telomeres were 15.6 base pairs shorter for each year of chronological age ($F=723.2$, $P<0.0001$). PA was inversely related to telomere length, after adjusting for all the covariates together ($F=8.3$, $P=0.0004$). Specifically, base pair differences between adults with High PA and those in the Sedentary, Low, and Moderate groups were 140, 137, and 111, respectively. Therefore, adults with High PA were estimated to have a biologic aging advantage of 9 yrs (140 base pairs \div 15.6) over Sedentary adults. The difference in cell aging between those with High and Low PA was also significant at 8.8 yrs (137 base pairs \div 15.6), as was the base pair difference between those in the High and Moderate PA categories (7.1 yrs; 111 base pairs \div 15.6). Additionally, adults in the Sedentary, Low, and Moderate PA categories had 1.95 (95% CI: 1.38-2.75), 1.66 (95% CI: 1.21-2.30), and 1.73 (95% CI: 1.24-2.40) times greater odds of possessing short telomeres than adults with High PA, after adjusting for the covariates. **CONCLUSIONS:** PA was significantly and meaningfully associated with telomere length in 5,823 men and women representing U.S. adults. Evidently, adults who engage in high levels of PA tend to have longer telomeres, accounting for up to 9 yrs of reduced cellular aging compared to their sedentary counterparts. They are also much less likely to have short telomeres than other adults.

2752 Board #272 June 2 11:00 AM - 12:30 PM
Disparities Between BMI And BFR To Evaluate Obesity Rate In Chinese Urban White-collar Population: A Cross-section Study

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Overweight and obesity (OO) are risk factors of metabolic syndrome. Body Mass Index (BMI) is commonly used to evaluate OO rates. However, even though the OO rates by BMI in Chinese population are significantly lower than in other ethnics, the incidence of metabolic syndrome remain same. Therefore, it's critical to find alternative methods to evaluate true obesity base on Body Fat Rate (BFR).

PURPOSE: To compare the difference between BMI and BFR on the assessment of the obesity rate in Chinese urban white-collar population and to explore a rational of BFR in justifying the true OO rates.

METHOD: From June 5, 2015 to August 14, 2016, a total of 2,195 white-collar employees (male 1049, female 1146) participated in this study in Zhangjiang InnoPark of Shanghai, China. The mean age was 33.69 ± 9.26 (18 to 66) years. BMI was obtained from each participant. BMI between 24 (kg/m²) and 27.9 (kg/m²) is defined as overweight and over 28 (kg/m²) as obese. BFR was obtained from Inbody 320 body composition analyzer based on the method of Direct Segmental Multi-frequency-Bioelectrical Impedance Analysis (DSM-BIA) and calculated the muscle weight and fat weight. Categorized by BFR, male over 20% and female over 28% are defined as body fat overweight rate (BFOR), respectively.

RESULTS: Applying BMI, the overall OO rates are 30.30%, 47.18% in men and 14.84% in women. While applying BFR, the overall BFOR are 52.67%, 57.58% in men and 48.17% in women. There are significant differences in three pair comparisons ($X^2=410.431$, $X^2=244.644$ and $X^2=160.277$, $p<0.01$). 588/2195 (26.79%) of the BMI-defined normal weight and underweight subjects were defined overweight by BFR, including 194/1049 (18.49%) males and 394/1146 (34.38%) females.

Conclusions: The BFOR of Chinese urban white-collar population is higher than the OO rates with BMI, especially in women. The BMI severely underestimates the true obesity incidence among Chinese population, BFR may replace BMI as a better method for obesity measurement.

2753 Board #273 June 2 11:00 AM - 12:30 PM

Objective And Self-reported Measures Of Physical Activity And Sex Hormones: Women's Lifestyle Validation Study.

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Physical activity (PA) has been associated with reduced breast cancer risk, which may be partially mediated through an effect on sex hormones. Prior studies of PA and sex hormones relied on self-reported measures of PA, thus the impact of PA duration and intensity remains unclear. **PURPOSE:** To evaluate the association of both objective (o-PA) and self-reported measures of PA (sr-PA) with circulating sex hormones. **METHODS:** This cross-sectional analysis was conducted within the Women's Lifestyle Validation Study, a sub-study of the Nurse's Health Study I and II cohorts (n=525). A triaxial accelerometer was used for 7 days to assess average counts per day (CPD), minutes of light intensity PA (o-LPA), and moderate-vigorous intensity PA (o-MVPA). A modified Paffenbarger PA questionnaire was used to assess self-reported minutes of total, LPA (sr-LPA) and MVPA (sr-MVPA). Dehydroepiandrosterone sulfate (DHEAS), testosterone, and sex hormone binding globulin (SHBG) were assayed among all women; estradiol was measured in postmenopausal women not currently on hormone therapy (n=426). Multivariable linear regression models analyzed each PA measure with each biomarker adjusted for age, race, parity, age at menarche, oophorectomy status and BMI. **RESULTS:** In general, the associations between PA and sex hormones appeared stronger with o-PA than sr-PA. For example, women in the 4th (vs. 1st) quartile of CPD and o-MVPA had 13% and 19% lower SHBG levels respectively (p<0.001), whereas women in the 4th (vs. 1st) quartile of sr-PA (i.e., total, LPA, and MVPA) had 10% lower SHBG levels (p<0.05). Further, women in the 4th (vs. 1st) quartile o-MVPA had 14% higher testosterone levels (p<0.001). There were no statistically significant relationships between any sr-PA measure with testosterone. CPD had the strongest impact on DHEAS and estradiol. Specifically, women in the 4th (vs. 1st) quartile CPD had 13% higher DHEAS levels (p<0.001) and 22% lower estradiol levels (p<0.01). There were no statistically significant relationships between any sr-PA measure with DHEAS. Women in the 4th (vs. 1st) quartile sr-MVPA had 10% lower estradiol levels (p<0.01). **CONCLUSIONS:** PA was modestly related to sex hormones in women. CPD and o-MVPA showed the strongest and most consistent relationships with sex hormones.

2754 Board #274 June 2 11:00 AM - 12:30 PM

Muscle Strengthening Activity, C-reactive Protein, And Diabetes: 1999-2006 Nhanes

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PURPOSE: Examine the associations between muscle strengthening activity (MSA) and elevated C-reactive protein (CRP) using a nationally representative sample of U.S. adults (≥ 45 years of age) with Diabetes Mellitus (DM). **METHODS:** Cross-sectional analyses utilized data from the 1999-2006 National Health and Nutrition Examination Survey. A dichotomous (yes/no) MSA variable was created based on self-reported participation over the past 30 days. Elevated CRP (> 3.0mg/L) was based on current recommendations. Pairwise tests were performed to contrast potential differences when comparing measured (fasting plasma glucose [FPG] ≥ 126mg/dL, n=757) DM and self-reported physician diagnosed DM (n=1,390). **RESULTS:** The prevalence of elevated CRP concentrations was 50.1% and 50.4% in the populations with measured FPG and self-reported DM, respectively. In both groups the prevalence of elevated CRP was significantly lower in those reporting MSA compared to those reporting no MSA (FPG, 39.8% vs. 52.4%, p= 0.0142; Self-reported diagnosis, 42.9% vs. 51.9%, p= 0.0478). **CONCLUSIONS:** The prevalence of elevated CRP was significantly lower in those reporting engaging in MSA using subjective and objective measures of DM.

2755 Board #275 June 2 11:00 AM - 12:30 PM

Impact Of The American Heart Association (AHA)'S 7 Health Metrics On Life Expectancy In The United States General Population

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 (No relationships reported)

The impact of the AHA's 7 health metrics on life expectancy in the US general population remains less explored. **PURPOSE:** We investigated the impact of the AHA's 7 health metrics on life expectancy and lifetime risk of all-cause mortality in the US general population. **METHODS:** We followed 1,5908 men and women, aged 20 to 90 years, who participated in the Third National Health and Nutrition Examination Survey (1988-1994) through December 31, 2006. All participants completed baseline health factors and lifestyle behavior questionnaires. The AHA's 7 ideal health metrics were defined as untreated blood pressure (<120/80 mmHg), untreated total cholesterol (<200 mg/dL), untreated fasting glucose (<100 mg/dL), physically active, never smoked, a healthy diet, and a normal waist girth. We further categorized these variables as having 0, 1, 2, 3, 4, 5, 6 or 7 combined ideal health metrics. Cox proportional hazards regression was used to investigate the associations of single and a combined number of 7 health metrics and all-cause mortality. Survival analysis was used to compute lifetime risk of all-cause mortality. **RESULTS:** During an average of 13.2 years of follow-up (217,404 person-years), there was a total of 3,352 all-cause deaths (1,413 CVD, 658 cancer, 299 respiratory diseases, 107 diabetes mellitus). After adjustment for multiple risk factors, men and women with all 6 or 7 combined ideal health metrics had a 62% (95% CI: 43% to 75%) lower risk of all-cause mortality compared with men and women with zero ideal health metrics. The lifetime risks of all-cause mortality (at 20 years of age to 90) across 0, 1, 2, 3, 4, 5, and 6 or 7 ideal health metrics were 63.5%, 55.0%, 44.6%, 35.8%, 38.0%, 33.0%, and 17.6%, respectively. Increasing number of ideal health metrics was associated with lower lifetime risk of all-cause mortality. Men and women with 1, 2, 3, 4, 5, and 6 or 7 combined ideal health metrics had 3.1, 5.7, 7.8, 7.6, 8.7, and 11.9 years longer life expectancy, respectively, as compared with men and women with zero health metrics. Approximately 40% (95% CI: 11% to 60%) of all-cause deaths might have been avoided if men and women had adopted all 6 or 7 combined ideal health metrics. **CONCLUSION:** The AHA's 7 ideal health metrics is associated with lower lifetime risk of all-cause mortality and longer life expectancy in the US general population.

2756 Board #276 June 2 11:00 AM - 12:30 PM

Functional Ability and Physical Activity in Urban African American and Rural White Older Adults

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Late-life motor impairment is a common part of aging and increasingly recognized as a barrier to the maintenance of independence and well-being in old age. Loss of motor function, such as slowed walking, is progressive, and there is increasing interest in health disparities related to activity limitations in older adults. Staying physically active is vital for maintaining physical function, but few studies have compared functional ability and physical activity in urban African American (AA) and rural white (RW) older adults. **PURPOSE:** The purpose of this investigation is to compare functional ability and physical activity in urban AA and RW older adults. **METHODS:** One group of participants included 31 self-identified older African-Americans (age= 68.2 yrs+6.5); BMI=34.5+9.2) living in an urban setting. The other group included 60 older white participants (age= 72.7 yrs+7.9); BMI=32.3+7.2) living in a rural setting. The participants completed questionnaires related to physical function (physical functioning questionnaire) (PF), physical activity (CHAMPS physical activity questionnaire) (PA), and self-regulation related to physical activity (SR). Additional measures included: 1) timed up and go (TUG), which involved rising from a chair, walking three meters, returning to the chair and sitting down, 2) gate speed (GS) over a six-meter distance, and 3) six-minute walk (6MW). Significant differences (p<0.05) between groups were identified using independent samples t-tests. **RESULTS:** For the objective physical measures, there were significant differences between AA and RW for TUG (13.1 vs 11.0 seconds) and UGS (0.990 vs 1.180 m/s) respectively. PF and PA were not significantly different. With regard to SR, significant differences between AA and RW were noted for goal setting (2.11 vs 1.55) and relapse 1.87 vs 1.456) respectively, related to being physically active. **CONCLUSIONS:** Both groups of participants had low levels of physical activity and would benefit from programs designed to improve functional ability. The differences noted for TUG and UGS as well as aspects of self-regulation can inform physical activity programming in our efforts to eliminate health disparities.

2757 Board #277 June 2 11:00 AM - 12:30 PM
Fatness and Low Back Pain: A Cohort Study of Japanese Male Workers in the Tokyo Metropolitan Area
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 (No relationships reported)

Low back pain is a major health problem worldwide. It is also the largest contributor to years of living with disability. Several studies have sought to explain the relationship between fatness and low back pain, especially in Western countries, but there are few studies clarifying this relationship among Japanese, for whom there is a different standard for obesity. **PURPOSE:** We evaluated whether obesity/overweight is a risk factor for chronic low back pain, by using body fat percentage (%FAT) and body mass index (BMI) as indices of fatness among Japanese male workers. **METHODS:** Participants underwent an annual health examination in 1986, and followed up in the 2009-2010 period. BMI was calculated based on height and weight. %FAT was estimated using the Brozek formula for body density, which was estimated by the Nagamine and Suzuki formula for skinfold thickness. Participants who had low back pain in 1986 or earlier were excluded. From annual health examinations in 2009-2010, participants who on our self-administered questionnaire responded "all the time" with regard to subjective back pain symptoms were considered as having chronic low back pain. These participants were divided into quartiles based on their %FAT and BMI. A logistic regression model was used to adjust the covariates and evaluate the relationship between presence of chronic low back pain and obesity. The multivariable-adjusted odds ratios and 95% confidence intervals (95%CI) were calculated for both %FAT and BMI, adjusting for age, cigarette smoking, and alcohol intake as the variables. **RESULTS:** Participants were 1,152, and median age (range) at baseline year was age 29 (18-43) years. Ninety people reported chronic low back pain in 2010. Following age, cigarette smoking, and alcohol intake adjustments, using the lowest %FAT (first quartile) group as a reference, the odds ratios (95%CI) for the second, third, and fourth quartiles were 0.86 (0.43-1.70), 1.46 (0.79-2.68), and 2.11 (1.16-3.83); *p* for linearity = 0.006. Moreover, using the BMI (first quartile) group as a reference, the odds ratios (95%CI) for the second, third, and fourth quartiles were 1.33 (0.69-2.56), 1.39 (0.71-2.69), and 1.80 (0.95-3.39), respectively; *p* for linearity = 0.011. **CONCLUSION:** Our findings suggest that both high %FAT and BMI are risk factors for chronic low back pain.

2758 Board #278 June 2 11:00 AM - 12:30 PM
Physical Fitness Changes In 80-year Old Japanese Adults With No-Medication Use Over 10 Years
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PURPOSE: The purpose of this study was to compare 10-year longitudinal changes in physical fitness (from age 70 to age 80 years) between older Japanese adults who did and did not take medications over the ten years period. **METHODS:** Six hundred men (n=306) and women (n=294), 70 years of age at baseline, residing in Niigata City, Japan, participated in this study. Baseline and follow-up physical fitness tests included hand-grip strength, isometric knee extensor strength, leg extensor power, stepping rate, and one-leg standing time with eyes open, and had medical examinations by physicians. Only the individuals who completed the physical fitness test at age of 80 years were grouped into no-medication or medication groups over the past decade, and divided into three groups: Group A: no medication over the 10 years period, Group B: medication at 80yr, no medication at 70yr, Group C: medication over the 10 years period. Their physical fitness at ages 70 and 80 years were compared using Paired t-test and Chi Square test. **RESULTS:** 59% of baseline data (n=354) were compared with 10 years follow-up data. Among these subjects, the rate of no medication use at 70 years old was 35.8%, which declined to 15.3% by 80 years of age. The most common chronic disease requiring medication was high blood pressure of these 80 year old men and women (n=122). The numbers of participants in each group were: A-56, B-104, and C-194. When compared the means of test results among these 3 groups at age 70 and 80 years, there were significant differences (*p*<0.05) in hand-grip

strength (A: 33.0kg, B: 30.2kg, C: 28.8kg) and knee extensor strength (A: 1.19kg/kg, B: 1.05kg/kg, C: 0.97 kg/kg). There were also significant decline over the ten years period in grip strength (A: -5.818kg B:-4.045kg C:-4.788kg), total protein (A: -0.135 g/dl, B: -0.112 g/dl, C: -0.223g/dl), and total cholesterol (A: -0.056mg/dl, B:-9.257mg/dl, C: -12.09mg/dl). Limitation of this study was significant decline of completion rate of the tests (leg extensor power, knee extensor strength) in participants in Groups B and C. **CONCLUSIONS:** The present study showed that the older adults with no medications over the ten years period had higher physical fitness level than medication groups. The findings of this study may provide interesting insight regarding the physical fitness in the elderly population.

2759 Board #279 June 2 11:00 AM - 12:30 PM
Physical Activity In Bouts And Nonbouts: Relation To Physical Fitness And Health-related Quality Of Life
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PURPOSE: It has been previously demonstrated that higher physical activity (PA) levels and better physical fitness (PF) were associated with higher health-related quality of life (HRQoL)¹. However, Wanderley et al. did not take the differences between PA levels calculated as overall PA (MVPA_{all}) or accumulated in bouts of at least 10 min (MVPA₁₀) into account. Therefore, the aim of this study was to compare the different effects of MVPA₁₀ and MVPA_{all} on PF and HRQoL in a population of young and older adults. **METHODS:** 21 young adults (YA: age 22.6±2.9 yrs; BMI 22.5±2.6 kg·m⁻²) and 21 older adults (OA: age 68.3±3.3 yrs; BMI 26.1±3 kg·m⁻²) wore an activity monitor for 7 consecutive days to obtain time spent in MVPA, analyzed in bouts of at least 10 consecutive min (MVPA₁₀) and in overall minutes (MVPA_{all}). To assess maximal isometric strength (iMVC), they performed a hand-grip strength test. Cardiorespiratory fitness (V'O_{2max}) was determined by indirect calorimetry using a maximal treadmill test. HRQoL was measured with the Short-Form 36 Health Status Survey (SF-36v2) that provided the physical (PCS) and the mental (MCS) component summary score. **RESULTS:** Although young adults resulted fitter than older adults (YA: V'O_{2max} 2.3±0.3 L·min⁻¹; iMVC 190.6±60.2 N; OA: V'O_{2max} 1.7±0.3 L·min⁻¹; iMVC 151.4±52.3 N; *p*<0.05), no differences were detected for MVPA (nor MVPA₁₀ neither MVPA_{all}) or HRQoL between groups. MVPA₁₀ was significantly lower than MVPA_{all} (MVPA₁₀: 28.7±35.6 min·day⁻¹; MVPA_{all}: 61.1±57.5 min·day⁻¹; *p*<0.01). The overall average PCS and MCS scores were 55.1±6.3 and 47.7±8.5, respectively. Regression analysis, adjusted for age and BMI, revealed that neither MVPA_{all} nor MVPA₁₀ were related to a higher PF or a higher HRQoL. Only V'O_{2max} was associated with a higher PCS (R²=0.095; β=4.216; *p*<0.05): each 1 L·min⁻¹ was associated with an increase of 4.5% in PCS. **CONCLUSIONS:** In contrast with Wanderley et al., this study showed that among relatively healthy, active but unfit older individuals HRQoL (PCS domain) is related only to V'O_{2max}. This observed positive association seems to be independent of age and BMI. This information will be useful for designing PA programs, aiming to improve cardiorespiratory fitness and that could also positively affect HRQoL. REFERENCES ¹Wanderley, Qual Life Res. 2011 Nov;20(9):1371-8.

2760 Board #280 June 2 11:00 AM - 12:30 PM
Dose-Response of Light Intensity Physical Activity and Glucose Dynamics in Older Adults
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National data reports older adults spend about 30% of their day in light intensity physical activity (LPA). This study was designed to examine how increasing the proportion of the day spent in LPA would affect glucose control. **PURPOSE:** To determine the duration-response of proportion of time spent in LPA on post-prandial glucose response in older adults in a controlled environment. **METHODS:** Older adults (N=9), 60 y and older, completed four, three-hour treatment conditions, a seated control condition, and three subsequent randomized conditions 1) 20% (36 min) of the condition spent in continuous LPA, the remaining time seated, 2) 40% (72 min) of the condition spent in continuous LPA, the remaining time seated, and 3) 60% (108 min) of the condition spent in continuous LPA, the remaining time seated. Energy expenditure was measured continuously and glucose was measured at baseline following mixed meal ingestion and each hour thereafter. Glucose AUC was calculated and compared between conditions using RMANOVA. **RESULTS:** A significantly greater amount of energy was expended during all activity conditions when compared to the seated condition (*p*<0.05). There was a significant difference between proportion of time spent in LPA and glucose AUC (F=11.601, *p*<0.001). Post-hoc analysis showed a significant difference between the seated condition and 60% LPA condition (AUC

mean difference (Seated-60%): 35.0 mg/dL, $p=0.016$), 20% LPA condition and 60% LPA condition (AUC mean difference (20%-60%): 17.3 mg/dL, $p=0.010$), and 40% LPA condition and 60% LPA condition (AUC mean difference (40%-60%): 9.8 mg/dL, $p=0.023$) **CONCLUSION:** These results provide experimental evidence to the importance LPA may play in the overall metabolic health of an older adult population. According to national data, LPA constitutes about 30% of the active day in older adults. Therefore, the translation of the current results suggest that if older adults, who spend on average about three hours per day in LPA, increase LPA by 36 min/d they could significantly benefit glucose control.

2761 Board #281 June 2 11:00 AM - 12:30 PM
Lower Cognition and Prefrontal Cortex Oxygenation during High Intensity Exercise in Individuals with Substance Addiction

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Substance addiction is a public health problem worldwide. Individuals with substance use disorder (SUD) have lower activity in the prefrontal cortex during resting state, which has been related to cognitive impairments and compulsive substance-seeking behavior. Exercise has shown to contribute in the treatment of SUD; however, its effects on the brain of these individuals is unclear, in particular under different intensities. **PURPOSE:** To verify the effects of an incremental exercise intervention on cognitive performance and oxygenation in the prefrontal cortex in individuals with substance use disorder (SUD). **METHODS:** The SUD group consisted of 14 patients (33.3 ± 5.6 years old) in a psychiatric hospital with substance use history (alcohol, marijuana, or crack cocaine) of 13.8 ± 5.6 years and classified as severe SUD by DSM-V. The control group (CG) consisted of 15 subjects (age: 25.3 ± 3.1 years) without addiction classification by the DSM-V. Both groups were subjected to an incremental test on a cycle ergometer accompanied by spirometry and assessments of prefrontal cortex oxygenation by near-infrared spectroscopy (oxyhemoglobin; ΔHbO_2) and cognitive performance (response time in ms on the Stroop task). Assessments were conducted at the respiratory compensation point (RCP) and maximal oxygen consumption (VO_2 peak), and effects were evaluated with two-factor mixed-design ANOVAs with post hoc Scheffé's tests. **RESULTS:** Although the groups did not differ in attained VO_2 peak ($p>0.05$), brain oxygenation increased for the SUD group (+9.1%) and the CG (+14.0%) as intensity increased during incremental exercise. Moreover, the SUD group showed lower cerebral oxygenation than the CG at high intensities (RCP ΔHbO_2 : SUD = 5.1 ± 2.4 vs. CG = 9.7 ± 3.1; VO_2 peak ΔHbO_2 : SUD = 9.11 ± 3.83 vs. CG = 14.01 ± 2.94) and demonstrated lower cognitive performance (RCP reaction time: SUD = 2583 ± 499 ms vs. CG = 1620 ± 356 ms; VO_2 peak reaction time: SUD = 2492 ± 399 ms vs. CG = 1539 ± 176 ms; $p<0.05$). **CONCLUSION:** Chronic addiction may impair prefrontal cortex oxygenation and cognition during exercise. Interestingly, exercising at high intensities promotes higher oxygenation in the prefrontal cortex, indicating its potential for treatment of individuals with SUD.

2762 Board #282 June 2 11:00 AM - 12:30 PM
Acute And Chronic Immune Responses To Consecutive Or Non-consecutive Days Of Resistance Training

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Current exercise guidelines recommend resistance training (RT) 2 to 3 days per week (wk), spaced 48-72 h apart for optimal muscle growth and strength improvement. However, shorter rest periods between RT sessions has not been well studied. In addition, the immunological effects of RT due to different recovery periods are poorly understood. **PURPOSE:** To investigate the immune responses to two identical RT programs using different recovery period. **METHODS:** Two groups of 15 recreationally active men performed RT 3 times per wk for 12 wk either on consecutive (C) or non-consecutive days (NC). Both groups performed leg press, latissimus pulldown, leg curl, dumbbell shoulder press and leg extension for 3 sets of 10 repetitions at their pre-determined 10 repetition-maximum. Blood was sampled in untrained (UT) and trained (T) state in wk 1 and 12 before 1st day of RT (UT Pre and T Pre), immediately post 3rd day of RT (UT 0h and T 0h) and 24h after the 3rd day of RT (UT 24h and T 24h). Samples were analysed for counts of total white blood cells (WBC), neutrophils (NE), lymphocytes (LY), monocytes (MO), eosinophils (EO), basophils (BA) and platelets (PL). Generalized estimating equations analyses were

performed. **RESULTS:** Both groups were similar in age [25 (SD 2) y], weight [65 (10) kg], height [1.72 (.06) m], BMI [22.2 (2.7) kg/m²], systolic and diastolic blood pressures [114 (5)/69 (8) mm Hg], fasting glucose [4.5 (.3) mmol/L] and physical activity level [2144 (1428) MET-min/wk] pre-RT. No interaction was found for all measures ($p = .065$ to $.967$). There were no group differences ($p = .103$ to $.525$) except MO, which was lower in C (.528 x 10⁹/L) than NC [.641 x 10⁹/L, 95% CI of difference (.028, .197), $p = .009$]. Significant main effects of time were found for all variables except MO ($p = 0.170$) and EO ($p = 0.236$). In wk 1, both groups increased WBC (C: +9.2%; NC: +7.0%; $p = 0.025$), LY (C: +12.4%; NC: +15.2%; $p < .001$), BA (C: +11.4%; NC: +23.1%; $p = .003$) and PL (C: +10.3%; NC: +12.1%; $p < .001$) at UT 0h compared to UT Pre. LY fell below UT Pre at UT 24h ($p = 0.002$). In wk 12, T 0h values for all measures were not significantly different from T pre values ($p = .772$ to $.999$) except for an increase in PL ($p = 0.001$). There was no difference between UT Pre and T Pre values for all measures ($p = .335$ to $.999$). **CONCLUSION:** Both groups had similar immune response to RT.
 Supported by NIE AcRF RI 5/14 YFF

2763 Board #283 June 2 11:00 AM - 12:30 PM
3 Week Behavioral Intervention Does Not Lower Urinary Bisphenol A Concentrations In Women With Obesity

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Previous studies have shown that women with obesity have higher concentrations of Bisphenol A (BPA), but an intervention to reduce BPA is lacking in women. **PURPOSE:** To determine whether a theory-based behavioral intervention designed to reduce BPA would decrease urinary BPA concentrations over 3 weeks in women with obesity. **METHODS:** Thirty college-aged, women were randomly assigned to an intervention (N=15; 31.5 ± 5.6 kg/m²; 21.6 ± 3.3 yrs) or control (N=15; 30.8 ± 5.8 kg/m²; 21.5 ± 3.1 yrs). The intervention included weekly face-to-face meetings to reduce BPA exposures from food, cosmetics, and other packaged products. Women were provided with BPA-free cosmetics, hygiene, glass food/water containers and daily self-monitored major sources of BPA. Fasting urine BPA and creatinine concentrations, and weight were assessed at baseline and after 3-weeks. **RESULTS:** BPA was non-detectable (limit of detection 0.05 µg/L) in 26% of samples at baseline. No significant (P=0.55) treatment x time interaction effect was observed on creatinine-adjusted BPA concentrations from baseline to 3-weeks in the intervention (0.41 ± 0.56, 0.77 ± 0.66 µg/g Creatinine) or control group (0.62 ± 0.92, 0.51 ± 0.81 µg/g Creatinine) using baseline BMI, age, and demographics as covariates. No significant treatment x time interaction effect (P=0.54) in weight was observed from baseline to 3-weeks in the intervention (83.9 ± 17.0, 83.9 ± 16.9 kg) or control group (81.4 ± 15.4, 81.1 ± 15.6 kg), and changes in creatinine-adjusted-BPA concentrations and weight were not significantly related (P>0.05). In sensitivity analysis, omitting subjects with non-detectable BPA concentrations at baseline, there was a trend for a significant treatment x time interaction (P=0.09). **CONCLUSION:** 3-week intervention had no effect on urinary BPA concentrations or weight in women with obesity. Future research is needed to examine intervention effects in individuals with high baseline urine BPA.

2764 Board #284 June 2 11:00 AM - 12:30 PM
Relationship Between Oxygen Consumption, Percentage Of Muscle Mass And Risk Of Cardiovascular Disease In Adult Men

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Previous studies have shown that physical exercise of resistance and strength are related to cardiovascular health. **PURPOSE:** This study aims to establish the relationship between maximum oxygen consumption, percentage of muscle mass and cardiovascular risk disease in professors from the Santo Tomas University of Bogota - Colombia. **METHODS:** The population was 56 men with a mean age of 42.1 ± 9.5 years. The 10-years cardiovascular risk (10y-CVR) was calculated using the Framingham scale, considering the parameters of gender, age, presence of diabetes, smoking (cigarettes per day), total cholesterol (Total-C), HDL cholesterol (HDL-C) and systolic blood pressure (SBP). Pre-prandial blood samples were collected and blood pressure was evaluated after 15 minutes of rest. In a different session, the muscle mass percentage (MP) was evaluated by bioimpedance, a submaximal fitness test (modified Bruce protocol) was performed and the maximum oxygen consumption ($\text{VO}_{2\text{max}}$) was calculated based on the test duration. The statistical analysis was

performed using the Pearson's correlation coefficient (r) with a significance level of 0.05. **RESULTS:** In the evaluated subjects, one was diabetic and 16 men smoke up to 20 cigarettes per day. The Total-C was 5.58 ± 1.09 mmol/l, the HDL-C 1.27 ± 0.24 mmol/l and the SBP 106.7 ± 10.2 mmHg. The 10y-CVR was $5.5 \pm 5.2\%$, with a range of 0.5 - 21.3%. The average of MP was $34.7 \pm 3.1\%$ and the relative $\dot{V}O_{2max}$ 49.1 ± 11.1 ml/kg/min. A negative correlation was observed between the MP and 10y-CVR ($r = -0.38$ $p = 0.01$) as well as between $\dot{V}O_{2max}$ and RCV ($r = -0.51$ of $p < 0.01$). **CONCLUSION:** The results of this research evidence the protective effect on the risk of cardiovascular disease arising from a good aerobic capacity, especially by the reduction Total-C, lower SBP and a greater amount of MP. This work contributes to evidence the beneficial effects of combining aerobic and of strength exercise in reducing cardiovascular risk, which will be used in prevention programs within the Santo Tomas University population.

2765 Board #285 June 2 11:00 AM - 12:30 PM
Effect of Bikram Yoga on Heart Rate Variability and Associated Outcomes in Stressed and Sedentary Adults

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Reported Relationships: Z.L. Hewett: Ownership Interest (Stocks, Bonds); Bikram Yoga Kingston.

PURPOSE: This study investigated the effect of a 16-week Bikram yoga intervention on the high frequency (HF) power component of heart rate variability (HRV) and associated physiological and psychological outcomes in stressed and sedentary adults. **METHODS:** Eligible adults were randomized to an experimental group ($n=29$) or a no-treatment control group ($n=34$) after baseline testing. Experimental group participants were instructed to attend three to five Bikram yoga classes per week at local studios. All outcomes were collected at baseline (week 0) and completion (week 17), with psychological outcomes also collected at midpoint (week 8). Secondary physiological outcomes included additional HRV measures, blood pressure, augmentation index, body composition (via DEXA), waist circumference, fasting blood glucose, cholesterol, and C-reactive protein. Secondary psychological outcomes included the Perceived Stress Scale, the General- and Exercise Self-Efficacy Scales and health-related quality of life (HRQoL) measures (via Short-Form-36). **RESULTS:** Sixty-three adults (37.2 ± 10.8 years, 79% women) were enrolled in the study and included in the intention-to-treat analysis. The experimental group attended 27 ± 18 classes. The HF component of HRV did not significantly change between groups over time, nor did any secondary physiological endpoints. However, higher attendance to the intervention was associated with significant reductions in diastolic blood pressure ($p=0.039$), body fat percentage ($p=0.001$), fat mass ($p=0.003$) and body mass index ($p=0.05$). Further, the experimental group significantly improved several psychological endpoints versus the control group including perceived stress ($p = 0.003$), general self-efficacy ($p=0.034$), exercise self-efficacy ($p=0.003$), and HRQoL 'Vitality' ($p=0.019$) and 'General Health' ($p=0.034$). **CONCLUSIONS:** A 16-week Bikram yoga program did not increase the HF power component of HRV or any physiological outcomes evaluated. Low adherence possibly contributed to these null effects. However, participants in the experimental group significantly improved perceived stress, and measures of self-efficacy and HRQoL. Future studies are required to address barriers to adherence and elucidate the dose-response effects of Bikram yoga practice.

2766 Board #286 June 2 11:00 AM - 12:30 PM
Association of Cardiorespiratory Fitness, Visceral Fat and Weight Cycling History in Pre-menopausal Women.

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(No relationships reported)

Weight cycling (WC), or repeated bouts of intentional weight fluctuations are common among overweight and obese women and have been linked to various cardiometabolic health risks such as visceral fat (VF) accumulation. Cardiorespiratory fitness (CRF), independent of weight loss, is a known counter measure to health risks and VF. Although, WC has been positively associated with increases in VF, this association may be confounded by age and/or physical activity status. **Purpose:** This cross sectional study explored the association of multiple factors (i.e., AGE, WC and CRF) on VF and investigated WC as a potential moderator on the relationship between CRF and VF among pre-menopausal women. **Methods:** 41 overweight and obese (BMI = 30.4 ± 6.2 kg/M²) pre-menopausal (age = 31.0 ± 5.6 yrs) women were assessed. Dichotomous WC groups were established from the number of self-reported WC bouts and total weight lost per bout. WC ($n = 19$) was defined as ≥ 3 cycles of ≥ 10 lb; and Non-WC ($n = 22$) was defined as not meeting WC definition. Additionally, a

weight cycling index (WCI) was constructed to form a continuous variable. WC due to pregnancy and illness were excluded from the totals. CRF was determined with indirect calorimetry using a cycle ergometer protocol to peak $\dot{V}O_{2max}$, and VF volume (cm³) was assessed with CoreScan software (iDXA, GE Lunar). Correlation and multiple regression analysis were used to examine the relationship between VF and potential predictors, and possible moderator effects. **Results:** Significant ($p < .001$) differences between WC vs. Non-WC groups were found for AGE (33.1 ± 3.7 vs. 29.3 ± 6.4 yr); BMI ($34.6.1 \pm 5.7$ vs. 26.7 ± 3.8 kg/M²); VF (1257.2 ± 1033.0 vs. 426.6 ± 547.0 cm³); and CRF (24.1 ± 5.7 vs. 31.0 ± 6.5 ml/kg/min). The strongest association was found between CRF and VF ($R = -0.718$, $p < .001$). The regression model with four factors (AGE, WCI, CRF, WC x CRF) was significant ($R^2 = .570$, $p \leq .001$); however, only CRF significantly predicted VF ($p \leq .001$). The WC x CRF interaction was not significant ($p = .150$) with a $\Delta R^2 = .026$, predicting only 2% of VF. Thus, no moderator effect was detected. **Conclusion:** These findings suggest the relationship between CRF and VF was independent of WC status and that CRF was the most influential factor predicting VF among overweight and obese pre-menopausal women with a history of weight cycling.

2767 Board #287 June 2 11:00 AM - 12:30 PM
Improvement Of Cognitive Function By dual-task Exercise

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(No relationships reported)

Studies have shown that exercise improves cognitive function and that dual-task exercise, in particular, has neuroprotective effective effects in elderly individuals. **PURPOSE:** The purpose of this study was to examine the improvement of cognitive function by a dual-task exercise intervention. We also tested if the improvement of cognitive function was associated with the number of steps and exercise duration at different exercise intensity levels. **METHODS:** In all, 17 men and 25 women (mean [SD], age 73.8 [6.0] years, height 158.6 [7.0] cm, weight 56.0 [7.6] kg, and body mass index 22.2 [3.2] kg/m²) participated in square-step exercise (dual-task) once per week for 12 weeks. The number of steps was recorded from a waist-mounted accelerometer, and weekly data were classified into four levels based on the exercise intensity (inactivity, light, moderate, and vigorous). Participants performed the Cognitive Assessment for Dementia (CADI2) and Trail Making Test (TMT) before and after the exercise program to evaluate cognitive function. **RESULTS:** The total reaction time determined by CADI2 was significantly shorter in the post-exercise test than that in the pre-exercise test (post: 89.3 [25.7] vs. pre: 96.1 [28.3] s, $p = 0.025$), which suggests that cognitive function improved during the 12-week exercise program. Conversely, there was no significant change in TMT score (TMT A post: [49.4] vs. pre: [54.7] s $p = 0.19$, TMT B post: [113.0] vs. pre: [138.5] s $p = 0.05$, TMT B-A post: [63.3] vs. pre: [83.8] s $p = 0.59$). However, changes in CADI2 score did not correlate with the number of steps and exercise duration at each level of exercise intensity. **CONCLUSIONS:** These results demonstrate that the improved cognitive function was not primarily derived from increases in physical activity but, specifically, from involvement in dual-task exercise.

2768 Board #288 June 2 11:00 AM - 12:30 PM
Physical Activity and Sedentary Behavior among Hispanic Obstructive Sleep Apnea Patients in Puerto Rico

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(No relationships reported)

Obstructive sleep apnea (OSA) is a chronic respiratory disease more prevalent in men compared with females, and commonly associated with obesity and poor quality of life. Few studies have reported low physical activity (PA), but none has evaluated sedentary time (ST) in this population; and these characteristics among Hispanics are unknown. **PURPOSE:** To describe PA behavior and ST, and their association with waist circumference and BMI in a group of Hispanic adults living with OSA in Puerto Rico (PR). **METHODS:** A group of 15 adults (10 men and 5 women, mean age = 44.3 ± 9.4 yrs) in treatment for OSA completed measurements of height and weight; and wore an ActiGraph GT3x+ accelerometer attached to a waist band placed in the right hip area for 7 days. Wilcoxon signed-rank tests were used to detect gender differences, and Spearman correlations to evaluate the association between PA, ST and BMI. **RESULTS:** No gender differences were observed. Participants spent 34.7 ± 46.9 min/week in moderate to vigorous physical activity (MVPA), and 8.8 ± 1.3 hrs/day in ST. Mean BMI was 34.7 ± 5.9 kg/m². No significant correlations were observed between PA

and BMI ($p = -0.39$, $P = 0.15$), ST and MVPA ($p = -0.23$, $P = 0.42$), and ST and BMI ($p = 0.05$, $P = 0.86$). **CONCLUSION:** Obesity was highly prevalent (93%) in this group of Hispanic adults living with OSA in PR, probably obscuring its association with PA and ST. In general, these participants could be classified as physically inactive and sedentary, factors associated with reduced life expectancy and poor quality of life. Clinical treatment must integrate strategies to help control body weight, improve PA, and reduce ST in this population.

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Effects of Short Term Detraining in Metabolic Syndrome Patients

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PURPOSE: Aerobic exercise training improves some of the components of metabolic syndrome (MSyn). Although it would be advisable to incorporate exercise permanently into life-style of MSyn patients, training discontinuation due to holidays, minor illness and/or musculoskeletal disorders is frequent. The aim of this study was to identify which of the metabolic syndrome factors reverses faster during short-term detraining. **METHODS:** Forty MSyn patients (54±8.9 yrs old; 32.4±1.2 BMI; 28 males and 12 females) underwent 8-wk of aerobic interval training (AIT). Then they were randomly divided into two groups, one that continued training for 3 more weeks (i.e., training group; TR, n=22) and another that stopped training during those 3-wks (i.e., detraining group; DeTR, n=18). Body composition, blood pressure and biochemistry were collected prior to start training, after 8 weeks (i.e., common training period) and 3 further weeks of either continuing training (TR group) or detraining (DeTR group). **RESULTS:** Before training started subjects in both groups were similar in body weight (90.6±3.9 vs. 93.9±4.2; $P = 0.56$) body fat (36.1%±1.4 vs. 33.1%±1.4; $P = 0.15$), number of MSyn factors (3.7±0.2 vs. 3.4±0.3; $P = 0.28$) and cardiopulmonary fitness level (2.5±0.7 vs. 2.2±0.7 L·min⁻¹). DeTR group did not increase body weight or fat mass and thus both groups remained similar in these parameters at week 11 ($P > 0.05$). Both groups reduced total cholesterol (T-CHOL), triglycerides (TG) and LDL-cholesterol (LDL-c) similarly after 8 weeks of training. However, DeTR compared to TR group showed blunted reductions TCHOL (-9.6±3.9 vs. -19.7±5.5, mg·dl⁻¹; $P < 0.05$), TG (4.3±13.9 vs. -3.2±6.8, mg·dl⁻¹; $P < 0.05$) and LDL-c (-6.0±3.6 vs. -13.1±4.7, mg·dl⁻¹; $P < 0.05$) at week 11, respectively. Furthermore, DeTR also blunted the reduction in resting heart rate (1.4±2.0 vs. -2.5±1.1, lat·min⁻¹; $P < 0.05$) although it did not affect arterial blood pressure that remained similarly reduced in both groups after 11 weeks. **CONCLUSION:** Our data suggest that short-term detraining (3 weeks) halts and tends to revert the benefits of 8 weeks of intense aerobic interval training in blood lipid profile despite no gains in body weight or body fat. In contrast, the cardiovascular benefits of training seemed more resilient to short-term detraining.

E-37 Free Communication/Poster - Respiratory

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2770 Board #290 June 2 11:00 AM - 12:30 PM

Effect of Age on Sex Differences in the Inspiratory Muscle Metaboreflex

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Sex differences exist in the cardiovascular consequences of the inspiratory muscle metaboreflex in young adults. However, it is unknown if these sex differences are present in older adults. **PURPOSE:** To determine the effect of age on sex differences in the cardiovascular consequences of the inspiratory muscle metaboreflex. We hypothesized that, compared to their younger counterparts, older men and women would exhibit greater 1) increases in mean arterial pressure (MAP) and limb vascular resistance (LVR) and 2) decreases in limb blood flow (Q_L). We also hypothesized that the inspiratory muscle metaboreflex-induced cardiovascular responses would not be different between older men and women.

METHODS: Sixteen young (8 men, 8 women; 18-24 yr) and older (8 men, 8 women; 60-73 yr) adults were recruited for this study. Subjects performed inspiratory resistive breathing tasks (IRBTs) at 2% and 65% of their maximal inspiratory pressure. During the IRBTs, breathing frequency was 20 breaths min⁻¹ with a 50% duty cycle. At rest and during the IRBTs, MAP was measured via automated oscillometry, Q_L was

measured via Doppler ultrasound, and LVR was calculated. End tidal CO₂ remained at baseline levels during the IRBTs. EMG was recorded on the leg to ensure no muscle contraction occurred.

RESULTS: The 65% IRBT led to significantly greater increases in MAP from baseline in OW (15.9±8.1 mmHg) compared to YW (6.9±1.4 mmHg), but not ($p > 0.05$) between OM (12.3±5.7 mmHg) and YM (10.3±5.7 mmHg). OW (-20.2±7.2 %) had greater ($p < 0.05$) decreases in Q_L from baseline compared to YW (-9.4±10.2 %), but no differences ($p > 0.05$) were present between OM (-22.8±9.7 %) and YM (-22.7±11.3 %) during the 65% IRBT. The 65% IRBT led to greater ($p < 0.05$) increases in LVR in OW (48.2±25.5 %) compared to YW (19.7±15.0 %), but no differences ($p > 0.05$) existed among OM (54.4±17.8 %) and YM (47.1±23.3 %). No differences ($p > 0.05$) were present in MAP, Q_L , or LVR between OM and OW. The 2% IRBT resulted in no changes ($p > 0.05$) in MAP, Q_L , or LVR across time or among groups. **CONCLUSIONS:** These data suggest older women compared to younger women exhibit greater inspiratory muscle metaboreflex-induced cardiovascular consequences, while there were no differences between older and younger men. Lastly, sex differences in the inspiratory muscle metaboreflex are not present in older adults.

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Respiratory Muscle Endurance And Cardiovascular Response To Hyperpnoea After Respiratory Muscle Training In Hypoxia

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Respiratory muscle endurance training improves respiratory endurance and attenuates respiratory muscle-induced metaboreflex. In an animal study, it was shown that a larger increase in citrate synthase activity in the diaphragm occurred after exercise training under hypoxic conditions than under normoxic conditions. From these findings, it was hypothesized that respiratory muscle training under hypoxic conditions would lead to a greater respiratory endurance and a larger reduction of cardiovascular responses to increased respiratory muscle work. **PURPOSE:** The purpose of the present study was to clarify the effects of respiratory muscle endurance training under hypoxic conditions on respiratory muscle endurance and respiratory muscle-induced metaboreflex.

METHODS: Collegiate male endurance runners were assigned to a normoxic (n=6) or hypoxic group (n=6). Before and after 6 weeks of respiratory muscle endurance training, cardiovascular responses to an incremental respiratory endurance test were measured. The training was isocapnic hyperpnoea under normoxic and hypoxic conditions. Minute ventilation during the training was initially set at 50% of the individual MVV₁₂, and thereafter, target minute ventilation increased progressively. Target SpO₂ in the hypoxic group was set at 90% in the first and second weeks, and thereafter it was set at 80%. **RESULTS:** Respiratory endurance time was extended after the training in both groups, but there was no difference between the normoxic and hypoxic groups (norm: +45.1%, hypo: +39.6%). The changes in HR and arterial BP during the incremental respiratory endurance test were significantly reduced after 6 weeks of respiratory endurance training in both groups. There were no significant differences between the normoxic and hypoxic groups in either HR or arterial BP during hyperpnoea. **CONCLUSION:** These results suggest that respiratory muscle endurance is improved and respiratory muscle-induced metaboreflex is attenuated by respiratory muscle endurance training, but there is no additional effect when the training is performed under hypoxic conditions.

2772 Board #292 June 2 11:00 AM - 12:30 PM

Pulmonary Function And Endurance Performance In Triathlon

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Pulmonary function, which supplies adequate and instantaneous amounts of oxygen consumption, is associated with the exercise performance. Endurance athletes, such as triathlon and swimming, have a higher and prolonged demand than power athletes and non-athletes for gas exchange and ventilation during exercise.

PURPOSE: The purpose of this study was to analyze pulmonary function and the relationship between pulmonary function and endurance performance in triathletes. **METHODS:** Twenty-four male subjects, aged 20-25 years old, were recruited and divided into triathletes (n=12), who participated in international competition, and non-athletic control (n=12) groups. Anthropometry and body fat were measured at rest.

Pulmonary function tests were performed using a spirometry, including tidal volume (V_T), vital capacity (VC), forced vital capacity (FVC), Forced expiratory volume (FEV) in 1 second (FEV_1) and maximal voluntary ventilation (MVV). Endurance performance tests were examined during treadmill exercise testing with respiratory gas analysis, including maximal oxygen consumption (VO_2 max) and time to exhaustion (TTE). Informed consent forms had been completed by all participants before the experiments started.

RESULTS: All of baseline characteristics were not significantly different between two groups, except for the percentage of body fat ($13.59 \pm 3.30\%$ and $19.70 \pm 4.73\%$, $p < .05$ in triathletes and control groups). Triathletes had significantly higher pulmonary function in V_T (0.80 ± 0.20 vs 0.63 ± 0.13 L, $p < .05$), FVC (5.09 ± 0.50 vs 4.53 ± 0.43 L, $p < .05$), and MVV (181.72 ± 21.70 vs 157.97 ± 17.83 L/min, $p < .05$) compared with the control group. Moreover, they had greater VO_2 max (66.90 ± 4.93 vs 47.00 ± 8.43 ml.min⁻¹.kg⁻¹) and higher TTE (1074.80 ± 43.10 vs 782.40 ± 92.30 secs) compared with their counterpart ($p < .05$). We also found that FVC, FEV_1 and MVV were significantly correlated with VO_2 max in all subjects ($p < .05$).

CONCLUSIONS: This study indicated that triathletes had higher pulmonary function and some correlations existed in pulmonary function and VO_2 max, which may provide useful information for triathlon training.

2773 Board #293 June 2 11:00 AM - 12:30 PM
Does Inspiratory Muscle Training Affect Leg Blood Flow during Hypoxic Exercise?

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High levels of ventilatory work have been shown to compromise locomotor muscle blood flow during endurance exercise. Inspiratory muscle training (IMT) may provide a useful technique to deal with increased ventilation during hypoxic exercise and maintain skeletal muscle blood flow.

PURPOSE: To examine if 6 weeks of IMT affects leg blood flow during endurance exercise in normobaric hypoxia.

METHODS: Ten male endurance trained athletes (VO_2 max = 61.6 ± 5.6 mL.kg⁻¹.min⁻¹) were pair matched based on pre-exercise maximal inspiratory pressure (MIP). Subjects underwent IMT for 3-d per week over a period of 6 weeks, with training set at either 80% sustained MIP (IMT group, n=5) or 30% sustained MIP (sham group, n=5), within a regimen of progressively increased work-rest ratios until task failure. Pre- and post-training, subjects completed respiratory muscle strength tests and a 20km cycling time trial (TT) in normobaric hypoxia ($F_{O_2} = 16.1\%$), where VO_2 was measured breath by breath and skeletal muscle deoxygenation (deoxygenated hemoglobin+myoglobin [HHb]) was measured via near-infrared spectroscopy. Using the change in HHb from unloaded cycling to exercise as a surrogate for a- VO_2 difference (O_2 extraction), VO_2/HHb gives an estimation for skeletal muscle blood flow.

RESULTS: The IMT group significantly improved MIP (145.3 ± 27.9 cmH₂O vs 171.7 ± 38.7 cmH₂O) following training ($p < 0.05$) while the sham group remained unchanged. During the last min of the 20km TT, VO_2 of the IMT group was at $87.4 \pm 12.5\%$ and the sham group at $91.7 \pm 8.9\%$ of normoxic VO_2 max. 20km TT mean V_E was higher post-IMT (98.9 ± 15.9 l.min⁻¹ vs 109.3 ± 22.4 l.min⁻¹, $p=0.055$) and unchanged in sham. V_E in the last min post-IMT was 133.6 ± 33.0 L.min⁻¹ compared to pre-IMT of 110.9 ± 18.2 L.min⁻¹ ($p=0.08$), and was unchanged in sham. The change in pre- to post- VO_2/HHb in the IMT group was $21.2 \pm 1.6\%$, but was not significant ($p=0.38$). There was no significant change in VO_2/HHb in the sham group and no differences were seen between groups following IMT.

CONCLUSION: Despite an increase in V_E and therefore, increased respiratory muscle work, there was no change in leg blood flow with IMT. IMT may allow for greater tolerance for increased ventilation during hypoxic exercise while maintaining leg blood flow.

2774 Board #294 June 2 11:00 AM - 12:30 PM
Blood Pressure Response During Hyperpnoea Is Lower in Women Compared with Men

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It has been reported that women exhibit less inspiratory muscle fatigue during exercise. Additionally, a recent study found a lower blood pressure response to resistive inspiratory muscle activity (high-resistance, low-speed inspiratory muscle contractions), indicating that women exhibit an attenuated inspiratory muscle metaboreflex compared to men. Another way to model the respiratory muscle metaboreflex is to measure the cardiovascular response to exercise-mimicking

hyperpnoea (low-resistance, high-speed inspiratory and expiratory muscle contractions). It is hypothesized that women will have a lower cardiovascular response to low-resistance, high-speed inspiratory and expiratory muscle contractions.

PURPOSE: To test this hypothesis, the cardiovascular response during voluntary normocapnic incremental hyperpnoea was evaluated in young women and age-matched men. **METHODS:** Healthy young subjects (8 men, 10 women) participated in this study. An incremental respiratory endurance test was performed as follows: target minute ventilation was initially set at 30% of maximal voluntary ventilation (MVV_{12}) and was increased by 10% MVV_{12} every 3 min. The test was terminated when the subject could no longer maintain the target ventilation. Heart rate and arterial blood pressure (BP) were continuously measured. **RESULTS:** There was no significant difference in respiratory endurance time between women (11.6 ± 0.6 min) and men (12.3 ± 0.5 min). The change in mean arterial BP (MBP) during the incremental respiratory endurance test was significantly lower in women compared to men (women: 105.9 ± 3.2 mmHg, men: 126.0 ± 6.0 mmHg at 9 min). **CONCLUSIONS:** The data from the present study suggests that the respiratory muscle-induced metaboreflex is blunted in women compared to age-matched men.

2775 Board #295 June 2 11:00 AM - 12:30 PM

Exercise Breathing During Arm And Leg Cycling in Adults with Motor Incomplete Spinal Cord Injury

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INTRODUCTION: Motor incomplete spinal cord injury (iSCI) is associated with impaired ventilation at rest and during exercise and may exacerbate functional limitations from the injury. iSCI reduces overall lung capacities and volumes below predicted values and is also associated with poor respiratory control. **PURPOSE:** To characterize the breathing pattern and timing during arm- and leg-cycling in adults with motor iSCI and compare their response to a reference group. **METHODS:** 6-subjects (REF: n=3, iSCI: n=3) REF group; age: 32 ± 4.58 years; BMI: 29.3 ± 2.6 kg/m²; height: 178 ± 3.6 cm; weight: 92.9 ± 16.3 kg and iSCI group; age 31 ± 18 years; BMI: 22.1 ± 2.6 kg/m²; height: 185.6 ± 6.0 cm; weight: 75.9 ± 14.3 kg; injury level: C3-C5. Subjects completed testing on 2 separated days. Day 1: They performed a maximum voluntary ventilation test (MVV), and then 3 6-minute constant work rate (CWR) bouts randomized to either Leg and Arm cycling trials that elicited 10, 20, 30% of MVV (V_E L.min⁻¹). Day 2: The other work trial was performed. Workload was adjusted during the first 3 minutes of each 6-minute bout to establish the required V_E ($\pm 10\%$). Pedaling frequency was kept at 60 ± 5 revolutions per minute (RPM). Each bout was followed by a 5-minute seated rest. MANOVA were used to compare inspiratory time (T_I), expiratory time (T_E), and inspiratory duty cycle (T_I/T_{TOT}) within and between the groups as well as intensity. **RESULTS:** There was no significant differences in breathing pattern and timing during arm- or leg-cycling within the REF group ($F = 0.70$, $P = 0.65$) and iSCI group ($F = 0.66$, $P = 0.68$). Intensities within arm and leg trials did not reach significance in either group ($P \geq 0.17$). However, there was a significant difference between the two groups during arm-cycling: T_I , T_E , T_I/T_{TOT} (REF = $1.06 \pm 0.3s$, $1.78 \pm 0.4s$, 0.37 ± 0.02 ; iSCI = $0.78 \pm 0.2s$, $1.66 \pm 0.5s$, 0.33 ± 0.3 ; $F = 7.61$, $P = 0.002 < 0.05$, respectively), and leg-cycling (REF = $0.89 \pm 0.2s$, $1.58 \pm 0.3s$, 0.35 ± 0.02 ; iSCI = $0.78 \pm 0.1s$, $1.72 \pm 0.6s$, 0.33 ± 0.05 ; $F = 3.46$, $P = 0.036 < 0.05$, respectively). **CONCLUSION:** iSCI had a shortened T_I and prolonged T_E , reduced T_I/T_{TOT} compared to REF. Our results suggest a greater expiratory phase with a reduced inspiratory duty cycle in iSCI during both arm- and leg-cycling compared to non-iSCI, which could be associated with the injury and not to the exercise intensity.

2776 Board #296 June 2 11:00 AM - 12:30 PM

Relation Between Inspiratory Muscle Strength and Recruitment Onset of Neck Inspiratory Muscles

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The diaphragm contributes approximately 70–90% to whole inspiratory muscle pressure generation. In contrast, the neck inspiratory muscles are not always active during quiet breathing in healthy people but frequently active in patients with respiratory disease who has lower inspiratory muscle strength, probably due to help performing inspiration for a certain lung volume. Taken together, the recruitment onset for the neck inspiratory muscles during an inspiration may depend on the inspiratory muscle strength.

PURPOSE: To test whether inspiratory muscle strength is associated with the recruitment onset for the neck inspiratory muscles during an inspiration. **METHODS:** First, eight healthy young subjects measured maximal inspiratory mouth pressure (MIP) as inspiratory muscle strength, and peak inspiratory flow rate (PIFR).

Then, subjects matched their flow rate to 20, 40, 60, 80, and 100% PIFR during volitional inspiration from residual volume (Flow rate-control task) to determine the index of recruitment onset for the neck inspiratory muscles. Flow rate-control task was performed with (W; 23cmH₂O) and without (WO) inspiratory load. Mean %PIFR and EMG amplitude (aEMG) of the sternocleidomastoid (SCM) and scalene (SC) were calculated over the duration of every 10% of maximal lung volume (MLV) ranging from 20% to 60% of MLV. The index of recruitment onset for each muscle was determined by the processed %PIFR-aEMG curves at each %MLV. Finally, a linear regression analysis was performed between MIP normalized to body weight (MIP/BW) and index of recruitment onset for each muscle across subjects, for which the Pearson product-moment correlation coefficient (*r*) was calculated at each %MLV.

RESULTS: MIP was ranged from 124 to 205 cmH₂O across subjects. When collapsed across %MLV, there were highly negative correlations between MIP/BW and index of recruitment onset for both muscles under W (SCM: *r* = -0.866; SC: *r* = -0.877, *P* < 0.01) and WO (SCM: *r* = -0.789; SC: *r* = -0.735, *P* < 0.05).

CONCLUSION: The current results indicate that the neck inspiratory muscles of a subject who has lower inspiratory muscle strength are recruited at lower flow rate with a certain lung volume, suggesting that MIP/BW becomes useful outcome for assessing not only inspiratory muscle strength but also recruitment onset of the neck inspiratory muscles.

2777 Board #297 June 2 11:00 AM - 12:30 PM
Ventilatory Strategies Of Swimmers During Submaximal Efforts

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Background: Pulmonary ventilation while swimming is constrained by the medium (water) and the timing associated with arm mechanics. Attempts at describing ventilation have been technically complex and therefore little published data exists on ventilatory strategies and pulmonary function while swimming. This is in contrast to the considerable data available for other exercise modes.

Methods: Ten trained, competitive men swimmers (age = 24.4 ± 1.91 yrs) were asked to perform six submaximal exercise tests on separate days, three on a cycle ergometer and three while swimming in a flume. Workloads were set to elicit 70, 80, and 90% $\dot{V}_{E,peak}$ based off previous incremental tests in both modes. Tidal volume (V_T), breathing frequency (fB), peak tidal flow expired (P_{TE}), time to inspire (T_i) and expire (T_e), total tidal time (T_t), and duty cycle (T_i/T_{tot}) were assessed repeatedly in both conditions via flow-volume loops. Oxygen consumption (\dot{V}_O) and ventilation (\dot{V}_E) was measured via open flow calorimetry. All variables were recorded over the final minute of each workload. Two-way, repeated measures ANOVAs were used for all comparisons, with the level of significance set at 0.05.

Results: At 70%, subjects had a larger \dot{V}_E (79.04 ± 10.1 vs. 72.49 ± 11.2 L/min; *p* < 0.05), T_i/T_{tot} (59.1 ± 2.86 vs. 48.8 ± 1.47%; *p* < 0.05), and P_{TE} (5.92 ± 0.79 vs. 3.53 ± 0.63 L/s; *p* < 0.05), and smaller T_e (0.70 ± 0.13 vs. 1.07 ± 0.35 s; *p* < 0.05) when swimming compared to cycling. At 80%, subjects had a larger T_i/T_{tot} (58.9 ± 4.81 vs. 48.8 ± 2.78%; *p* < 0.05), P_{TE} (6.46 ± 1.16 vs. 4.31 ± 1.05 L/s; *p* < 0.05), and smaller T_e (0.62 ± 0.10 vs. 0.86 ± 0.23 s; *p* < 0.05) when swimming compared to cycling. At 90%, subjects had a larger T_i/T_{tot} (59.1 ± 2.86 vs. 48.8 ± 1.47%; *p* < 0.05) and P_{TE} (6.47 ± 0.87 vs. 5.01 ± 1.05 L/s; *p* < 0.05) but smaller \dot{V}_E (95.49 ± 20.4 vs. 103.18 ± 22.0 L/min; *p* < 0.05) and T_e (0.61 ± 0.12 vs. 0.76 ± 0.23 s; *p* < 0.05) when swimming compared to cycling. Swimming elicited a higher \dot{V}_E across all intensities (3.16 ± 0.64, 3.36 ± 0.73, 3.57 ± 0.69 vs. 2.65 ± 0.35, 2.96 ± 0.44, 3.19 ± 0.50 L/min; *p* > 0.05).

Conclusions: Unlike cycling, ventilatory strategies during swimming seem to be independent from the metabolic demand, calling for a forced hyperventilation at lower intensities but transitioning into a hypoventilation at near maximal intensities. The cause of this phenomena remains unclear.

2778 Board #298 June 2 11:00 AM - 12:30 PM
Hypercapnia and Voluntary Activation of the Diaphragm in Healthy Humans

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As a result of central fatigue, adults with severe pulmonary disease, e.g., asthma and COPD, may be unable to fully activate the respiratory muscles, eventually leading to pulmonary insufficiency. While hypercapnia is a common characteristic of pulmonary disease, the relationship between hypercapnia and voluntary activation of the diaphragm is unclear. **PURPOSE:** To examine whether or not hypercapnia

independent of ventilatory work contributes to central fatigue of the diaphragm in healthy humans. **METHODS:** Fourteen (N = 14) healthy volunteers visited the laboratory on two occasions. Following standardized pulmonary function testing and familiarization of experimental procedures on Day 1, subjects visited the laboratory on Day 2 to spontaneously breathe room air at rest (NN) and a gas mixture containing 7% CO₂ to induce hypercapnia (HH). Thereafter, subjects volitionally hyperventilated while breathing room air in an effort to match the inspired minute ventilation (\dot{V}_I) of HH while end-tidal PCO₂ (P_{ET,CO_2}) was maintained at eucapnic levels (NH). Twitch interpolation with bilateral magnetic stimulation of phrenic nerves at functional residual capacity was used to assess voluntary diaphragmatic activation (VA_{di}). VA_{di} was assessed during spontaneous breathing and the ventilatory manipulation period. Thus, the present study utilized a repeated-measures design with P_{ET,CO_2} and \dot{V}_I as the independent variables and VA_{di} as the dependent variable. **RESULTS:** Inhaling 7% CO₂ significantly increased P_{ET,CO_2} (NN = 38.6 ± 4.5, HH = 55.6 ± 2.2, NH = 39.5 ± 5.0 mmHg, *p* < 0.05). Although hypercapnia resulted in significant increases in the diaphragmatic pressure-time integral ($\int P_{di}$; NN = 349.6 ± 88.2, HH = 521.9 ± 110.4, NH = 492.5 ± 135.4 cmH₂O, *p* < 0.05) and \dot{V}_I (NN = 12.11 ± 2.95, HH = 40.27 ± 10.93, NH = 42.84 ± 12.64 L·min⁻¹, *p* < 0.05), there was no difference in VA_{di} across the experimental trials (NN = 94.5 ± 5.0, HH = 93.3 ± 7.0, NH = 94.9 ± 4.7%, *p* > 0.05). **CONCLUSIONS:** Our findings indicate that the magnitude of hypercapnia acutely imposed was not effective in inhibiting voluntary neural drives to the diaphragm in normal resting individuals. This may be due to an insufficient activation of the thin muscle afferents or a counterbalanced motor command to the ventilatory muscle.

2779 Board #299 June 2 11:00 AM - 12:30 PM
Hypoxic Preconditioning Enhances Diaphragm Function Via Erk And Akt Signaling In COPD Mice

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Diaphragm experiences sustained hypoxia in chronic obstructive pulmonary disease (COPD). Prolonged low O₂ exposure is linked with excessive reactive oxygen species formation, which may exacerbate muscle fatigue and compromise respiratory efficiency. Hypoxic preconditioning (HPC) represents a novel strategy that can effectively protect diaphragm against hypoxic stress caused by COPD. During HPC, muscles are treated with alternate high and low levels of O₂, which can induce certain adaptive changes to hypoxia. However, the associated mechanism remains unresolved. **PURPOSE:** To determine whether ERK and AKT signaling contribute to the protective effect of HPC during hypoxia in COPD mice.

METHODS: C57BL6 mice were exposed to cigarette smoke for two hours each day, five days a week for three months to develop COPD symptoms. When the smoking protocol was completed, mice were sacrificed, and their diaphragms were dissected out. Isolated muscle strip was mounted in a contractile chamber and treated with (n = 6) or non-treated with HPC (n = 5) or incubated with AKT inhibitor (MK 2206, 50 μM, n = 5) or ERK inhibitor (PD 98059, 100 μM, n = 5) prior to HPC. Muscle strips were electrically stimulated for five minutes during the middle of a 30-min hypoxia treatment (PO₂ = 5 Torr). The contraction force at the end of contraction protocol was recorded and normalized by the initial force to indicate muscle function. Data were expressed as mean ± SE and analyzed using multi-way ANOVA.

RESULTS: Our results show that HPC significantly improve muscle function during hypoxia (29 ± 2.8% for HPC vs. 6 ± 1.3% for control, *p* < 0.05). Either the inhibition of AKT or ERK diminished HPC protective effect on diaphragm (9 ± 2.6% for AKT inhibitor + HPC; 5 ± 1.3% for ERK inhibitor + HPC; 29 ± 2.8% for HPC, *p* < 0.05).

CONCLUSION: We propose that HPC attenuates diaphragm fatigue during hypoxia through AKT and ERK activation in COPD mice.

2780 Board #300 June 2 11:00 AM - 12:30 PM
Effects Of Inspiring Hyperoxic Air On Excess Post-exercise Oxygen Consumption And Muscle Temperature After Exhaustive High Intensity Intermittent Exercise

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PURPOSE: The purpose of the present study is to elucidate effects of inspiring hyperoxic air (60% O₂; 40% N₂) on excess post-exercise oxygen consumption (EPOC) and muscle temperature after exhaustive high intensity intermittent exercise.

METHODS: Eight young males volunteered for this study. Means ± standard deviations (SDs) of the subjects' age (yrs), body mass (kg), and VO_{2,max} (ml/kg/min) were 23±2, 65.1±9.0, and 48.2±6.5, respectively. For normoxic experiment (N-E), the subjects entered the metabolic chamber at 10:00. After 10 min of warming up, the subjects started an exhaustive high intensity intermittent bicycle exercise (6 to 7

sets of 20-s exercise at an intensity of 170% $\dot{V}O_{2max}$ with a 10-s rest between each bout: HIIE) from 10:30. Until 14:00, the subject stayed in the metabolic chamber, and were measured oxygen uptake, rectal temperature and temperature of the vastus lateralis which is a mainly recruited muscle during the bicycle exercise. For hyperoxic experiment (H-E), the subjects followed the same protocol, except for inspiring the 60% O_2 air during the exercise. The order of N-E and H-E were randomly assigned for each subject.

RESULTS: Compared with the N-E (811.0±155.6 J/kg), total work during the HIIE was significantly higher on the H-E (880.7±141.0 J/kg). From the end of the HIIE until 10:48, oxygen uptake was significantly higher on the H-E (146.4±26.4 ml/kg) than the N-E (130.7±24.7 ml/kg). However, no differences in oxygen uptake between N-E and H-E was observed after 10:49. Compared with the N-E (36.14±0.51 °C), the muscle temperature after the HIIE was significantly higher from the end of the HIIE until 10:48 on the H-E (37.05±0.74 °C), while no difference in rectal temperature between H-E and N-E was observed after HIIE to 10:48. The Δ oxygen uptake observed in H-E over N-E (15.7±14.3ml/kg) from the end of the HIIE to 10:48 was highly correlated with the Δ muscle temperature measured in H-E over N-E during the same time period after the HIIE (0.91±0.66°C, $r=0.95$, $p<0.01$).

CONCLUSIONS: The present investigation demonstrated that hyperoxia elevates the total work during HIIE and EPOC after the HIIE. Furthermore, a significant part of the increased oxygen consumption observed until 15 min after the HIIE may be explained by the elevated muscle temperature which might enhance metabolism in the exercised muscle.

2781 Board #301 June 2 11:00 AM - 12:30 PM
Older Women Exhibit Higher Airway 8-isoprostane Responses To Exhaustive Exercise Compared To Older Men

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INTRODUCTION: Development of late-onset asthma and cardiovascular disease are associated with elevated lipid peroxidation in the airways and systemically. However, sex differences exist in development of these diseases. Using an exhaustive exercise bout as a physiological stressor may elucidate whether there is a sex difference in post-exercise lipid peroxidation in older adults. **PURPOSE:** To determine whether sex differences exist in airway and systemic 8-isoprostane responses to exhaustive exercise and establish whether changes in airway 8-isoprostane generation correlate with lung function from pre to post-exercise. We hypothesized that older women (OW) would have elevated post-exercise airway 8-isoprostane compared to older men (OM). Also, we hypothesized that airway 8-isoprostane would be negatively associated with improvements in lung function from pre to post-exercise. **METHODS:** Twenty-four subjects aged 60 years and over completed the study (12 OW/12 OM). Subjects came to the laboratory for one testing session after a 2-hour fast, with no exercise for at least 24 hours. Baseline measurements included exhaled breath condensate (EBC) for assessment of airway 8-isoprostane, a blood draw for systemic 8-isoprostane, and standard pulmonary function testing (PFTs) to assess forced expiratory volume in 1-second (FEV₁), forced vital capacity (FVC), FEV₁/FVC, and forced expiratory flow at 25-75% of FVC (FEF_{25-75%}). Participants then performed a $\dot{V}O_{2peak}$ test on a cycle ergometer. Immediately post-exercise, PFTs, a blood draw, and EBC were performed. **RESULTS:** The generation of airway 8-isoprostane from pre to post-exercise was different between OW and OM ($p=0.003$), increasing ~74±77% in OW and decreasing ~12±50% in OM. Systemic 8-isoprostane did not change over time in either group ($p=0.81$). In OW, FEV₁ increased post-exercise ($p=0.02$), but was not associated with 8-isoprostane. In OM, FEV₁, FEV₁/FVC and FEF_{25-75%} increased post-exercise ($p>0.05$), and the decreased 8-isoprostane was associated with an increased FEV₁/FVC and FEF_{25-75%} ($p<0.05$). **CONCLUSIONS:** OW had a greater airway 8-isoprostane response to exhaustive exercise compared to OM. These results suggest that sex differences in lipid peroxidation may play a role in the airway remodeling that is associated with disease development.

2782 Board #302 June 2 11:00 AM - 12:30 PM
Gait Parameters of Individuals with Chronic Obstructive Pulmonary Disease

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Gait assessment for persons with chronic obstructive pulmonary disease (COPD) is beneficial in assessing fall risk and potentially treating limitations with ambulation associated with the disease. Some of the studies that estimated gait parameters in persons with COPD used the 6-minute walk test whose objective is to cover as much

distance as possible in 6 minutes rather than focusing on the pace at which they walk. There is a current lack of literature identifying fall risk among persons with COPD estimated using standard testing procedure for gait.

PURPOSE: To determine differences in gait parameters among individuals with COPD, healthy older adults, and older adults at high fall risk. **METHODS:** Seven persons with COPD (mean age 61.7±17.7 years), seven healthy older adults (mean age 70.4±6.8 years) and seven older adults at high fall risk (mean age 68.1±8.6 years) walked across a GAITrite walkway at their normal comfortable pace. Gait speed, stride length, % of swing phase of the three groups were compared using a one-way ANOVA. **RESULTS:** Persons with COPD had a significantly slower gait speed (75.6±17.3 cm/s) when compared to healthy older adults (132.4±14.6 cm/s; $p<0.001$) and to older adults at high fall risk (111.4±16.0 cm/s; $p=0.002$). Persons with COPD also had a significantly shorter stride length (94.3±16.9 cm) when compared to healthy older adults (138.4±17.4 cm; $p<0.001$), but not to older adults at high fall risk (116.5±17.2 cm; $p=0.08$). Persons with COPD spent less percentage of their gait cycle in swing phase (32.8±1.9%) when compared to healthy older adults (38.4±1.3%; $p<0.001$) and to older adults at high fall risk (37.2±1.8%; $p<0.001$). There were no significant differences between the healthy older adults and older adults at high fall risk. **CONCLUSIONS:** These results indicate that persons with COPD exhibit more conservative gait, walking slower, with a shorter stride length and less time spent in swing phase compared to healthy older adults and older adults at high fall risk. A gait-training program for this population may be beneficial. A randomized control trial with persons without COPD is also needed.

E-38 Free Communication/Poster - Skeletal Muscle

Friday, June 2, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

2783 Board #303 June 2 9:30 AM - 11:00 AM
The Relationship between AR and ERK1/2 Pathway in Rat Skeletal Muscle During Exercise

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PURPOSE: By blocking androgen receptor (AR), to investigate the effect of exercise on extracellular signal-regulated kinase 1/2 (ERK1/2) pathway in skeletal muscle, and by blocking ERK1/2 pathway, to further discuss the relationship between AR and ERK1/2 pathway during exercise.

METHODS: 48 adult male SD rats were randomly divided into control group (C), exercise group (E) that exercised on treadmill (20 m/min, 10%, 60 min/d), flutamide group (F) that implanted subcutaneously with a single 21-d release pellet of 50 mg/pellet flutamide, flutamide+exercise group (EF), blocking ERK1/2 group (P) that i.p. 5mg/kg/d of PD98059, blocking ERK1/2+exercise group (EP), sham group (S) and DMSO group (D). After 10 days, extensor digitorum longus (EDL) was isolated at 6h after the last exercise. The protein expression of MHC, AR, p-AR^{Ser210}, and the phosphorylated protein expression of ERK1/2 pathway (p-MEK1/2^{Ser217/221}, p-ERK1/2^{T202/Y204}, p-p90^{RSK Thr573}) of EDL were examined by western blotting analysis. **RESULTS:** Exercise can activate p-AR^{Ser210} ($P<0.05$) and p-MEK1/2^{Ser217/221}, p-ERK1/2^{T202/Y204}, p-p90^{RSK Thr573} (all $P<0.05$), eventually contributing to the increase of MHC ($P<0.05$). In EF group, p-AR^{Ser210}, p-MEK1/2^{Ser217/221}, p-ERK1/2^{T202/Y204} and p-p90^{RSK Thr573} were significantly decreased compared with E group (all $P<0.01$), and had no significant difference compared with F group. The MHC content in EF group decreased by 48.0% compared with E group ($P<0.01$), but had no significant difference compared with F group. In EP group, p-ERK1/2^{T202/Y204} and p-p90^{RSK Thr573} were significantly decreased compared with E group ($P<0.05$; $P<0.01$), and p-MEK1/2^{Ser217/221} and p-ERK1/2^{T202/Y204} were significantly decreased compared with P group ($P<0.01$; $P<0.01$), but AR had no significant change. The MHC content in EP group decreased by 24.2% compared with E group ($P<0.05$), but had no significant difference compared with P group. There are no significant difference between S group, D group and C group.

CONCLUSIONS: During exercise, blocking AR can lead to the phosphorylation expression of ERK1/2 pathway increasing, but blocking ERK1/2 pathway had no significant effect on AR. It is indicated that exercise can regulate ERK1/2 pathway via AR to promote protein synthesis in skeletal muscle.

2784 Board #304 June 2 9:30 AM - 11:00 AM

Effects of Heavy Load Exercise and Acupuncture on Mitophagy in Rat Skeletal MuscleHua-yu SHANG¹, Yu Fu¹, Sheng-chao Bai², Bo-ya Gu², Zhi Xia³, Rui-yuan Wang². ¹Chengdu Sport Institute, Chengdu, China. ²Beijing Sport University, Beijing, China. ³Jinggangshan University, Ji'an, China.

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(No relationships reported)

PURPOSE: To examine the effects of heavy load exercise and acupuncture on mitochondrial structure and mitophagy in rat skeletal muscle.

METHODS: Male Sprague-Dawley rats were divided into 4 groups: control group (C, n=40), exercise group (E, n=40), acupuncture group (A, n=40), exercise and acupuncture group (EA, n=40). Rats in the E and EA groups ran on a rodent treadmill down a 16° grade at 16m/min for 90 min, and those in the A and EA groups received a 2-min session of acupuncture (needling of the bilateral soleus muscle). Each group was further divided into 0h, 12h, 24h, 48h and 72h sub-groups (n=8 each), and at each time point the bilateral soleus muscle was collected under anesthesia. Mitochondrial ultrastructural changes in skeletal muscle were observed by a transmission electron microscope. The content of quantitative enzyme citrate synthase (CS) was measured by ELISA. Protein expression of PTEN-induced putative kinase 1 (PINK1), mitochondrial Parkin, microtubule-associated protein 1 light chain 3 (LC3) were determined by western blot. Mitochondrial co-localization with Parkin and LC3 was measured by the immunofluorescence double labeling technique. The data of variables were all analyzed by one-way or multivariate ANOVA.

RESULTS: After heavy load exercise, the mitochondrial structure appeared to be abnormal and formed a large number of mitophagosomes; the CS content decreased 25.8%-50.1%; the expression of PINK1 (E12=2.552±0.141), Parkin (E24=2.535±0.100), LC3 (E12=2.757±0.180) significantly increased (C=1.000, p<0.05 to p<0.01). Acupuncture promoted the recovery of mitochondrial ultrastructure, alleviated the reduction of CS content, and lowered the expression of PINK1 (EA12=1.738±0.083), Parkin (EA24=2.053±0.117), LC3 (EA12=1.718±0.095) in mitochondria (C=1.000, p<0.05).

CONCLUSION: Heavy load exercise may activate the PINK1/Parkin pathway, promote the combination of LC3 and mitochondria, and result in mitophagy and mitochondrial damage within skeletal muscle. Acupuncture can decrease the expression of PINK1 and Parkin, and inhibit the combination of LC3 and mitochondria, thereby inhibiting excessive activation of mitophagy and alleviating mitochondrial damage within rat skeletal muscle. (Supported by Sports Medicine key laboratory of Sichuan province Foundation).

2785 Board #305 June 2 9:30 AM - 11:00 AM

The Combined Effect of Obesity & Pulmonary Arterial Hypertension on the Gastrocnemius in Zucker Rats

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(No relationships reported)

Pulmonary arterial hypertension (PAH) often leads to systemic hypoxic conditions promoting peripheral dysfunctions that affect skeletal muscle. Clinically, PAH is often observed concomitantly with obesity; as many as 38%-48% of PAH patients are obese. Recent studies have focused on the cellular mechanisms involved in PAH-associated skeletal muscle dysfunction; however, many of these studies have not included the additional effect of obesity. Further research into the combined effects of PAH and obesity on skeletal muscle could provide insight into unforeseen complications that arise in the PAH, obese population. **PURPOSE:** Describe the combined effect of PAH and obesity on myogenic capacity and fiber size in the gastrocnemius of Zucker rats. **METHODS:** Twenty-Four Zucker rats were divided into four groups: lean control (LC) (n=6), obese control (OC) (n=6), lean PAH (LP) (n=6) and obese PAH (OP) (n=6). At 9 weeks of age, control and PAH groups were injected with saline and mono-crotaline, respectively. Four weeks after injection, mice were sacrificed. Gastrocnemius muscles were excised. Gene expression and histochemical analysis was conducted. **summary of RESULTS:** There was a main effect of obesity to decrease cross-sectional area (CSA) (p<0.05). Cyclin D1 mRNA abundance was higher in the LP group compared to the OP group (p<0.05). The LP group also had higher CyclinD1 mRNA content compared to its control counterpart (LC) (p<0.05). MyoD mRNA abundance was higher in the LP group compared to the OP group (p<0.05). The LP group also had higher MyoD mRNA content compared to its control counterpart (LC) (p<0.05). Myogenin mRNA abundance was lower in the OC group compared to the LC group (p<0.05). The LC group also had higher Myogenin mRNA content compared to its PAH counterpart (LP) (p<0.05). **CONCLUSION:** Higher mRNA abundance of CyclinD1 and MyoD in the LP group are suggestive that skeletal muscles in LP rats may induce a compensatory effect against atrophic conditions. This is supported

by the CSA of the LP group being statistically similar to the CSA of the LC group. Additionally, this compensatory effect is lost in the OP group possibly resulting in the observed loss in CSA.

2786 Board #306 June 2 9:30 AM - 11:00 AM

The Impact of Acetaminophen Consumption on mTOR Signaling in Human Skeletal Muscle Following Resistance ExerciseAndrew C. D'Lugos¹, Shivam H. Patel², Jordan C. Ormsby¹, Tara N. Mahmood¹, Don P. Curtis³, Glenn A. Gaesser, FACSM¹, Christopher S. Fry⁴, Chad C. Carroll², Jared M. Dickinson¹. ¹Arizona State University, Phoenix, AZ. ²Purdue University, West Lafayette, IN. ³Midwestern University, Glendale, AZ. ⁴University of Texas Medical Branch, Galveston, TX. (Sponsor: Glenn A Gaesser, FACSM)

(No relationships reported)

Resistance exercise (RE) is a powerful stimulus for skeletal muscle adaptation. Previous data have shown that cyclooxygenase (COX) inhibiting drugs may interact with the cellular mechanisms governing the adaptive responses of skeletal muscle to exercise. **PURPOSE:** Determine if prior consumption of acetaminophen (APAP) alters skeletal muscle mammalian target of rapamycin (mTORC1) signaling in response to RE. **METHODS:** In a double-blinded, counter-balanced, crossover design, healthy young men (n=8; 25 ± 1 yr, BMI: 26 ± 2 kg·m⁻²) performed two trials of unilateral knee extension (8 sets, 10 reps, 70% 1RM). For 24h prior to each trial, subjects ingested either APAP (1000mg/6h) or placebo (PLA) (final dose consumed immediately post RE). Muscle biopsies (*vastus lateralis*) were collected at rest and at 1 and 3h postexercise during each trial. Western blot was utilized to assess phosphorylation and total protein levels of mTORC1 signaling proteins. **RESULTS:** Total protein for all markers was unchanged with time or treatment (p>0.05). Relative phosphorylation (p/t) of mTOR^{Ser2448} was similarly increased from rest (p<0.05) in both trials at 1h (PLA, 1.5 ± 0.2; APAP, 1.8 ± 0.2 fold) and 3h postexercise (PLA, 1.6 ± 0.2; APAP, 1.8 ± 0.2 fold), while the relative phosphorylation of S6K1^{Thr389} was only increased (p<0.05) in APAP at 3h (PLA, 2.0 ± 0.3; APAP, 3.5 ± 1.2 fold). In contrast, absolute phosphorylation levels of mTOR^{Ser2448} and S6K1^{Thr389} were only increased from rest (p<0.05) following RE in PLA, while absolute phosphorylation levels of 4E-BP1^{Thr37/46} were reduced (p<0.05) postexercise in APAP. Absolute and relative phosphorylation of eEF2^{Thr56} were reduced (p<0.05) following RE only in APAP. **CONCLUSION:** Compared with other COX-inhibiting drugs (i.e., ibuprofen), prior APAP consumption may have a reduced impact on the relative phosphorylation of mTORC1 signaling proteins following RE. These findings further highlight the unique interaction between the consumption of different COX-inhibiting drugs and the adaptive cellular response of skeletal muscle to exercise.

Supported by intramural funds from ASU and MU.

2787 Board #307 June 2 9:30 AM - 11:00 AM

Relationship Between Estimated Muscle Fiber-type And Peak Velocity For The Upper And Lower Extremity

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(No relationships reported)

Changes in muscular strength across isokinetic protocols have been used as a non-invasive method to estimate fast-twitch muscle fiber-type. However, few have determined the utility of estimated muscle fiber-typing in predicting performance. **PURPOSE:** Determine the relationship between estimated fast-twitch (FT%) muscle fiber-type and peak velocity (PV) of upper (UE) and lower (LE) extremity muscle groups. **METHODS:** Nineteen (mean ± SD: age = 23.62 ± 2.97 years, height = 178.67 ± 5.22cm, mass = 88.91 ± 13.86kg) males visited the laboratory on 2 occasions, separated by 2-3 days. During the first visit, participants were familiarized with the isokinetic protocols and maximal voluntary contractions (MVCs) of the UE [Elbow Flexors (EF) and Extensors (EE)] and LE [Knee Flexors (KF) and Extensors (KE)]. During the second visit, participants performed a maximal isokinetic protocol (50 repetitions at 180°·s⁻¹) for the UE and LE. The order of testing was randomized and a 20-minute rest period was implemented between protocols. Peak torque was calculated for each repetition of the isokinetic protocol and the average of the highest three and lowest three repetitions were used to calculate fatigue index (FI%) [FI% = (highest - lowest) ÷ highest * 100] and FT% muscle fiber-type [FT% = (FI% - 5.2) ÷ 0.90]. Prior to each protocol, isokinetic MVCs at 500°·s⁻¹ were completed in order to assess PV. The highest values recorded for PV were used for analysis. A Pearson correlation coefficient was computed to assess the relationship between FT% and PV for all muscle groups. **RESULTS:** The means ± SDs for each muscle group, as well as the results of the Pearson correlations are shown in Table 1. **CONCLUSION:** The results of the present investigation reveal that of the four muscle groups examined, only the EF showed a significant relationship between FT% and PV. These findings indicate that FT% may have a limited ability to accurately predict PV performance in various upper and lower extremity muscle groups.

Table 1. Mean \pm SD values for peak torque fatigue index (PTFI), estimated fast-twitch (FT%) muscle fiber type, and peak velocity (PV) for each muscle group. Pearson's r and p value reported from PTFI to PV for each muscle group.

	PTFI (%)	FT (%)	PV (deg·s ⁻¹)	Correlation	
				r	p
EF	46.58 \pm 10.07	45.98 \pm 11.19	422.46 \pm 32.55	0.536*	0.018
FE	57.28 \pm 15.06	57.86 \pm 16.73	410.20 \pm 25.78	0.405	0.085
KF	61.12 \pm 11.63	62.13 \pm 12.92	484.00 \pm 16.35	0.265	0.273
KF	55.35 \pm 11.77	55.73 \pm 13.08	476.81 \pm 22.96	0.218	0.369

* = significant relationship ($p < 0.05$) between FT% and PV

2788 Board #308 June 2 9:30 AM - 11:00 AM
The Effect Of Exercise Intensity On Gene Expression And Protein Function Of Rs9939609 Gene Variant In Fto

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Recent meta-analysis has shown the association between FTO risk allele and the odds of obesity to be attenuated by 27% in physically active adults, which may suggest a possible relationship between exercise and FTO protein function. **PURPOSE:** To examine differences in FTO gene expression and protein function following high and low intensity exercise. **METHODS:** Twenty eight apparently healthy untrained males and females were genotyped for the FTO rs9939609 (T>A) polymorphism, prior to performing continuous isocaloric (400 kcal) cycle ergometer exercise on two separate occasions at 80% (HI) and 40% (LO) VO₂peak. Skeletal muscle biopsies were sampled from the vastus lateralis at pre exercise (0 mins), 10 and 90 mins post exercise. Differences in FTO genotype, gene and protein expression, and m6A RNA methylation status before and/or after exercise were determined using an ANOVA. **RESULTS:** Distribution of the FTO variant alleles was 36% homozygous (AA), 32% heterozygous (AT) and 32% wild-type alleles (TT). No significant differences between genotypes in time to expend 400 kcal during the HI (AA: 36:45 \pm 2:00min:sec, AT: 39:29 \pm 3:07min:sec, TT: 41:21 \pm 3:02min:sec, $p = 0.511$) and LO intensity (AA: 54:28 \pm 2:58min:sec, AT: 57:59 \pm 4:06min:sec, TT: 61:04 \pm 4:19min:sec, $p = 0.472$) exercise protocol, or for average RER, glucose utilization and fat utilization (g.kgLBM⁻¹.T.I⁻¹) ($p < 0.05$) during each exercise protocol were noted. FTO mRNA expression was significantly increased at 10 mins post HI exercise (AA: 0.69-fold, AT: 0.21-fold, TT: 0.23-fold, $p = 0.003$). No genotype or genotype by time interaction was observed ($p < 0.05$). m6A on RNA was significantly decreased at 90 minutes following both LO and HI intensity exercise (Delta Change: HI - AA: -0.29 \pm 0.10ng, AT: -0.27 \pm 0.12ng, TT -0.06 \pm 0.17ng, $p < 0.05$; LO - AA: -0.07 \pm 0.12ng, AT: -0.16 \pm 0.11ng, TT: -0.20 \pm 0.06ng, $p < 0.05$). No genotype or genotype by time interaction was observed ($p < 0.05$). No main effect for time, genotype or genotype by time interaction was identified for muscle FTO protein expression in response to HI and LO intensity exercise. **CONCLUSIONS:** Physical exercise has a significant impact of FTO gene expression and possible function. The significance of these findings requires further investigation.

2789 Board #309 June 2 9:30 AM - 11:00 AM
The Acute Effect Of Massage On Local Skeletal Muscle Perfusion And Oxygenation: A Pilot Study

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 (No relationships reported)

Massage therapy is purported to hasten performance recovery, in part, through an augmentation of circulation leading to increased oxygen delivery to tissues, removal of metabolites and an earlier return to homeostasis. Despite this, existing research is equivocal, reporting little or no effect of massage on macrocirculation. However, given that perfusion of skeletal muscle can occur independently of macrocirculation, evaluating the microcirculation response may be more pertinent.

PURPOSE: To determine if massage therapy acutely increases local skeletal muscle perfusion and oxygenation.

METHODS: Twelve males (27 \pm 7 yr) attended the laboratory after an overnight fast, refraining from caffeine, alcohol and exercise for 24 h. After 15-min of prone rest, baseline oxyhaemoglobin (O₂Hb), deoxyhaemoglobin (HHb), total haemoglobin (tHb) and tissue saturation index (TSI%) of the gastrocnemius were determined using

near-infrared spectroscopy (NIRS). Subsequently, changes in NIRS variables were determined during (last minute) and 1-min, 5-min, 10-min and 15-min after massage therapy. The therapy consisted of 10-min of effleurage and petrissage techniques.

RESULTS: Repeated measures ANOVA's revealed significant 'time' main effects for tHb ($P < 0.001$, $\eta^2_p = .566$), O₂Hb ($P < 0.001$, $\eta^2_p = .472$) and HHb ($P < 0.001$, $\eta^2_p = .587$). *Post hoc* analysis revealed that tHb (MD -6.5 μ mol, 95% CI [-11.2, -1.8]), O₂Hb (MD -3.2 μ mol, 95% CI [-6.8, 0.2]) and HHb (MD -3.5 μ mol, 95% CI [-5.7, -1.2]) were reduced during massage when compared to baseline, but were unchanged at any other time point. TSI% was unchanged during and following massage ($P > 0.05$).

CONCLUSION: A reduction in muscle perfusion during massage therapy likely reflects the mechanical action of massage inhibiting capillary inflow but aiding outflow from the muscle. Whilst a lack of change in perfusion, oxygenation and TSI% following massage suggests a modest impact upon microcirculation, it is acknowledged that skeletal muscle perfusion but not blood flow was assessed. A lack of change in perfusion suggests that massage did not result in more capillaries being perfused; however, blood flow may still have been altered. Future studies should simultaneously assess blood flow through the macrocirculation, as well as microcirculation perfusion and blood flow.

2790 Board #310 June 2 9:30 AM - 11:00 AM
In Vivo Intracellular Ca²⁺ Dynamics Over 7 Days Following Eccentric Contractions In Rat Skeletal Muscle

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In vitro studies have supported an important role for intracellular calcium ion concentration ([Ca²⁺]_i) as an intracellular signal for protein synthesis and degradation. Eccentric contractions (ECC) facilitate Ca²⁺ influx from the extracellular space via stretch-activated channels and cause high-levels of [Ca²⁺]_i accumulation. Accumulated [Ca²⁺]_i activates proteolysis-related enzymes and induces muscle damage. A few days after ECC, the damaged muscle fiber shifts from this proteolytic to a regenerative phase. Whether there is any temporal and/or spatial correspondence between [Ca²⁺]_i accumulation and structural damage/repair during recovery from ECC is unknown. **PURPOSE:** Specifically, we tested the hypothesis that there would be a dynamic pattern of [Ca²⁺]_i accumulation post-ECC that would relate temporally to the damage-recovery cycle. **METHODS:** In anesthetized adult Wistar rats, the tibialis anterior muscles (TA) were subjected to unexercised controls (CONT) and ECC (5 sets of 40 contractions). After 1 day (1D), 3 days (3D), and 7 days (7D) of ECC, the TA was loaded with ratiometric dye Fura-2 AM. We used the 340/380 nm ratio to analyze alterations in [Ca²⁺]_i by *in vivo* fluorescence imaging. After *in vivo* observations, the TA muscles were dissected to identify the histological features of the damage-to-regeneration cycle. **RESULTS:** After ECC, there was profound swelling at 1D followed by infiltration at 3D and regeneration at 7D (i.e. appearance of central nucleus). The mean [Ca²⁺]_i was significantly increased after ECC at 1D (1.48 \pm 0.09) and 7D (1.47 \pm 0.04) but not at 3D (1.34 \pm 0.05) compared with CONT (1.31 \pm 0.05). Whereas there was a heterogeneous [Ca²⁺]_i accumulation pattern evident among fibers it was interesting that [Ca²⁺]_i oscillated significantly more over the 30 minute observation period at 1D (mean variation range: 0.10 \pm 0.07) than at any other time (CONT: 0.08 \pm 0.03, 3D: 0.07 \pm 0.02, 7D: 0.08 \pm 0.02). **CONCLUSIONS:** We determined that: 1. There were peaks of [Ca²⁺]_i accumulation during both the swelling (1D) and regeneration (7D) phases. 2. The swollen and edematous fibers at 1D evidenced an oscillatory [Ca²⁺]_i pattern. These profiles of [Ca²⁺]_i accumulation may be key to controlling the extended pattern of protein synthesis and degradation that characteristically follows novel ECC.

2791 Board #311 June 2 9:30 AM - 11:00 AM

Growth Inhibition Of Mesenchymal Stem Cells By Laminarin Definitions

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GROWTH INHIBITION OF MESENCHYMAL STEM CELLS BY LAMINARIN, a β -D-GLUCAN: IMPACT ON CHONDROCYTE DIFFERENTIATION**ABSTRACT**

Mesenchymal stem cells (MSCs) are multipotent adult stem cells that differentiate to form cartilage, bone, tendons, muscle, and skin. Usually found in the bone marrow and can also be isolated from other tissues including cord blood or adipose tissue. Given the innate ability of MSCs to promote cellular damage recovery and tissue repair, there is rising interest in their use in a broad repertoire of cell-based therapy for the treatment of several diseases. One of the most important tasks of MSCs therapy is to control cells proliferation and differentiation. These processes model and shape tissue and organ relationships in multicellular organisms. Previous investigations showed that cell growth pathways are mediated through protein-glycan interactions. We have adopted this approach to study the effect of laminarin, a beta-(1→3)-D-glucans. **Methods:** MSCs were isolated from the bone marrow of six-week old male Wistar rats then cultured in MSC growth and chondrogenic differentiation mediums. Proliferation rate and apoptosis were explored by cell count, MTT assays and Annexin V staining. mRNA and protein expression of specific markers for MSCs and chondrocytes were studied using qPCR and immunofluorescence. **Results:** Laminarin treatment reduced cell proliferation of MSCs cultured in both growth and chondrogenic mediums. Annexin V staining showed no apoptosis. Cells in MSC growth medium showed no impact of laminarin for Thy1, nucleostemin and endoglin mRNA analysis. Conversely, in chondrogenic medium, laminarin had a negative effect on Thy1 levels and no change in nucleostemin and endoglin. Collagen II responded positively in chondrogenic medium in absence of laminarin and significantly reduced when laminarin was added. **Conclusion:** These results indicate that laminarin inhibited both cells proliferation and chondrogenic differentiation suggesting potential clinical applications in MSC therapy.

2792 Board #312 June 2 9:30 AM - 11:00 AM

Leg Dominance and Fiber Type Composition Influence Landing Performance in Resistance-Trained Men

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Leg dominance may lead to asymmetrical performance and injuries. No study has investigated this issue at both the biomechanical and single muscle fiber level.

PURPOSE: Simultaneously investigate leg dominance, muscle fiber type composition, and landing performance in resistance-exercise trained (RE) men. **METHODS:** Fourteen men (age=24.1±2.6yrs; height=181.6±6.6cm; mass=87.8±10.9kg) answered a leg dominance questionnaire (preferred kicking leg) and performed drop-jumps (30cm) onto two independent force plates (one foot per plate), alternating the step off leg. Muscle biopsies were performed on the vastus lateralis in both dominant (D) and non-dominant (ND) legs. Individual muscle fibers (107.8±34.3/leg/person) were isolated and sodium dodecyl sulfate polyacrylamide gel electrophoresis was used to identify myosin heavy chain fiber type (MHCI, MHCI/IIa, MHCIIa, MHCIIa/IIx, or MHCIIx). **RESULTS:** Significant differences in MHCI [t ($df=13$)= 3.135, $p=0.008$] and MHCIIa [t ($df=13$)=-2.898, $p=0.012$] between legs were identified; D had a higher percentage of MHCI (33.9±11.2% vs. 24.9±15.3%) and ND had a higher percentage of MHCIIa (54.8±13.3% vs. 61.8±14.8%) fibers. Significantly more fibers containing MHC I isoforms (MHCI+MHCI/IIa) in D was present [t ($df=13$)=3.273, $p=0.006$] compared to ND (42.1±14.6% vs. 34.1±14.5%), and significantly more fibers containing MHC II isoforms (MHCIIa+MHCIIa/IIx+MHCIIx) in ND was present [t ($df=13$)=-1.923, $p=0.077$] compared to D (57.6±13.9% vs. 65.3±14.8%). A significant interaction existed between landing foot and step-off foot ($f=11.99$, $p=0.004$). ND produced a significantly higher landing rate of force absorption (RFA) compared to D ($p=0.03$) when stepping off with ND. The RFA in ND (stepping off with ND) was negatively

correlated with the percentage of fibers containing MHCI isoforms ($p=0.029$, $r=-0.581$) and positively correlated with the percentage of fibers containing MHCII isoforms ($p=0.048$, $r=0.536$). **CONCLUSIONS:** The preferred kicking leg was not preferred to absorb landing force. The greater abundance of MHCIIa fibers in the preferred force absorbing leg may provide an explanation for, or a result of, the observed asymmetry. These results enhance our understanding of leg dominance, performance, and muscle fiber type composition in RE men.

2793 Board #313 June 2 9:30 AM - 11:00 AM

Body Weight Support Training Modulates Muscle NF- κ B p65 Expression Induced By Spinal Cord Injury

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Purpose: To improve the efficacy of exercise rehabilitation following traumatic spinal cord injury (SCI), a better understanding of muscle-associated cellular signaling is imperative. The transcription factor NF- κ B is a "master controller" of the inflammatory pathway with P65 being the main subunit. Thus we hypothesized that P65 is expressed in muscle of SCI rodents and that body weight supported treadmill training (BWSTT) modulates P65-related signaling cascade. **Methods:** A low-thoracic spinal cord contusion was performed on 16 Sprague Dawley rats and 8 were trained 5 days/week for 4 weeks. Proteins were extracted from soleus (Sol), gastrocnemius (GM), tibialis anterior (TA), and extensor digitorum longus (EDL) muscles. Immunoblot analysis for total NF- κ B p65, and I κ B- β was performed. Equal amounts of protein were analyzed by 4 to 12% SDS-polyacrylamide gel electrophoresis. Following transfer (TransBlot Turbo, Bio Rad), membranes were blocked in 5% milk and incubated overnight at 4°C with a primary antibody (p65, and I κ B, Santa Cruz Biotechnology, Santa Cruz, CA). Following incubation with a peroxidaseconjugated secondary antibody, bands were visualized by ECL, imaged and densitometry was determined (QuantityOne, Versadoc Bio-Rad). **Results:** P65 was strongly expressed in all muscles of untrained animals. Training significantly decreased P65 only in TA muscles ($P<.05$). P65 inhibitor I κ B- β expression increased in EDL, and GM muscles ($P<.05$) and decreased in Sol ($P<.05$) following training. The ratio of P65:I κ B- β significantly increased for Sol and decreased for EDL, GM, and TA for the trained group ($p<.05$). **Conclusion:** P65 was expressed in all muscles of SCI rodents. The BWSTT modulation of P65 expression seems to be related to I κ B interaction and is muscle-dependent.

E-39 Free Communication/Poster - Systematic Reviews and Meta-Analysis

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2794 Board #314 June 2 9:30 AM - 11:00 AM

Systematic Review Of The Association Between Physical Activity With Natural And Assisted Female Fertility

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PURPOSE: This systematic review summarized the association between physical activity (PA) and natural and assisted female fertility.

METHODS: We searched 5 databases for eligible studies through May 2016. Included studies were required to report an association between PA (exposure) and fertility (outcome) and focus on either natural or assisted fertility among women. Both observational studies and randomized controlled trials were eligible for inclusion, although none of the latter were identified.

RESULTS: The search yielded 25,168 titles. We included 21 studies from 19 unique populations: 13 cohort studies; 6 cross-sectional studies; 1 case control study; and 1 case cohort study. Fourteen distinct studies from 12 patient populations reported on the association between PA and natural fertility (in Canada, Denmark, Finland, Iran, the Netherlands, Norway, and the United States). Both PA and fertility were self-reported in all studies. Eight studies reported on the association between PA and natural fertility: 3 identified favorable associations, 1 identified unfavorable associations, and 6 identified no association between higher PA and natural fertility. Among 7 studies, findings for vigorous activity were similarly mixed. In 1 study, duration of daily standing or walking at work was not associated with pregnancy attempt duration, while another study found women with higher mean energy expenditure/working hour had

lower fecundability compared to women with lower mean energy expenditure/working hour. Seven cohort studies reported associations between PA and assisted fertility (in Brazil, Iran, Italy, Taiwan, Turkey, and the United States). Assisted fertility included in vitro fertilization (IVF) in 6 studies and intracytoplasmic sperm injections (ICSI) in 2 studies. PA was self-reported in all studies; one study also used accelerometry. Four studies found favorable associations, 1 found unfavorable associations, and two found no association between higher PA and assisted fertility.

CONCLUSION: The association between PA and natural and assisted fertility remains unclear. Future studies should incorporate objective PA measures and explore the PA volume and dose associated with fertility.

KRH supported by the Wellcome Trust. SGS supported by the Science Without Borders Program.

2795 Board #315 June 2 9:30 AM - 11:00 AM
Motor Impairments in Transient Ischemic Attack and Subsequent Stroke

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(No relationships reported)

PURPOSE: Transient ischemic attack (TIA) increases the risk for a subsequent stroke. Typical symptoms include motor weakness, difficulty with speech, and loss of coordination. The association between the presence of motor impairments during a TIA and the chances of a subsequent stroke has not been systematically examined. In the current study, we examine whether the odds of a recurrent stroke are greater in TIA individuals who experience motor impairments as compared to those who don't experience motor impairments.

METHODS: We conducted systematic search of electronic databases as well as manual searches of the reference lists of retrieved articles. The meta-analysis included studies that reported an odds ratio relating motor impairments to a subsequent stroke, or the number of individuals with or without motor impairments who experienced a subsequent stroke. We examined these studies using rigorous meta-analysis techniques including random effects model, forest and funnel plots, I², publication bias, and fail-safe analysis.

RESULTS: Twenty-two studies with 11,084 participants from North America, Australia, Asia, and Europe qualified for inclusion. An odds ratio of 2.14 (95% CI, 1.66 - 2.77, p = 0.000) suggested that the chances of a subsequent stroke are increased by two-folds in individuals who experience motor impairments during a TIA.

CONCLUSIONS: The presence of motor impairments during TIA is a significantly high-risk clinical characteristic for a subsequent stroke, requiring specialist follow-up care and stringent secondary measures to prevent a further stroke. Thus, TIA prognosis warrants more robust quantification of motor impairments beyond clinically determined motor weakness.

2796 Board #316 June 2 9:30 AM - 11:00 AM
A Meta-analytic Approach To Determine The Effectiveness Of Exercise Interventions On Abdominal Fat And Liver Enzymes In Overweight And Obese Youth.

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PURPOSE: Interestingly, despite the prevalence of obesity and the multiple position stands promoting exercise for the treatment of obesity and hepatic function, a meta-analytic approach has not previously been used to examine the effects in the paediatric population. However, several studies also show inconsistent results particularly with respect to children and adolescents, where data are scarce. Due to heterogeneity between studies in terms of results, we used a meta-analytic approach to determine the effectiveness of exercise interventions on abdominal fat and liver enzymes in overweight and obese youth.

METHODS: A computerized search was made using three databases. The analysis was restricted to studies that examined the effect of supervised exercise interventions

on abdominal fat (visceral and subcutaneous fat) and liver enzymes (alanine aminotransferase, aspartate aminotransferase and gamma-glutamyl transferase). Standardized mean difference [SMD] and 95% confidence intervals were calculated.

RESULTS: Fourteen clinical trials (1,231 youths) were eligible for inclusion in this systematic review and meta-analysis. Exercise was associated with a significant reduction in visceral ([SMD]=-0.661; 95% CI, -0.976 to -0.346; p<0.001), subcutaneous (SMD=-0.352; 95% CI, -0.517 to -0.186; p<0.001) and intrahepatic fat (SMD=-0.802; 95% CI, -1.124 to -0.480; p<0.001), as well as gamma-glutamyl transferase (SMD=-0.726; 95% CI, -1.203 to -0.249), but did not alter any other liver enzymes.

CONCLUSIONS: This meta-analysis supports current recommendation for physical exercise, mainly aerobic, as an effective intervention in the treatment of non-alcoholic fatty liver disease, through reduction on visceral and subcutaneous adipose tissue and intrahepatic fat. **Systematic review registration:** PROSPERO CRD42016042163

2797 Board #317 June 2 9:30 AM - 11:00 AM
Effects Of Mhealth Apps On Physical Activity And Weight Loss Outcomes: A Meta-analysis

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PURPOSE: Little systematic review has been conducted on mobile device health applications (a.k.a., mHealth apps) frequently used in health promotion. This meta-analysis synthesized evidence regarding the effectiveness of mHealth apps on physical activity (PA) and weight loss (WL).

METHODS: A total of 150 published articles regarding mHealth apps and PA/WL were found. Twelve studies met the following inclusion criteria: 1) empirical articles published between 2000 and 2016 in English; 2) examined the effectiveness of an mHealth app on PA or WL outcomes; and 3) each study contained ≥ 1 comparison. Data extraction for comparisons was completed for the following outcomes: 1) PA; 2) WL; and 3) body mass index (BMI). Moderator analyses were performed for studies reporting intervention fidelity frequency of: 1) greater than every two weeks; 2) less than every two weeks; or 3) not reported. Calculation of effect size (ES; Hedge's g) was completed with Comprehensive Meta-Analysis software for each entry. Analyses were run separately between mHealth apps and control (i.e., standard care or no treatment) or comparison (i.e., another experimental treatment) conditions.

RESULTS: mHealth apps were most commonly used for WL (n= 10). Compared to control and comparison, mHealth apps had no effect on WL (ES= .02 and ES= .08, respectively; all p > .05). Seven and six studies investigated mHealth apps effect on BMI and PA, respectively (one study examined both outcomes). Regarding BMI, mHealth apps had no effect versus control (ES= -.08, p > .05) or comparison (ES= -.09, p > .05). The same result was seen when using mHealth apps to promote PA outcomes. Specifically, when compared to control, mHealth apps demonstrated no effect in promoting increased step counts (ES= -.10, p > .05) and moderate-to-vigorous PA (ES= -.12, p > .05). Intervention fidelity was only reported by 4 of the included studies, with moderator analyses revealing no effect of intervention fidelity frequency on the study outcomes (all p > .05).

CONCLUSIONS: Findings indicate mHealth apps to be at least as effective as standard/no treatment or another experimental treatment condition. To improve effectiveness of mHealth apps in promoting PA and WL, future studies need to improve intervention fidelity measures and use established behavioral theory to implement the study.

2798 Board #318 June 2 9:30 AM - 11:00 AM
The Protective Role Of Physical Activity On Type 2 Diabetes: A Race/Ethnic-specific Meta-analysis

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(No relationships reported)

It is well known physical activity (PA) plays a role in the prevention of Type 2 diabetes (T2D). However, the extent to which PA may impact T2D risk among different race/ethnic groups is unknown. **PURPOSE:** To systematically examine the protective relationship between PA and T2D across five common race/ethnic groups (Caucasian, African American, American Indian, Hispanic, and Asian). **METHODS:** PubMed and Embase databases were systematically searched through June 2016. Study assessment for inclusion was conducted in three phases: 1) title review (N= 13,022), 2) abstract review (N=2,200), and 3) full text review (N=265). A total of 27 studies met the inclusion criteria and were used in the analysis. Relative risks (RRs) and 95% confidence intervals (CIs) were extracted and analyzed using the Comprehensive Meta-Analysis software. All analyses used a random-effects model. **RESULTS:** Statistically significant protective summary RRs, comparing the most active to the least active PA group, were found for Caucasians (RR 0.71, 95% CI 0.60-0.85), Asians (RR 0.76,

95% CI 0.67-0.85), Hispanics (RR 0.75, 95% CI 0.64-0.89), and American Indians (RR 0.73, 95% CI 0.60-0.88). The RR for African Americans did not attain statistical significance (RR 0.91, 95% CI 0.76-1.08). **CONCLUSIONS:** The results of this study indicate that PA (comparing most to least active groups) provides significant protection from T2D across the race/ethnic groups, with the exception of African Americans. Although the reason is not completely elucidated, this may be due to lowered fat oxidation rates at-rest and during exercise, large increases in susceptibility to diabetes with small decreases in insulin sensitivity, and higher percentages of type II muscle fibers in African Americans. The results also suggest a need for race- and ethnic-specific reporting of T2D RRs related to PA dose among prospective cohort studies.

2799 Board #319 June 2 9:30 AM - 11:00 AM

The Effect Of Exercise Training On Leptin: A Meta-analysis Of Randomized Controlled Trials

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PURPOSE: Leptin is the primary energy balance hormone released from adipose cells. Lower leptin levels activate peripheral and central systems to restore energy balance; higher leptin levels inhibit feelings of hunger and are associated with increased energy expenditure. The effects of acute exercise bouts on leptin has been previously examined, however the effect of chronic exercise training on leptin is still incompletely characterized. As such, the primary aim of this study was to quantify the effect of exercise training on leptin level. **METHODS:** Articles published before April 14, 2016 were located using searches of the Physical Education Index (n=149), PubMed (n=355), Scopus (n=225), SPORTDiscus (n=54), and Web of Science (n=314) online databases using combinations of the terms: exercise, training, exercise training, leptin, randomized, randomized controlled study, and randomized controlled trial. All studies included in this meta-analysis were peer reviewed and published in English. Human participants were assigned to a non-exercise comparison group or exercise training group, with interventions lasting ≥ 2 weeks. Leptin levels were measured at baseline, during and/or after completion of the exercise training program. Each study effect size (ES) was calculated as the change in the control group subtracted from the change in the treatment group, divided by the pooled standard deviation of baseline values. Random-effects models were used to aggregate a mean ES and 95% confidence intervals (CI). A positive ES indicated a decrease in leptin following exercise training. **RESULTS:** The cumulative results from 128 effects extracted from 73 articles published between 1998 and 2016 indicate that exercise training can effectively reduce leptin levels (ES=0.2178, 95% CI: 0.1499-0.2856; $P < 0.0001$). The estimate of the effect increased slightly after accounting for the nesting of multiple effects within a single study (ES=0.2431, 95% CI: 0.1431-0.3431; $P < 0.0001$). The significant decrease in leptin following exercise training was moderately heterogeneous ($Q_{127}=218.66$, $I^2=41.92\%$; $P < 0.001$), with sampling error accounting for 64.8% of the observed variance. **CONCLUSIONS:** These results suggest that exercise training decreases leptin levels.

2800 Board #320 June 2 9:30 AM - 11:00 AM

Current Evidence of Gait Modification Strategies to Reduce Knee Adduction Moment: Systematic Review and Meta-Analysis

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(No relationships reported)

Knee osteoarthritis (KOA) is a debilitating joint disease that predominantly occurs in the medial compartment due to excessive joint loads. Gait retraining using real-time biofeedback (RTB) is a conservative approach for reducing knee joint loads. While outcomes suggest moderate to large short-term treatment effects, existing evidence limits generalizability and clinical application.

PURPOSE: To determine if gait retraining interventions using RTB are beneficial for altering knee adduction moment (KAM) in KOA and asymptomatic individuals.

METHODS: An electronic search was conducted using the following databases: PubMed, EBSCO host, Embase, PROQuest, and Cochrane [1970 to January 1, 2016]. Duplicates were removed within then across databases. A total of 11 full text articles were retained that evaluated the effects of RTB on KAM. Methodological quality was assessed using the PEDro scale. Standardized mean differences (SMDs) were calculated for 1st peak KAM. Gait modification strategy (medial weight shift, lateral trunk lean, and self-selected) and mode of RTB (haptic and visual) were used as moderators for separate meta-analyses of studies with healthy participants. An inverse variance with random effects model approach was used with SMDs to account for heterogeneity between studies. Heterogeneity was quantified with the I^2 statistic with $P < 0.10$ being statistically significant.

RESULTS: Mean PEDro score was 6.0 ± 0.6 out of a possible 11 with internal validity scoring poorly across all studies. For studies including healthy participants, the I^2 index averaged 93%, with $P < 0.10$, in the two meta-analyses. Gait modifications strategies presented: $Tau^2 = 3.2644$, $Chi^2 = 180.6403$, $df = 14$ ($P < 0.0001$); $I^2 = 94.66\%$, $z = 2.4552$ ($P < 0.05$). The overall SMD was 1.18 [0.24; 2.13]. Self-selected gait modification strategies presented the greatest SMD. Mode of RTB results presented: $Tau^2 = 2.4776$, $Chi^2 = 122.8985$, $df = 12$ ($P < 0.0001$); $I^2 = 92.31\%$, $z = 3.7829$ ($P < 0.0001$) with an overall SMD of 1.19 [0.95; 1.43].

CONCLUSIONS: Evidence presented in this review suggests that gait modification via RTB is effective in reducing KAM in both symptomatic and asymptomatic individuals. However, evidence is limited and of low quality, meaning the optimal combination of gait modification strategy and mode of RTB delivery remains unclear.

2801 Board #321 June 2 9:30 AM - 11:00 AM

Arterial Stiffness Is Reduced Regardless Of Exercise Training In Obese Paediatric Populations: A Meta-analysis Of Randomised Controlled Trials

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(No relationships reported)

PURPOSE: In paediatric populations, the use of carotid intima-media thickness (IMT) as a marker of cardiovascular risk has increased. However, previous studies examining the effects of exercise training on arterial structure and function in obese children and adolescents have shown inconsistent findings. The primary aim of this systematic review and meta-analysis is to expand on the current body of literature by providing a quantitative estimate of the change in carotid IMT following exercise training, as well as to provide an exploratory analysis of potential moderators associated with the variation in response to an exercise training intervention in overweight and obese youth.

METHODS: A search of the literature was performed using the electronic databases CENTRAL, EMBASE, and MEDLINE. The terms used were: ['Obesity' and 'Overweight' OR], ['Exercise' and 'Training' and 'physical activity' and 'sport' OR]. All medical subject heading terms were combined with intima-media thickness* and children and adolescent as limiters. Studies reported in languages other than English were not explored. The analysis was restricted to studies that examined the effect of exercise interventions on carotid IMT in paediatric obesity (6-18-year-olds). Six randomised controlled trials (RCTs) (303 youths) were included. Hedges' g and 95% confidence intervals were calculated.

RESULTS: Exercise was associated with a small-to-moderate but significant reduction in carotid IMT ($g = -0.306$; 95% CI, -0.540 to -0.072 ; $p = 0.011$). Likewise, exercise programme duration per week significantly influenced the effect of exercise on carotid IMT ($\beta = -0.060$; $p = 0.015$). The meta-regression analysis shows that there was a greater decrease in carotid IMT in studies with a duration of more than a week. The slope regression coefficient was -0.060 [95% CI = -0.136 to -0.015] and was significant ($p = 0.015$). These data indicate that greater decrease in carotid IMT was observed in individuals that achieved larger interventions in terms of minutes per week.

CONCLUSIONS: Exercise seems to reduce carotid IMT in childhood obesity. Therefore, encouraging obese paediatric individuals to become physically active can lead to favourable changes in the arterial wall.

PROSPERO Registration: CRD42016045232

2802 Board #322 June 2 9:30 AM - 11:00 AM

Exploring the Relationship between Fundamental Motor Skills & Physical Activity Levels in Children: A Meta-Analysis

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(No relationships reported)

PURPOSE: Fundamental motor skills (FMS) are the building blocks for movements used throughout life and its proficiency is correlated with higher levels of physical activity (PA) and decreased incidence of obesity in school-aged children (SC) (5-12 years). However, it is unknown if the same relationship exists in preschool children (PC) (3-5 years). This review aims to evaluate interventions for improving FMS and PA levels in children from 3-5 and 5-12 and determine whether there is a similar relationship between a change in FMS and a change in PA across age groups.

METHOD: A systematic search of 7 electronic databases was conducted up until 20th July 2016. Controlled trials that implemented a FMS/PA intervention and qualitatively measured PA levels and FMS in healthy children between the ages of 3-12 years were included. Exclusions included intellectual/developmental delay, or a chronic disease/disability. Sub-analysis was conducted based on the type of intervention (teacher led (TL) or teacher educated (TE)), sessions/week (<3 or ≥3) and age group (PC or SC). Standardized mean difference (SMD), heterogeneity, bias and percentage change (%Δ) were calculated using RevMan 5.3.

RESULTS: Search terms yielded 16,576 articles, of which 13 met the inclusion criteria. In total 3,695 children (age 5.6±2.8 years) were studied. On average, interventions ran for 27±15 weeks, 3±2 sessions/week lasting for 41±23 minutes. Seven studies reported significant improvements in at least one measure of FMS or PA. Sub-analysis showed that TL interventions which run ≥3 sessions/week in PC were effective at increasing FMS (SMD=0.26 [0.10, 0.42]; p=0.002), PA (SMD=0.30 [0.10, 0.50]; p=0.003), and moderate-vigorous PA (SMD=0.24 [0.02, 0.46]; p=0.03). However, there was no significant correlation between the %Δ in FMS and %Δ in PA in either age group.

CONCLUSION: FMS and PA are both significantly improved by TL interventions run ≥3 sessions/week in preschools. This information should be used in designing future programs to implement in pre-schools. Further research is required on the relationship between change in FMS and PA across childhood, as research is limited.

2803 Board #323 June 2 9:30 AM - 11:00 AM

A Systematic Review And Meta-analysis Physical Activity Intervention Fitness Of Female'S Middle Students In China

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(No relationships reported)

Purpose: It is reported that approximately 50 % of Chinese weights are not reach the national standard. 2015 China Adolescent Weight Investigate Report. Approximately 70 % of Chinese adolescent are not physically active enough to achieve health benefits. The purpose of this study was to systematically review and meta-analyze the effect of fitness for Chinese middle students interventions on physical activity.

Methods: CNKI, Wanfang Data, Weipu Data and Web of Science Database were systematically searched to identify all relevant randomized controlled trials that evaluated the effect of fitness for Chinese middle students on physical activity from 2011 to 2015 years. According to the study design, the data of the boys were selected for analysis. The studies were described and effect size data were included in meta-analyses.

Results: Eighteen studies were included in the review and ten reported statistically significant improvements in physical activity. A meta-analysis of ten studies showed a statistically significant effect (SMD=0.24, P=0.0009<0.001) of Sit and Reach on physical activity immediately post-intervention. However, it is not statistically significant effect of Vital Capacity (SMD=0.08, P=0.24), Height(SMD=0.13, P=0.06), Weight(SMD=0.05, P=0.45) and Grip(SMD=0.10, P=0.17) on physical activity immediately post-intervention.

Conclusion: Female's daily activity is to be effective at increasing weekly duration of exercise in middle students, but the effect size is too small. Training Chinese female adolescents to encourage increased physical activity may provide an effective method for reaching their fitness health. More studies with detailed quantification of total physical activity will help to find more precise relative estimates for different levels of activity of Chinese females adolescents.

2804 Board #324 June 2 9:30 AM - 11:00 AM

Effects Of Accumulated Short-bout Exercise On Systolic And Diastolic Blood Pressures: A Meta-analysis

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(No relationships reported)

Exercise guidelines allow for the accumulation of short-bout exercise, but the effect of short-bout exercise (6-15 minute bouts) on reducing blood pressure is uncertain. **PURPOSE:** To determine the effect of accumulated short-bout exercise on systolic (SBP) and diastolic (DBP) blood pressures. **METHODS:** The mean and standard deviation of blood pressure change scores (the difference between pre- and post-intervention) were extracted to calculate effect sizes (ESs). SBP and DBP were analyzed separately. A random effects model was used to calculate an overall ES and 95% confidence interval (CI). Each ES was weighed by the inverse variance to give more weight to studies with larger samples. Moderator analyses were conducted to evaluate the effects of total intervention period (e.g., ≥12 weeks, <12 weeks) and total

exercise minutes per week (e.g., ≥150 mins, <150 mins) on overall ES. Heterogeneity was evaluated using Cochran's Q statistic. Comprehensive Meta Analysis (Version 2.2) software was used to conduct ES calculation and moderator analyses. **RESULTS:** Key search words included short, intermittent, and accumulated bouts in Ebscohost and Google Scholar databases. The searches yielded 446 articles. After initial screening of titles and abstracts, 34 potentially relevant studies were reviewed in full, 10 studies involving 163 participants were included, and 20 ESs were calculated in this meta-analysis. Overall mean ES for SBP was significant (ES = -0.324, CI = -0.59, -0.05). This indicated that accumulated short-bout exercise was effective in reducing SBP. Moderator analyses indicated that the mean ES for SBP was influenced by total intervention period, $Q_{\text{between}} (Q_b) = 5.028, df = 1, p = .025$, but not by total exercise minutes per week. Overall mean ES for DBP was not significant (ES = -0.136, CI = -0.45, 0.18). This indicated that short-bout exercise was not effective in reducing DBP. Moderator analyses indicated that the mean ES for DBP was not influenced by any of the two moderator variables. **CONCLUSION:** The accumulation of short-bout exercise can have a significant effect on decreasing SBP, especially with a longer intervention period (≥ 12 weeks). However, these changes are not seen in DBP. To better establish guidelines, more research should be conducted to understand the effects of short-bout exercise on DBP.

E-40 Free Communication/Poster - Vascular Function

Friday, June 2, 2017, 7:30 AM - 12:30 PM

Room: Hall F

2805 Board #325 June 2 9:30 AM - 11:00 AM

The Impact of Laminar and Oscillatory Shear Stress on Cellular Adhesion Molecule Expression in HUVEC

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(No relationships reported)

PURPOSE: To investigate the influence of acute laminar shear stress (LSS) on the expression of VCAM-1 and fractalkine on human umbilical vein endothelial cells (HUVEC) following prolonged exposure to oscillatory shear stress (OSS) *in vitro*. **METHODS:** Cultured EC were stimulated with TNF-α for 24 hr and immediately exposed to shear experiments using a parallel-plate flow chamber: (i) 24 hr of LSS or OSS, and (ii) 24 hr of OSS followed by 30 min of LSS. Cells were collected and incubated with primary antibodies for surface VCAM-1 and fractalkine. Samples were analyzed via standard fluorescence-activated cell sorting. **RESULTS:** Prolonged LSS and OSS significantly reduced the TNF-α-induced elevation in the % of gated cells expressing VCAM-1 (p<0.001) and fractalkine (p=0.001); however, the reduction in VCAM-1 caused by LSS was shown to be significantly greater than the reduction elicited by OSS (p=0.006). Interestingly, the mean fluorescent intensity (MFI) of TNF-α-induced VCAM-1 was significantly elevated by prolonged OSS (1.60±0.01 fold [p<0.001]). Whereas, prolonged LSS had no impact on the MFI of TNF-α induced VCAM-1 (p=0.931). Prolonged LSS and OSS elicited a significant elevation in the MFI of TNF-α induced fractalkine (p=0.017). Lastly, acute LSS following prolonged OSS had no effect on the % of gated or MFI of cells expressing VCAM-1 and fractalkine. **CONCLUSIONS:** Prolonged OSS may increase markers of vascular inflammation. However, an acute period of LSS, utilized as a model of physical activity, does not appear to alter the OSS-induced inflammatory state.

2806 Board #326 June 2 9:30 AM - 11:00 AM

Physical Activity Attenuates NLRP3 Inflammasome-associated Vascular Dysfunction in Obese Mice Heart

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(No relationships reported)

Activation of the NLRP3 inflammasome mediates the release of pro-inflammatory cytokine IL-1β and thereby plays a pivotal role in the inflammatory response in vascular pathology. An active lifestyle has beneficial effects on inflammation-associated vascular dysfunction in obesity. However, it remains unclear how physical activity regulates NLRP3 inflammasome-mediated vascular dysfunction in obesity. **PURPOSE:** To determine the protective effect of physical activity on NLRP3 inflammasome-associated vascular dysfunction in mice heart, and the potential underlying mechanisms. **METHODS:** C57BL/6J male mice were randomly divided into four groups: (1) control low-fat diet (LF-SED), (2) LF diet given free access to a voluntary running wheel (LF-RUN), (3) high-fat diet (HF-SED); 45% of calories

from fat), and (4) HF-RUN. Western blotting and immunofluorescence staining determined NLRP3 inflammasome-related signaling pathways and nitric oxide (NO) bioavailability-related pathways in the heart. **RESULTS:** Western blotting showed increased protein expression of NLRP3 in HF-SED (31%) compared to LF-SED, but it was reduced by voluntary wheel running. Immunofluorescence staining illustrated significantly higher expression of caspase-1 and IL-1 β in coronary endothelial cells and arterioles in HF-SED than LF-SED, LF-RUN, and HF-RUN. Compared to LF-SED, decreased expression of endothelial nitric oxide synthase (eNOS; 32%) and increased NOX2 (NADPH oxidase 2; 51%) expression in HF-SED were normalized to the level of LF-SED by voluntary wheel running. **CONCLUSION:** Our findings suggest that voluntary running would oppose high fat diet-induced vascular dysfunction in mice heart by suppressing NLRP3 inflammasome activation and possibly improving NO bioavailability via increased expression of eNOS and reduced oxidative stress.

2807 Board #327 June 2 9:30 AM - 11:00 AM

Vigorous-Intensity Physical Activity May Improve Central Aortic Pressure Response to Glucose Loading in Overweight/Obese Men

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Central aortic systolic blood pressure (cSBP) decreases after a meal or glucose challenge, but the response is impaired by obesity-related disorders. We have previously reported that the blunted cSBP response to oral glucose loading in overweight/obese men was normalized after a 12-week aerobic exercise training program. However, the most effective intensity of physical activity to improve the cSBP response to glucose loading is unclear. **PURPOSE:** To evaluate the effect of intensity of regular physical activity on cSBP response to oral glucose loading in overweight/obese men. **METHODS:** Thirteen overweight/obese (body mass index, BMI ≥ 25 kg/m²) men (age, 50 \pm 8 years; BMI, 27.1 \pm 2.5 kg/m²; mean \pm SD) completed a 12-week aerobic exercise training program, involving both supervised and unsupervised walking/jogging. Physical activity time (PAT) was measured using a tri-axial accelerometer for 2-3 weeks prior to the exercise program and during 12 weeks of the exercise program, and was classified into low- (1.5-2.9 METs), moderate- (3.0-5.9 METs), or vigorous-intensity (≥ 6.0 METs). Before and after the program, cSBP was noninvasively estimated using applanation tonometry of the radial artery with a validated general transfer function at fasting and 120 min after 75 g oral glucose loading. **RESULTS:** Moderate- and vigorous-intensity PAT significantly increased during the exercise program, whereas low-intensity PAT did not change (low-intensity: 244 \pm 55 to 254 \pm 63 min/day, $P = 0.39$; moderate-intensity: 48 \pm 16 to 70 \pm 19 min/day, $P < 0.01$; vigorous-intensity: 0 \pm 1 to 12 \pm 10 min/day, $P < 0.01$). Glucose loading significantly decreased cSBP only after the exercise program (109 \pm 13 to 104 \pm 14 mmHg, $P < 0.05$), but not before (111 \pm 15 to 110 \pm 17 mmHg, $P = 0.56$). Changes in cSBP response to glucose loading after the exercise program were significantly correlated with changes in vigorous-intensity PAT, but not with changes in low- and moderate-intensity PAT (low-intensity: $r_s = 0.03$, $P = 0.93$; moderate-intensity: $r_s = -0.16$, $P = 0.61$; vigorous-intensity: $r_s = -0.78$, $P < 0.01$). **CONCLUSIONS:** Vigorous-intensity physical activity during the 12 weeks of aerobic exercise training program may have improved the cSBP response to oral glucose loading in overweight/obese men. Supported by Grant-in-Aid for JSPS Fellows (15J00840).

2808 Board #328 June 2 9:30 AM - 11:00 AM

The Impact of Repetitive Long-duration Water Immersion on Vascular Function

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While physiological responses to water immersion (WI) are well-studied, the vascular responses after WI are less understood. **PURPOSE:** The objective of this study was to quantify the changes in endothelial function and vascular stiffness following repeated six-hour WIs with surface-supplied air. **METHODS:** Sixteen healthy subjects (15 male) performed six-hour resting thermoneutral water immersions (WI) at 1.35 atmospheres absolute (ATA) for four consecutive days, with follow-up on the fifth day. Measurements included endothelial function and arterial stiffness (peripheral arterial tonometry), beat-to-beat blood pressure (photoplethysmography), heart rate (HR), and plasma volume (PV) calculated from changes in hemoglobin and hematocrit. **RESULTS:** The reactive hyperemia index (RHI), a marker of endothelial function, increased with repeated immersions ($p=0.008$) as did lnRHI ($p=0.025$). By WI 3, RHI and lnRHI increased 16% and 17%, respectively, compared to WI 1 values, but no significant differences were detected between WI 4 and WI 1 for either measure.

Absolute arterial stiffness (augmentation index, AI) increased by an average of 33% ($p<0.001$) and AI normalized for HR (AI@75) by 11% ($p=0.12$) following each WI. PV decreased significantly by 13.2% ($p<0.001$) following WI and remained 6.8% lower at follow-up compared to pre-WI. Systolic blood pressure significantly decreased by an average of 2.5% following each WI ($p=0.012$). HR decreased 4.3% after each WI ($p<0.001$) but increased overall by 6.6% over the course of repeated WI ($p<0.001$). Total peripheral resistance increased by an average of 13.1% following WI ($p=0.003$).

CONCLUSION: Four consecutive days of six-hour WIs while breathing air at 1.35 ATA results in a transient increase in arterial stiffness following each WI as well as an increase in endothelial function on the third day. Additionally, in the context of acute exposure to WI, blood pressure and endothelial function diverge from their usual direct associations with arterial stiffness

2809 Board #329 June 2 9:30 AM - 11:00 AM

Serum CTRPs Levels Are Associated With Exercise Training-induced Reduction Of Arterial Stiffness In The Elderly

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(No relationships reported)

Habitual aerobic exercise reduces arterial stiffness and decreases fat accumulation, concomitant with an elevated serum level of adiponectin, as an adipokine of anti-inflammatory factor. Adiponectin regulates endothelial nitric oxide (NO) synthase in endothelial cells, promoting NO production. Recently, C1q/tumor necrosis factor-related proteins (CTRPs) has been identified as a novel adipokines and are paralog of adiponectin. However, the association between exercise-training effects of arterial stiffness and circulating CTRPs levels remain unclear.

PURPOSE: This study aimed to clarify whether reduction of arterial stiffness by exercise training is associated with change in serum levels of CTRPs.

METHODS: Fifty-six middle-aged and older subjects were enrolled in this study. The study subjects were randomly divided into two groups: the training group ($n = 28$, 68 \pm 1 years) and the control group ($n = 28$, 65 \pm 2 years). Subjects in the training group completed 8-week of aerobic exercise training (60-70% peak oxygen uptake [VO₂peak] for 45 min, 3 days/week). Before and after the intervention, we measured body composition by magnetic resonance imaging (MRI) and dual-energy x-ray absorption (DXA), carotid-femoral pulse wave velocity (cfPWV) as an indicator of arterial stiffness, and serum CTRPs (adiponectin, CTRP3, CTRP5, CTRP9) concentrations using enzyme-linked immunosorbent assay (ELISA) method.

RESULTS: In the training group, %body fat, abdominal visceral fat area and cfPWV were significantly decreased after the intervention ($P < 0.05$). Moreover, aerobic exercise training significantly elevated serum adiponectin and CTRP5 levels ($P < 0.05$) and tended to increase serum CTRP3 level. Additionally, the training-induced change in cfPWV was negatively correlated with training-induced change in serum adiponectin, CTRP3 and CTRP5 levels ($r = -0.46$, $r = -0.52$, $r = -0.39$, respectively, $P < 0.05$). By contrast, none of these parameters changed significantly in the control group. **CONCLUSION:** These results suggest that the exercise training induced increase in serum CTRPs levels may be associated with the reduction of arterial stiffness in middle-aged and older adults.

Supported by Grants-in-Aid for Scientific Research (#26282199 and #16K13059, M. Iemitsu) and JSPS KAKENHI (#16J09131, N. Hasegawa)

2810 Board #330 June 2 9:30 AM - 11:00 AM

Evidence Suggesting Reduced Macrovascular and Microvascular Dilator Function in Well-Healed Burned Survivors

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In healthy non-burned individuals, prolonged physical inactivity impairs vascular function and structure evidenced by reduced resting femoral artery diameter and macrovascular and microvascular dilator function. Burn survivors are exposed to prolonged physical inactivity immediately post-injury, which often persists years into recovery. Therefore, burn survivors may be at a heightened risk for vascular dysfunction. **PURPOSE:** To test the hypothesis that macrovascular and microvascular

dilator function is reduced in burn survivors compared with healthy non-burned controls. **METHODS:** Seven healthy non-burned adults (3 females; age 32 ± 10 years; mass 72 ± 22 kg; height 167 ± 9 cm; mean \pm SD) and 12 adults having sustained a burn injury covering at least 20% of their body surface area (11 ± 8 years prior to assessment (5 females; age 39 ± 16 years; mass 82 ± 20 kg; height 171 ± 11 cm; body surface area burned 53 ± 23 %) participated in this study. Macrovascular (flow mediated dilation) and microvascular (peak reactive hyperemia and area under the curve) dilator function was assessed, via duplex ultrasonography, of the brachial artery following 5 minutes of arterial occlusion. Nitroglycerin mediated dilation (0.4 mg sublingual administration) was used to assess endothelial independent vasodilation. **RESULTS:** Macrovascular dilator function tended to be reduced in burn survivors (controls $7.6 \pm 1.0\%$ vs burn survivors $5.1 \pm 0.8\%$; $P = 0.08$). Likewise, forearm vascular conductance area under the curve (controls 2.73 ± 0.34 ml mmHg^{-1} vs burn survivors 2.03 ± 0.26 ml mmHg^{-1} ; $P = 0.1$) and peak forearm vascular conductance (controls 5.27 ± 0.56 ml min^{-1} mmHg^{-1} vs burn survivors 4.07 ± 0.42 ml min^{-1} mmHg^{-1} ; $P = 0.1$) tended to be lower in burn survivors. Nitroglycerin mediated vasodilation did not differ between groups (controls $21.8 \pm 2.3\%$ vs burn survivors $21.1 \pm 2.4\%$; $P = 0.8$). **CONCLUSION:** In these preliminary data, macrovascular and microvascular dilator function tends to be impaired in burn survivors. However, endothelial independent vasodilation is well maintained in these individuals, suggesting that endothelial dysfunction contributes to their attenuated macrovascular and microvascular dilator responses. Funded by National Institutes of Health (GM-068865).

2811 Board #331 June 2 9:30 AM - 11:00 AM
Serum Salusin- α Level Is Associated With Exercise Training-induced Reduction Of Arterial Stiffness In The Elderly
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 (No relationships reported)

Aging-induced elevation of blood pressure and arterial stiffness is reduced by aerobic exercise training. Administration of salusin- α to healthy rats induces a decrease in mean arterial blood pressure, and circulating salusin- α level was lower in patients with hypertension or coronary artery disease compared with healthy controls. Additionally, circulating salusin- α level is significantly negative correlated with brachial-ankle pulse wave velocity (baPWV) as an indicator of systemic arterial stiffness. However, it is unclear whether circulating salusin- α level is associated with exercise training-induced reduction of risks for hypertension and arteriosclerosis. **PURPOSE:** The aim of this study was to investigate whether serum salusin- α level is associated to exercise training-induced changes in blood pressure and arterial stiffness in healthy middle-aged and older adults.

METHODS: Twenty-eight healthy middle-aged and older subjects (67 ± 1 years) were participated in this study. Subjects completed 8-week of aerobic exercise training (60-70% peak oxygen uptake [VO_{2peak}] for 45 min, 3 days/week). We measured brachial blood pressure, carotid-femoral pulse wave velocity (cfPWV) as an indicator of central arterial stiffness, and VO_{2peak} as an indicator of cardiorespiratory fitness.

RESULTS: After the exercise intervention, VO_{2peak} was significantly increased, and systolic blood pressure and cfPWV were significantly decreased (each $P < 0.05$). Serum salusin- α level was significantly increased after the exercise training ($P < 0.05$). Additionally, significant negative correlations between the training effects of serum salusin- α level and cfPWV ($r = -0.580$, $P < 0.05$) and systolic blood pressure ($r = -0.409$, $P < 0.05$) were seen.

CONCLUSIONS: These results suggest that aerobic exercise training-induced changes in serum salusin- α level may be related to the reduction of blood pressure and arterial stiffness in healthy middle-aged and older adults. Supported by Grants-in-Aid for Scientific Research (#26282199, M. Iemitsu; #16J08331, S. Fujie)

2812 Board #332 June 2 9:30 AM - 11:00 AM
Physical Fitness Protects Against Age-Related Vascular Dysfunction in the Lower Limb
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 (No relationships reported)

Vascular function is reduced with sedentary aging, which contributes to increased cardiovascular disease risk with age. Physical activity can prevent, and/or reverse, age-related vascular dysfunction. Data supporting the beneficial impact of physical activity,

however, are primarily derived from assessments of vascular function in the arm. **PURPOSE:** This study sought to examine the impact of aging and physical fitness on lower limb vascular function. **METHODS:** Flow-mediated dilation (FMD, Doppler ultrasound) of the superficial femoral and popliteal arteries (SFA and PA, respectively) was assessed in a total of 32 subjects, consisting of 8 young sedentary (Y; 23 ± 1 yrs), 8 old sedentary (OS; 73 ± 2 yrs), 8 old active (OA; 71 ± 2 yrs), and 8 old endurance trained (OT; 72 ± 1 yrs) adults. Subjects were grouped based on age, physical activity (interview and accelerometry), and maximal oxygen consumption (VO_{2max}) assessed on a cycle ergometer. **RESULTS:** FMD was reduced in the OS group relative to the Y in the SFA (Y: $4.3 \pm 0.9\%$, OS: $1.7 \pm 0.4\%$, $p < 0.05$) and PA (Y: $6.3 \pm 0.9\%$, OS: $1.9 \pm 0.4\%$, $p < 0.05$). Increasing levels of physical fitness corresponded to an increase in FMD in the SFA (OA: $2.9 \pm 0.6\%$, OT: $4.3 \pm 0.8\%$) and PA (OA: $2.3 \pm 0.8\%$, OT: $5.2 \pm 1.1\%$), such that SFA FMD was not different from the Y in the OA and OT groups, and PA FMD was not different from the Y in the OT group. Additionally, in the old subjects, both SFA ($r = 0.44$) and PA ($r = 0.48$) FMD were significantly correlated with VO_{2max}. **CONCLUSION:** Collectively, these data suggest that physical fitness diminishes the detrimental effect of aging on lower limb vascular function. Importantly, these data extend observations in the arm, in terms of the benefits of physical activity on vascular function with advancing age, to the lower limb, which, as a consequence of limb-specific vascular aging, may be at a greater predisposition for age-related vascular dysfunction.

2813 Board #333 June 2 9:30 AM - 11:00 AM
The Acute Effect of Total Resistance Training Load on Blood Pressure: A Meta-Analysis
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Systemic arterial hypertension is a multifactorial disease with high prevalence in the elderly population. Resistance training has shown promising results in reducing hypertension; finding mainly explained by the post-exercise hypotensive effect. **PURPOSE:** The purpose of this meta-analysis was to determine the acute effect of the total resistance training load on blood pressure (BP). **METHODS:** A systematic search of articles evaluating post-exercise BP responses published until June 2016 was performed in 6 databases. Risk of bias was assessed using a 5 point Likert-type scale. Hedge's standardized mean difference effect size (ES) was calculated for each result; then, ESs pooled using random-effects models. Non-overlapping 95% confidence intervals (CI_{95%}) were considered statistically significant. Heterogeneity was assessed using Q and I², while funnel plots and Egger's regression test were used to assess small-study effects (potential bias). The z-test was computed to determine whether ESs were different from zero. **RESULTS:** Twelve studies were selected, representing 171 subjects for a total of 342 ESs. For systolic BP, the overall ES was -0.86 (CI_{95%} = -0.73 , -1.02 ; $z \neq 0$, $p < 0.05$), which translates to a reduction of 6.3 mmHg. For diastolic BP, the ES was -0.51 (CI_{95%} = -0.62 , -0.40 ; $z \neq 0$, $p < 0.05$), which translates to a reduction of 3.3 mmHg. Normotensive and physically-active participants who were prescribed exercise intensities based on submaximal tests showed higher reductions in BP than hypertensive, sedentary, and when one maximal repetition (1-RM) was used for exercise intensity prescription ($p < 0.05$). Significant reductions in diastolic BP following exercise were observed with higher session total training load ($r = -0.23$, $p < 0.05$). **CONCLUSIONS:** The total resistance training load is highly correlated to post-exercise BP reductions, providing significant clinical benefits for patients.

2814 Board #334 June 2 9:30 AM - 11:00 AM
Arterial Stiffness is Not Altered in Well-Healed Burn Survivors.
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Recovery from severe burn injuries involves prolonged hospitalization and accompanying bed rest. Additionally, burn survivors are often physically inactive for years following the burn injury, which together with the aforementioned bed rest during hospitalization may contribute to a reduction in vascular health. **Purpose:** Using arterial stiffness as an indicator of vascular health, the purpose of this study was to test the hypothesis that arterial stiffness is greater in burn survivors compared with non-burned control subjects, indicative of a less compliant vascular bed. **Methods:** Central (carotid-femoral) and peripheral (carotid-radial) arterial stiffness were assessed via pulse wave velocity (Doppler) in eight non-burned adults (4 females; age 33 ± 10 years; height 167 ± 8 cm; mass 76 ± 24 kg; mean \pm SD) and 15 burn survivors (8

females; age 40 ± 15 years; height 170 ± 11 cm; mass 80 ± 19 kg; mean \pm SD). Burn survivors had an average of $49 \pm 23\%$ (range: 16 - 85%) body surface area burned and were at least two years post burn injury. **Results:** Neither peripheral arterial stiffness (controls: 8.3 ± 0.5 m s⁻¹; burn survivors: 7.8 ± 0.4 m s⁻¹; $P = 0.5$) nor central arterial stiffness (controls: 6.6 ± 0.6 ; burn survivors: 6.7 ± 0.5 m s⁻¹; $P = 0.9$) differed between groups. **Conclusions:** These data suggest that arterial stiffness is not altered in well-healed burn survivors.

Supported by NIH Grant R01 GM-068865.

2815 Board #335 June 2 9:30 AM - 11:00 AM

Effect Of Topical EMLA Application On Cutaneous Sympathetic C-fiber Function

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Purpose: Activation of nociceptive afferents (small C-fibers) in the skin results in the activation of an axon reflex mediated increase in cutaneous blood flow. Topical lidocaine (EMLA) is often used to mitigate the axon reflex and its impact on the skin blood flow response to local heating. However, it is possible that EMLA would impact cutaneous sympathetic nerves which are also small C-fibers. **Methods:** To evaluate this hypothesis, we examined the effect of topical EMLA application on axon reflex mediated sweating induced by intradermal electrical stimulation in 10 subjects with and without EMLA application. Local sweat rate (SR) was measured by passing dry gas through a small sweat capsule mounted on the skin. The skin was stimulated at a constant current intensity of 2.5 mA for 30 s at frequencies of 0.2, 1, 2, 4, 8, 16, 32, and 64 Hz using two small stainless steel stimulating electrodes. This procedure produced a sigmoid shape stimulus-response curve when we plotted the area under the SR-time curve versus stimulus frequency. **Results:** In control conditions peak local SR during 64 Hz stimulation averaged 0.364 ± 0.219 mg \cdot min⁻¹ \cdot cm⁻² which was significantly ($p < 0.05$) reduced by application of EMLA to 0.078 ± 0.098 mg \cdot min⁻¹ \cdot cm⁻². The stimulus-response curves were significantly different from each other with a significant reduction in the plateau with EMLA (11.7 ± 1.3 versus 2.6 ± 0.6 , $p < 0.05$) but with a similar EC₅₀ values (7.2 ± 0.11 versus 9.9 ± 0.2 Hz). **Conclusion:** These data support the hypothesis that topical application of EMLA does impact cutaneous sympathetic C fiber function. As such, topical EMLA cream should not be viewed as an appropriate method to selectively eliminate superficial sensory fiber activity from studies of human cutaneous blood flow.

2816 Board #336 June 2 9:30 AM - 11:00 AM

Effect Of Habitual Interval Walking On Arterial Stiffness In Older Adults

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Arterial stiffness that increases with aging is an independent risk factor for cardiovascular diseases. Interval walking is an effective way to prevent cardiovascular diseases.

PURPOSE: The present study aimed to determine whether habitual interval walking decreases arterial stiffness in older adults. **METHODS:** Fifty-four older adults (72.3 \pm 5 yrs) were randomly assigned to undergo interval walking (IW; n=26; male, n=14) or normal walking (NW; n=28; male, n=11). The IW group repeated five 3-min walks at $\leq 40\%$ (low intensity) and $\geq 70\%$ (high intensity) peak aerobic capacity for a total of 6 min per set. The NW group walked continuously at 50% (moderate intensity) peak aerobic capacity. Both groups repeated the walks 3-6 days/week for 20 weeks. The IW group was instructed to walk at high intensity (fast walking) for ≥ 60 min per week (total walking time per week: ≥ 120 min). The NW group walked each week for a total of ≥ 120 min. Energy expenditure during each walk was monitored using a triaxial accelerometer. Carotid-femoral (cf) and femoral-ankle (fa) pulse wave velocity (PWV), which reflects central (aortic) and peripheral (leg) arterial stiffness, were measured using an automatic oscillometric device (form PWV/ABI, Omron-Colin Co. Ltd., Komaki, Japan). Brachial systolic and diastolic blood pressure and heart rate were simultaneously measured using an automatic waveform analyzer and electrocardiography during waveform recording. The cfPWV, faPWV, brachial blood pressure, and heart rate were measured before (baseline) and at 10 and 20 weeks after both types of walking. **RESULTS:** The weekly amount of energy expended while walking was significantly lower in the IW, than in the NW group (IW vs. NW; 566 ± 37 vs. 1166 ± 147 kcal, $p < 0.05$). The cfPWV in both groups significantly decreased from baseline to 20 weeks (IW; 1283 ± 41 to 1167 ± 44 cm/sec, NW: 1214 ± 40 to 1159 ± 34 cm/sec, $p < 0.05$, respectively), whereas the faPWV in both groups did not. The degree of changes in cfPWV was significantly lower in the IW than in the NW group (IW vs. NW; 9 ± 2 vs. 4 ± 1 %, $p < 0.05$). **CONCLUSIONS:** These results suggest that central arterial stiffness was apparently reduced by IW despite a decreased energy expenditure compared with NW in older adults. Therefore, risk factors for cardiovascular diseases seemed to be decreased more effectively in IW than NW.

ACSM May 30 – June 3, 2017

2817 Board #337 June 2 9:30 AM - 11:00 AM

Post Exercise Hypotension and Blood Flow Characteristics Between Eccentric and Concentric Exercise

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PURPOSE: Post exercise hypotension following resistance training has been reported in a variety of populations, though its mechanisms are not clear. The role of metabolism in post-exercise hypotension can be explored through the isolation of eccentric and concentric contraction, due to the greater metabolic cost of concentric contractions. Therefore the purpose of this study is to determine how metabolic activity, independent of mechanical work, influences post-exercise hypotension. **METHODS:** Twelve healthy participants (6 male, 6 female) completed a traditional, a concentric, and an eccentric exercise session, each matched for total work. Participants performed 3 sets of 10 repetitions in the traditional session and 3 sets of 20 repetitions in the concentric and eccentric session, all at 65% of a predetermined 1 repetition max. Blood pressure was collected at baseline, after each exercise (6), and every 15 minutes after exercise for 2 hours. Brachial and femoral blood flow were also assessed at baseline, immediately after exercise, and at 30, 60, 90, and 120 minutes after exercise. **RESULTS:** Repeated measures ANOVA results indicated a significant main effect of time ($F_{9,90} = 2407$, $P = .017$), condition ($F_{2,20} = 9.29$, $p = .001$), and a significant time by condition interaction ($F_{18,180} = 5.12$, $p < .001$) for mean arterial pressure (MAP). Results also indicated significant main effects of time ($F_{2,22} = 10.10$, $P < .001$), condition ($F_{5,55} = 32.24$, $P < .001$), and a time by condition interaction ($F_{10,110} = 9.13$, $P < .001$) for brachial blood flow; and significant main effects of time ($F_{5,55} = 2.59$, $P < .001$), condition ($F_{2,22} = 7.93$, $P = .001$), and a time by condition interaction ($F_{9,110} = 1.75$, $P = .012$) for femoral blood flow. **CONCLUSIONS:** Results from this study indicate that metabolic activity does influence post exercise hypotension independently from factors related to force production. Furthermore, these data suggest that eccentric exercise may elicit a sustained post exercise hypertensive response.

2818 Board #338 June 2 9:30 AM - 11:00 AM

Reductions In Posterior Cerebral Blood Flow Are Susceptible To Orthostatic Stress During Post-exercise Acute Hypotension

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Recent work suggests that reductions in posterior cerebral blood flow (CBF) rather than anterior CBF may be associated with orthostatic intolerance. Thus, we reasoned that the response of posterior CBF to post-exercise acute hypotension may be related to "grey- or black-out" after heavy resistance exercise.

PURPOSE: We tested the hypothesis that the response of posterior CBF to post-exercise acute hypotension is modified by orthostatic stress.

METHODS: Nine healthy subjects performed handgrip exercise (HG) for 3 min at 30% maximum voluntary contraction with and without lower body negative pressure (LBNP; -40mmHg) applied before, during and for 1 min following HG. Vertebral artery (VA) blood flow was measured throughout using duplex Doppler ultrasound.

RESULTS: At rest, there was no difference in VA blood flow between with and without LBNP ($P = 0.39$), while stroke volume was significantly decreased ($P < 0.01$). HG increased VA blood flow similarly from resting baseline with ($+31.7 \pm 6.3$ %baseline) and without ($+30.9 \pm 2.8$ %baseline) LBNP. VA blood flow and mean arterial pressure decreased immediately after HG (recovery from 0 to 15sec) with and without LBNP ($P < 0.01$). However, the reduction in VA blood flow was larger with LBNP (-35.8 ± 4.2 ml/min) than without LBNP (-20.0 ± 3.3 ml/min, $P < 0.05$). In contrast, there was no difference in VA vascular conductance between conditions at rest, during HG or recovery.

CONCLUSIONS: The application of LBNP augmented the reduction of posterior CBF to post-exercise acute hypotension. This reduction in VA blood flow appeared to be driven by the decrease in arterial blood pressure as there were no differences in VA vascular conductance with LBNP. Collectively, these findings suggest that posterior CBF is sensitive to orthostatic stress during post-exercise acute hypotension and may be associated with "grey- or blackout" after heavy resistance exercise.

2819 Board #339 June 2 9:30 AM - 11:00 AM

Internal Laboratory Validation of Flow Mediated Dilation Analysis

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Flow Mediated Dilation (FMD) has immense potential to become a clinical, non-invasive assessment of endothelial function. However FMD analysis techniques could deviate significantly in different laboratories if a validation process is not involved. **PURPOSE:** To provide validation to the assessment of FMD analysis in our lab and to standardize this process as a first step in every lab before reporting results of FMD. **METHODS:** Brachial and femoral arteries FMD was performed on 30 young, apparently healthy participants (15 males). For the intratester reliability study, 10 subjects were asked to come to the lab for a second brachial FMD within 48 hours. All FMD procedures were performed by the same investigator, while the FMD analyses were performed by 2 independent testers who were blind to each other analyses. FMD analyses included baseline artery diameter measurements, peak artery diameter after 5 minutes of ischemia, and FMD. Analysis was completed via Brachial Analyzer for Research Software (Medical Imaging Applications LLC, Coralville, Iowa) by both testers. Intratester and intertester reliability were determined by using coefficient of variation (CV) between first and second visit (intratester) and between results obtained by both testers (intertester). **RESULTS:** For tester 1, the intratester CVs were 4.45% ($\pm 6.31\%$) for brachial baseline artery diameter, 5.23% ($\pm 6.47\%$), for brachial peak artery dilation, and for brachial FMD was 2.42% ($\pm 1.77\%$). For tester 2, the intratester CVs were 5.08% ($\pm 6.64\%$) for baseline brachial artery diameter, 5.60% ($\pm 7.49\%$) for peak brachial artery dilation, and for FMD was 4.82% ($\pm 5.82\%$). The intertester CVs were 2.40% ($\pm 1.94\%$) for brachial baseline artery diameter, 3.16% ($\pm 3.00\%$) for brachial peak artery dilation, and 3.37% ($\pm 3.46\%$) for brachial FMD, and 4.52% ($\pm 9.42\%$) for femoral baseline artery diameter, 5.50% ($\pm 12.55\%$) for femoral peak artery dilation, and 3.46% ($\pm 3.36\%$) for femoral FMD. **CONCLUSIONS:** All CVs were under or around 5%, confirming a strong reliability of the method. Our lab has illustrated the accuracy necessary to reproduce quality results from FMD procedures results due of the significantly low coefficient of variation. It is necessary for all labs to validate FMD procedures, to obtain a reproducible and validated value for future procedures utilizing FMD.

2820 Board #340 June 2 9:30 AM - 11:00 AM

Influence of an Acute Bout of Sitting on Leg Vascular Function

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Following an extended sitting challenge of 1-6 hours, endothelial function measured via flow-mediated dilation (FMD) is impaired in the leg. Further, this impairment has been shown to be mediated by the reduction in shear stress that occurs in the legs with prolonged sitting. Interestingly, previous findings have demonstrated that prolonged periods of sitting result in a reduction in shear rate as early as 10 minutes into the sitting period. However, it is unknown whether this acute reduction in shear stress is sufficient to alter conduit artery endothelial function or if the decline in shear stress must be maintained for a longer period. **PURPOSE:** We tested the hypothesis that 10 minutes of sitting would result in a reduction in popliteal artery shear stress and an impairment in FMD. **METHODS:** Popliteal artery diameter and blood velocity were continuously recorded via duplex Doppler ultrasound in ten healthy men before, during, and after a 10 minute sitting period. In addition, popliteal artery FMD was performed before and after the acute sitting period. Shear rate was calculated as $[8 \times \text{mean blood velocity}/\text{diameter}]$. FMD was calculated as $[(\text{peak diameter} - \text{base diameter})/\text{base diameter} \times 100]$ and was ANCOVA-corrected for hyperemic shear rate AUC. **RESULTS:** Popliteal artery shear rate was significantly reduced with 10 minutes of sitting (PreSit: $57.1 \pm 11.2 \text{ s}^{-1}$ vs. PostSit: $37.4 \pm 5.1 \text{ s}^{-1}$; $P = 0.034$); however popliteal artery FMD was unaffected (PreSit: $4.5 \pm 0.6\%$ vs. PostSit: $4.6 \pm 0.8\%$; $P = 0.738$). ANCOVA-corrected FMD yielded similar results ($P = 0.715$). Interestingly, reactive hyperemia, a measure of microvascular dilator function, tended to be lower following the acute bout of sitting (PreSit: $59.243 \pm 9.642 \text{ a.u.}$ vs. PostSit: $41.201 \pm 6.578 \text{ a.u.}$; $P = 0.06$). **CONCLUSIONS:** These preliminary findings demonstrate that shear rate is diminished within the first 10 minutes of sitting, yet this stimulus is not sufficient to affect conduit artery endothelial function. However, microvascular function

may be more sensitive to this brief reduction in shear stress, suggestive of a distinction between sitting-induced impairments in macrovascular and microvascular responsiveness.
Supported by UTA College of Nursing and Health Innovation.

2821 Board #341 June 2 9:30 AM - 11:00 AM

Habitual Endurance Exercise And Vascular Mechanical Biomarkers Derived From Arterial Reservoir Pressure Analyses

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A number of vascular mechanical biomarkers have been developed and proposed to predict cardiovascular outcomes. Among them, systolic (SC) and diastolic rate constants (DC) of reservoir pressure waveform have recently been shown to predict future cardiovascular events in large cohort studies. Impairments in arterial reservoir functions can result in a larger reservoir pressure wave with accelerated reservoir filling rate (higher SC) and faster reservoir emptying rate (higher DC). Currently, the effects of regular exercise training on these vascular biomarkers are unknown. **Purpose:** We determined the role of habitual aerobic exercise on well-established vascular function measures and novel arterial reservoir pressure parameters by using both cross-sectional and interventional approaches. **Methods:** First, we studied 60 apparently healthy, normotensive adults who were either sedentary (SED) or endurance-exercise trained (ET). Second, we studied 16 sedentary healthy subjects before and after a 3-month endurance training, and their data were compared with a sedentary time control group (N=10). **Results:** The cross-sectional analyses showed that ET had higher aerobic fitness, carotid artery distensibility, and lower pulse wave velocity compared with SED. Of the reservoir pressure waveform analysis, ET demonstrated a lower DC, the rate of reservoir pressure decay during diastole phase, than SED. DC was negatively associated with aerobic fitness and positively associated with central systolic blood pressure (cSBP) and pulse wave velocity. In the intervention approach, regular aerobic exercise reduced cSBP and DC. Changes in cSBP were positively associated with SC. **Conclusions:** Both cross-sectional and interventional approaches consistently demonstrate that regular aerobic exercise modulates diastolic constant of reservoir pressure waveform that represents reservoir emptying. This may be one mechanism by which habitual endurance exercise lowers the risk of vascular diseases.

2822 Board #342 June 2 9:30 AM - 11:00 AM

High Fit Older Adults Maintain a Similar Endothelial Response to Acute Inflammation as Younger Adults

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Acute and chronic inflammation are associated with an increased risk of cardiovascular (CV) events in older adults and reduced endothelial function (flow-mediated dilation; FMD). Higher cardiorespiratory fitness levels are associated with lower risk of CV events and improved vascular function. Whether fitness plays a role in the endothelial response during acute inflammation is unknown. **Purpose:** To evaluate the role of fitness in the endothelial response to acute inflammation in younger (YA) and older (OA) adults. **Methods:** An influenza vaccine induced acute inflammation in 23 YA (12 male, 26 ± 4 yrs, $24.0 \pm 3.5 \text{ kg/m}^2$) and 60 OA (20 male, 65 ± 5 yrs, $27.8 \pm 5.0 \text{ kg/m}^2$). Blood pressure, FMD and serum inflammatory markers were measured before vaccination and 24 hours after. $\text{VO}_{2\text{max}}$ was measured via a treadmill test. Participants were divided into low and high fitness by age group. **Results:** OA with high fitness reduced FMD more than OA with low fitness ($p=0.04$) at 24h even with similar C-reactive protein and interleukin-6 responses. Both high and low fit YA similarly decreased FMD at 24 hr ($p=0.76$). YA and high fit OA had a similar reduction (relative %) in FMD. There were no differences in baseline FMD or blood pressure changes in either group. Regression analyses indicated no association between $\text{VO}_{2\text{max}}$ and change in FMD ($\beta=-0.01$, $p=0.98$) in YA, whereas an association existed in OA ($\beta=-0.36$, $p=0.04$) after adjusting for age, sex, BMI and baseline FMD. **Conclusion:** In OA, higher fitness is associated with a greater decrease in endothelial function during acute inflammation; high fit OA had a similar endothelial response compared to YA. This suggests intact reactivity of the vasculature to stress in high fit OA, which indicates a healthier vessel in high fit versus low fit OA.

	YA – High Fit	YA – Low Fit	OA – High Fit	OA – Low Fit
n	12	11	33	27
VO ₂ Max, ml/kg/min	49.7 (4.9)*	36.6 (4.9)	30.6 (4.2)*	20.1 (3.1)
Baseline FMD, %	12.2 (2.9)	11.9 (5.0)	6.3 (3.5)	5.6 (2.6)
Baseline CRP, mg/l	1.2 (0.7)*	0.6 (0.5)	2.2 (2.9)	2.9 (2.2)
Baseline IL-6, pg/ml	1.1 (0.7)	0.8 (0.4)	1.6 (1.2)	1.6 (1.1)
Change SBP, mmHg	-3 (6)	2 (8)	-2 (10)	-2 (10)
Change PP, mmHg	2 (6)	4 (7)	0 (8)	-1 (8)
Change FMD, %	-3.2 (4.5)	-2.6 (5.0)	-2.3 (4.1)*	-0.2 (3.4)
Change CRP, mg/l	1.0 (1.6)	0.9 (0.8)	0.8 (2.1)	0.9 (1.5)
Change IL-6, pg/ml	0.9 (1.6)	1.5 (2.1)	0.6 (2.1)	0.5 (1.0)

FMD: Flow mediated dilation, CRP: C-reactive protein, IL-6: interleukin-6, SBP: systolic blood pressure, PP: pulse pressure

*p < 0.05 vs. low-fit of same age category

2823 Board #343 June 2 9:30 AM - 11:00 AM
Arterial Distensibility and Compliance Following Hypovolemic Challenge in Individuals with and without Down Syndrome

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Individuals with Down syndrome (DS) commonly exhibit autonomic dysfunction, which may contribute to abnormal arterial function and partially explains low exercise tolerance in this population. Arterial stiffness, reduced arterial compliance and distensibility, is a strong predictor of future CV events and all-cause mortality. Individuals with DS also have alterations in arterial function and the effect of sympathetic stimulation on arterial distensibility is unclear in individuals with DS. **Purpose:** To examine potential differences in carotid artery distensibility, arterial compliance (AC), and hemodynamics to sympathoexcitation using hypovolemic lower body negative pressure (LBNP) in individuals with and without DS. **Methods:** VO_{2peak} was measured in 20 volunteers (DS=9, 23 yrs; Control=11, 24 yrs) using an individualized treadmill protocol. Changes in hemodynamics and vascular reactivity (BP, carotid distensibility, AC and β -stiffness) were measured by ultrasonography at baseline, during and immediately after LBNP (-20 mmHg). **Results:** Compared with controls, individuals with DS have lower VO_{2peak} (24.6 ± 5.9 vs. 41.1 ± 7.1 mL/kg/min, respectively) and higher BMI (22.6 ± 2.4 vs. 33.5 ± 8.1 kg/m²) (p < 0.05). LBNP did not alter arterial stiffness, AC or distensibility for either group. Overall carotid distensibility appeared to be higher in individuals with DS with a medium effect size (partial η^2 = 0.092). In addition, AC approached a significant group effect and yielded a large effect size (p < 0.06, partial η^2 = 0.175) for those with DS. **Conclusions:** Our results indicate that individuals with DS exhibit more compliant arteries than controls, which may be due to autonomic dysfunction with reduced sympathetic tone, as well as alterations in collagen and elastin, which are commonly observed in the skeletal muscles and ligaments in this population. However, the medium effect size suggests that a larger sample size is necessary.

	DS (N = 9)			Control (N = 11)		
	Baseline	LBNP (-20mmHg)	Recovery	Baseline	LBNP (-20mmHg)	Recovery
CarSBP (mmHg)	127 ± 6	122 ± 5	125 ± 4	125 ± 5	117 ± 4	123 ± 4
CarDBP (mmHg)	72 ± 3	71 ± 2	70 ± 3	73 ± 2	73 ± 2	77 ± 2
AC (mL/mmHg)	1.19 ± 0.10	1.23 ± 0.12	1.25 ± 0.14	0.92 ± 0.09	0.90 ± 0.11	1.01 ± 0.13
Distensibility (mL/min)	0.0042 ± 0.0012	0.0039 ± 0.0015	0.0038 ± 0.0010	0.0036 ± 0.0012	0.0034 ± 0.0015	0.0031 ± 0.0014
β -Stiffness	5.17 ± 1.61	5.56 ± 1.46	5.61 ± 2.33	5.56 ± 1.99	6.09 ± 1.68	5.61 ± 1.56

Mean ± SEM, p < 0.05

2824 Board #344 June 2 9:30 AM - 11:00 AM
Reliability of the Passive Leg Movement Assessment of Vascular Function

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Purpose: Although vascular function is an independent predictor of cardiovascular disease risk, and therefore has significant prognostic value, there is currently not a single clinically accepted assessment of vascular function. The recently emerged passive leg movement (PLM) assessment of vascular function appears to reflect predominantly endothelium-dependent vasodilation and can identify changes in vascular health with both advancing age and pathology. However, the reproducibility of the PLM model has yet to be examined. **Methods:** Seventeen healthy subjects (age: 24 - 37 yr) were studied on three separate experimental days, allowing five total trials of PLM to be performed on each subject, three within day (Trials 1-3) and three between day (Trials 1,4,5). The leg blood flow (LBF) response to PLM was assessed with Doppler ultrasound, and expressed as the change from baseline to peak (Δ LBF_{peak}). **Results:** The PLM-induced Δ LBF_{peak} was similar across all five trials (Trial 1: 1,030 ± 113, Trial 2: 960 ± 107, Trial 3: 909 ± 106, Trial 4: 1,000 ± 139, Trial 5: 973 ± 135 ml/min; p = 0.27) and these Δ LBF_{peak} values were significantly correlated both within (r: 0.64 - 0.88; p < 0.001) and between days (r: 0.73 - 0.85; p < 0.001). Also these repeated PLM assessments revealed high intraclass correlation coefficients (ICC) (within-day: 0.91; between-day: 0.93). Finally, despite the inclusion of all data, although some were clearly statistical outliers, PLM measurements exhibited a coefficient of variation of ~20%. **Conclusions:** The blood flow response to PLM is both consistent and reproducible between trials, whether performed repeatedly on the same day or on separate days. In combination with the growing evidence that PLM can distinguish between healthy individuals and populations with known vascular dysfunction (elderly, heart failure, sepsis, COPD, etc.), these findings support the continued movement to foster clinical acceptance of PLM as an effective assessment of vascular function and future cardiovascular disease risk.

2825 Board #345 June 2 9:30 AM - 11:00 AM
Quantification of Sympathetic Transduction in Type 2 Diabetes Patients

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Type 2 Diabetes patients (T2D) have been shown to have greater alpha-adrenergic sensitivity. How this impacts the transduction of muscle sympathetic nerve activity (MSNA) to arterial blood pressure under resting conditions using spontaneous fluctuations in MSNA, as well as during stressors known to elicit sympatho-excitation (e.g., cold pressor test (CPT)) is unclear.

PURPOSE: We tested the hypothesis that T2D patients would exhibit greater sympathetic transduction compared to age- and BMI-matched, healthy controls. **METHODS:** MSNA (microneurography), heart rate (ECG), and beat-to-beat arterial blood pressure (finger photoplethysmography) were continuously recorded during a 10 minute baseline period, and in response to a 2-minute CPT in six T2D patients and six age- and BMI-matched, healthy controls (CON). To quantify sympathetic transduction at rest, normalized burst heights were divided into four quartiles (smallest to largest), related to the corresponding peak change in mean arterial pressure (MAP) within those quartiles and a slope was determined. To quantify sympathetic transduction in response to a stressor, the change in MAP was related to the change in MSNA from rest to the last minute of CPT.

RESULTS: There were no differences in resting sympathetic transduction between groups (CON slope: 0.0103 ± 0.0023 mmHg/AU, T2D slope: 0.0095 ± 0.0016 mmHg/AU; p=0.78). Indeed, signal averaging of MSNA bursts indicated a similar peak increase in blood pressure in CON (+4.2 ± 0.6 mmHg) and T2D (+4.0 ± 0.9 mmHg) (p=0.66). Although the peak increase in blood pressure to CPT tended to be higher in T2D (T2D: +31.6 ± 3.4 mmHg, CON: +21.4 ± 3.7 mmHg; p=0.096), the Δ MAP/ Δ MSNA relationship during CPT was not different between groups (CON: 0.4158 ± 0.21, T2D: 0.1862 ± 0.05; p=0.36).

CONCLUSIONS: Despite clear sympathetically-mediated increases in blood pressure in T2D patients and healthy CON subjects both at rest and during the CPT, neither of the methodologies used to estimate sympathetic transduction, with respect to changes in arterial blood pressure, detected group differences.

Supported by AHA-20160072.

2826 Board #346 June 2 9:30 AM - 11:00 AM
Exercise And Vascular Function In Overweight And Obese Adults: A Meta-analysis
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PURPOSE: Obesity is strongly associated with vascular dysfunction, including a reduction in flow-mediated dilation (FMD), and evidence has shown that exercise training improves vascular dysfunction and FMD. The objective of this meta-analysis is to summarize the effect of exercise intervention on FMD in overweight and obese adults, as well as to investigate the role of age, weight, body mass index (BMI), exercise type, and intervention period on the effects observed. **METHODS:** We searched four electronic databases (Pubmed, Scopus, CINAHL, and Medline), through June 2016 for relevant studies pertaining to the effectiveness of exercise intervention on FMD. Search terms were "(obesity OR overweight) AND (Exercise OR training) AND (Flow mediated dilatation OR Flow mediated dilation OR FMD)". Inclusion criteria were as follows: 1) included value of relative FMD, 2) included exercise intervention at least 7 days, 3) studied only obesity or overweight adult subjects, and 4) published in English language peer-reviewed articles. Comprehensive Meta-Analysis version-3 software was used to compute the mean effect size (ES) and 95% CI using a random effects model. Cochran's Q statistic was also used to assess heterogeneity across individual studies. Subgroup analyses were conducted to identify moderator effects. **RESULTS:** Of 91 citations identified by the search strategy, 17 studies met the inclusion criteria and 33 ESs were calculated. The results showed that the exercise interventions had moderate effects on FMD, with an overall effect size of 0.52 (95% CI = 0.26, 0.79). The results of subgroup analyses demonstrated that BMI (Qb = 8.11, df = 2, p = 0.017) and weight change (Qb = 13.11, df = 4, p = 0.011) explained the heterogeneity of ESs. The group with highest BMI (>35) (ES = 1.98) and most weight loss (>5kg) (ES = 1.41) appeared to be most effective in increased FMD. No significant group differences were found by age, intervention period, and exercise type, but exercise interventions had significant effects on FMD for specific groups (e.g., over 12 months, aerobic training, and combined aerobic and resistance training). **CONCLUSION:** Exercise training significantly improves vascular function in overweight and obese adults as measured by increased FMD, and this benefit is dependent on the exercise modality and degree of weight loss.

2827 Board #347 June 2 9:30 AM - 11:00 AM
Cardiorespiratory Fitness and Adiposity do not Predict Vascular Reactivity in Sedentary Men and Women
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PURPOSE: Prior, small-scale studies have demonstrated significant associations between endothelial function (assessed by brachial artery flow-mediated dilation; FMD) and both cardiorespiratory fitness (VO₂max) and adiposity. We examined the associations between FMD and both VO₂max and several measures of adiposity in a larger cohort of sedentary, predominantly overweight and obese men and women. **METHODS:** Sixty-one subjects (9 females; Age = 30 ± 8 yrs) with a mean body mass index (BMI) of 31.4 ± 5.7 kg/m² (range = 20.2 - 49.1) and body fat percentage of 35.3% ± 9.6% (range = 14.0% - 52.9%) were sequentially enrolled in this cross-sectional study. Subjects were weighed using a calibrated scale and abdominal circumference was recorded at the level of the umbilicus. They then underwent dual-energy x-ray absorptiometry (DXA) for determination of fat mass, % body fat and visceral adipose mass. FMD was quantified using high-resolution B-mode ultrasound and automated edge-detection software. Finally, they underwent VO₂max testing on an electronically-braked cycle ergometer with a ramp protocol. All testing was conducted at a similar time of day to rule out effects of diurnal variation, and women were examined during the follicular phase of their menstrual cycle. Pearson correlation coefficients were used to examine the relationship of VO₂max, FMD and measures of adiposity. **RESULTS:** No significant (P > 0.6) correlations were found between FMD and DXA-measured body fat % (r = 0.07) and visceral adiposity (r = -0.03). Similarly, FMD was not significantly (P > 0.15) correlated with abdominal circumference (r = 0.18) or BMI (r = -0.04). Finally, VO₂max was not significantly correlated with FMD (r = -0.06, P = 0.63).

CONCLUSIONS: Contrary to previously published data, traditional and sophisticated DXA-based anthropometric measures as well as Vo₂max were not significantly associated with brachial artery flow-mediated dilation in this cohort of predominantly overweight and obese, sedentary men and women without evidence of cardiovascular disease.

2828 Board #348 June 2 9:30 AM - 11:00 AM
Effect of Sitting Time on Measures of Subclinical Atherosclerosis in Older Adults
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 (No relationships reported)

Increased sitting time has been associated with increased risk of cardiovascular disease and cardiovascular mortality. In young adults, sitting time was found to correlate with arterial stiffness and wave reflection, two subclinical markers of early atherosclerotic progression. **PURPOSE:** To determine if sitting time is associated with markers of subclinical atherosclerosis in older adults. **METHODS:** 99 adults between the ages of 60 and 85 yrs (mean: 68±6 yrs; 46.5% female) completed the International Physical Activity Questionnaire to assess physical activity behavior, including sitting time. Markers of subclinical atherosclerosis included common carotid intima-media thickness (IMT), carotid β stiffness, and Young's elastic modulus (ε) as measures of carotid stiffness, carotid-femoral pulse wave velocity (c-fPWV) as a measure of aortic stiffness, and aortic augmentation index (AIx) as a measure of global wave reflections. IMT, β stiffness, and ε were assessed on the left common carotid artery using ultrasound, while c-fPWV and AIx were assessed on the right side via applanation tonometry. Pearson correlations were performed to determine the strength of the relationship between sitting time and subclinical atherosclerotic measures. **RESULTS:** Older adults sat for an average of 6.3±2.8 hrs·d⁻¹ and sitting time was not different between the sexes (6.0±2.5 vs. 6.6±3.0 hrs·d⁻¹, p = 0.279, for women and men, respectively). Sitting time was not significantly correlated with IMT (r = -0.089, p = 0.193), β stiffness (r = -0.047, p = 0.324), ε (r = -0.013, p = 0.449), c-fPWV (r = 0.038, p = 0.356), or AIx (r = -0.003, p = 0.488). When exploring associations by sex, there were no associations between sitting time and any measure of arterial stiffness or wave reflection (p ≥ 0.073). **CONCLUSIONS:** Sitting time is not associated with measures of subclinical atherosclerosis in older adults. These data suggest sitting time may not further impact the structure of the aged artery. Future studies using objective measures of sedentary behavior are needed to further explore the relationship between sitting time and subclinical atherosclerotic risk. Supported by Dairy Research Institute/Dairy Management Inc.

2829 Board #349 June 2 9:30 AM - 11:00 AM
Anti-Bacterial Mouthwash Reduces Plasma Nitrite Following Dietary Nitrate Supplementation but Does Not Alter Stress Response
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Rinsing the mouth with anti-bacterial mouthwash (MW) suppresses the reduction of nitrate (NO₃⁻) to nitrite (NO₂⁻) and nullifies the reduction in blood pressure (BP) often reported after dietary NO₃⁻ supplementation. Given the known interactions between the microbiome and the central nervous system, we speculated that disruption of the oral flora with MW would induce a stress response exemplified by increased BP and cortisol secretion. **PURPOSE:** To determine the effects of ingesting NO₃⁻-rich beetroot juice (BR) and using MW on BP, plasma [NO₂⁻] and [NO₃⁻] and salivary [cortisol]. **METHODS:** After a 'no treatment' control (CON), ten healthy male participants rinsed with an inert placebo mouthwash (PM) prior to ingestion of 5 x 70 ml BR (~31 mmol NO₃⁻) over the 24 h prior to the experiment (PM+BR) followed by two further experimental arms conducted in a randomised order. In one arm, participants used MW prior to ingestion of BR (MW+BR) and in the other they used MW prior to the ingestion of a NO₃⁻-depleted beetroot juice placebo (MW+PLA). Blood was collected and measurements performed after 30 min of laying supine. Plasma [NO₂⁻] and [NO₃⁻] were measured by chemiluminescence. **RESULTS:** Plasma [NO₂⁻] in PM+BR (209 ± 98 nM) was elevated in comparison to all other experimental arms (all P<0.04). Plasma [NO₂⁻] was similar between CON (95 ± 27 nM) and MW+BR (115 ± 57 nM, P=1.0) but lower in MW+PLA (41 ± 24 nM) compared to all other arms (all P<0.03). Plasma [NO₃⁻] was higher in PM+BR (382 ± 104 μM) and MW+BR (412 ± 87 μM) both compared separately to CON and MW+PLA (all P<0.001). Plasma [NO₃⁻] was not different between CON (64 ± 24 μM) and MW+PLA (43 ± 14 μM, P=0.385) or

between PM+BR and MW+BR ($P=1.0$). Diastolic BP was lower in PM+BR (63 ± 5 mmHg) compared to MW+BR (67 ± 5 mmHg, $P=0.018$) but not different between other experimental arms (all $P>0.43$). There were no differences in systolic BP, mean arterial BP, or salivary cortisol between any arms of the experiment (all $P>0.16$). **CONCLUSIONS:** As expected, MW reduced plasma $[\text{NO}_2^-]$ but not $[\text{NO}_3^-]$, with and without ingestion of BR. Contrary to our hypothesis, however, MW did not alter BP or cortisol levels suggesting that it does not induce a stress response with short-term use. Further research employing a longer intervention and more extensive assessment of stress markers is required to confirm these observations.

2830 Board #350 June 2 9:30 AM - 11:00 AM
Aortic Reservoir Function of Lifelong Japanese Female Pearl Divers

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PURPOSE: Female pearl divers in Japan, called "Ama", perform repeated breath-hold free-diving for collecting pearls in oysters, seaweeds, and shellfish in the cold sea. In a typical day, they dive 50-200 times, 4-6 days/week throughout the year. We have previously reported significantly lower systemic arterial stiffness values in Ama compared with the age-matched sedentary peers living in the same fishing villages. As a follow-up study, the primary aim of the present study was to evaluate their aortic reservoir function and segmental arterial stiffness.

METHODS: We recruited 115 female pearl divers (mean age: 65 ± 11 yr) as well as age-matched 50 physically inactive and 33 physically active female non-divers living in the same fishing villages in rural locations. Aortic reservoir and excess pressure were calculated from the synthesized aortic pressure waveforms derived from carotid arterial pressure waveforms obtained with arterial applanation tonometry. Pulse wave velocity from the heart to the brachial artery (hbPWV; partly reflecting proximal aortic stiffness) and between the brachial artery and the ankle (baPWV; reflecting stiffness of abdominal aorta and leg arteries) were measured.

RESULTS: There were no significant differences in age, body weight, and body mass index among the groups. Blood pressure and pulse pressure in the brachial artery and the aorta were not different among the groups. Aortic reservoir function, as measured by the normalized area under the curve of aortic reservoir pressure by area under the curve of aortic blood pressure, tended to be higher in physically active individuals ($P=0.06$) and significantly greater in Ama ($P<0.05$) compared with their sedentary peers. baPWV was 8-9% lower in Ama and physically active adults than in sedentary adults ($P<0.05$ for both). hbPWV was 5% lower in physically active adults and 9% lower in Ama compared with their sedentary peers ($P<0.05$).

CONCLUSIONS: Our present findings suggest that life-long repetitions of breath-hold diving are associated with proximal aortic destiffening and improved aortic reservoir function.

2831 Board #351 June 2 9:30 AM - 11:00 AM
The Effect of a High Fat Meal on Cerebral Vascular Function

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It is well known that a single high fat meal (HFM) causes a robust and transient elevation in serum triglycerides (TG). This elevation in serum TG is a primary contributor to the post-prandial attenuation of peripheral vascular endothelial function, as assessed by flow-mediated dilation in the brachial artery. Whether a similar impairment in vascular reactivity can be observed in the cerebral circulation remains unknown, and was the focus of this investigation. **PURPOSE:** To test the hypothesis that cerebral vascular function is impaired following a HFM.

METHODS: End-tidal carbon dioxide partial pressure (PETCO_2), middle cerebral artery blood velocity ($\text{MCAV}_{\text{mean}}$), calculated cerebral vascular conductance index (CVCI ; $\text{MCAV}_{\text{mean}}/\text{mean arterial pressure}$) and cerebral vasodilator response to rebreathing induced hypercapnia (% increase in CVC from baseline at common maximal ΔPETCO_2) were assessed in 6 healthy young men (27 ± 5 years). Measures were assessed during fasted baseline and again at 2 and 4 h post meal consumption (HFM day) or at a similar time point in the fasted state (TC day). The two visits were separated by 2-7 days and were conducted in a randomized order. Blood lipids were assessed at baseline and at the 2 h time point into each respective condition.

RESULTS: As expected, consumption of the HFM significantly elevated serum TG concentrations relative to TC at 2 h (HFM: 101 ± 38 to 169 ± 77 mg/dL, TC: 107 ± 32 to 92 ± 31 mg/dL, $P=0.007$). However, the HFM had no effect of cerebral vasodilator

capacity during rebreathing induced hypercapnia. The maximal increase in %CVC achieved at the highest common ΔPETCO_2 during all conditions within each subject was unchanged during 2hr and 4hr post HFM or TC (condition x time interaction: $P=0.96$). Similarly, the slope of the change in %CVC per change in ΔPETCO_2 was unaffected by HFM across time ($P=0.49$).

CONCLUSIONS: Contrary to our hypothesis, and unlike the peripheral vasculature, our preliminary data suggest that the cerebral circulation appears to be protected from the acute negative effects of a high fat meal.

2832 Board #352 June 2 9:30 AM - 11:00 AM

Vascular Peripheric Differences In Patients With Chagas Versus Ischemic Heart Failure

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Purpose: Heart failure (HF) is characterized by a complex blend of central and peripheral pathophysiologic alterations, among which is vascular dysfunction and increased arterial stiffness. Applanation tonometry (AT) non-invasively assesses central blood pressure (CBP) and arterial stiffness [augmentation index (Aix)]. The presence of lower arterial compliance (higher Aix) represents an abnormal state and is a prognostic marker in HF. The influence of HF etiology on AT measures has not been explored. Thus, the aim of this study was compare AT measurements in patients with ischemic and Chagas HF.

Methods: Third-two male subjects, 11 ischemic (IS) HF, 10 Chagas (CH) HF, and 11 healthy controls (HC) matched by age and body mass index were included in this analysis. The radial artery pulse wave was measured non-invasively by resting AT.

Results: The Chagasic group had a lower peripheral systolic (SBPp) and central blood pressure (CBP). While the ischemic HF group demonstrated a higher Aix (Table 1). **Conclusion:** The ischemic HF group presented with greater arterial stiffness, reflected by a significantly higher Aix. Otherwise, chagasic patients as healthy control individuals had non increment arterial stiffness. These findings indicate assessment and treatment strategies for arterial stiffness may be more relevant in HF patients with an ischemic etiology. In conclusion, key AT differences were observed in patients with ischemic and Chagas HF, indicating these two HF etiologies present with unique pathophysiologic mechanisms.

Table 1: Applanation Tonometry Measurements.

Variables	Control (m ± sd)	Ischemic HF (m ± sd)	Chagas HF (m ± sd)	P value
SBP _p	118 ± 12.44	113 ± 16.59*	97 ± 14.23 [∞]	0.010
CSP	108 ± 13.97	108 ± 15.29	88 ± 10.10 [∞]	0.0074
Aix	80.27 ± 15.23	93.36 ± 10.74*	80.60 ± 17.91 [∞]	0.049

Legends: SBP_p = Peripheral Systolic Blood Pressure; CSP = Central Systolic Blood Pressure; Aix = Augmentation index. * = significant difference between ischemic HF and control Groups; [∞] = Significant difference between ischemic HF and Chagas HF groups; [∞] = Significant differences between Chagas HF and Control Groups.

2833 Board #353 June 2 9:30 AM - 11:00 AM

Effect of Chronic Lower Limb Heating on Indices of Vascular Function and Functional Capacity in Aged Humans

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In aged adults, acute lower limb heating increases leg blood flow, vascular shear stress, and improves macro- and microvascular dilator function. However, the effect of chronic lower limb heating on indices of vascular function and functional capacity remains unclear. **Purpose:** To test the hypothesis that chronic lower limb heating improves macro- and microvascular dilator function and functional capacity in aged adults. **Methods:** Five healthy aged adults (4 females; age 66 ± 4 years; height 163 ± 4 cm; weight 68 ± 7 kg; mean \pm SD) were exposed to 8 weeks of chronic lower limb heating. Subjects immersed their lower limbs ~33 cm into a heated (~42°C) and circulated water bath 4 days per week, for 45 min per session. Prior to and after the chronic limb heating regimen, duplex ultrasonography was used to assess macro-

(flow-mediated dilation) and microvascular (3 min reactive hyperemia area under the curve) dilator function in the superficial femoral artery following 5 min of arterial occlusion. Functional capacity was assessed via a 6 min walk test. Rating of perceived exertion (Borg scale) was also recorded immediately following the walk test. **Results:** Chronic lower limb heating improved macrovascular dilator function (pre $1.9 \pm 0.2\%$ vs. post $3.2 \pm 0.2\%$; $P = 0.01$), while microvascular dilator function tended to increase (pre 468 ± 89 ml vs. post 562 ± 131 ml; $P = 0.09$). Likewise, distance covered during the 6 min walk test tended to increase following chronic heating (pre 629 ± 36 m vs. post 665 ± 32 m; $P = 0.06$), whereas rating of perceived exertion did not differ (pre 12 ± 1 vs. post 13 ± 1 ; $P = 0.4$). **Conclusions:** Taken together, chronic lower limb heating improves macrovascular dilator function in aged adults, while perhaps improving microvascular dilator function and functional capacity, despite a similar perceived effort. These data suggest that chronic lower limb heating may be an effective therapy to reduce cardiovascular disease risk in aged adults by improving vascular health and functional capacity. Funded by National Institutes of Health (GM-068865 & GM-117693).

2834 Board #354 June 2 9:30 AM - 11:00 AM
The Acute Effect of Aerobic and Resistance Training on Arterial Diameter: A Meta-Analysis
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A positive chronic effect of different exercise modalities on vascular endothelial diameter and function has been reported; however, little is known about the arterial vascular response to acute bouts of exercise. **PURPOSE:** The purpose of the study was to investigate the acute response of two exercise modes (aerobic and resistance training) on the endothelium vascular diameter. **METHODS:** A meta-analysis was planned where the inclusion criteria for studies were: 1) experimental trials; 2) only one exercise session (acute treatment); 3) aerobic (AE) or resistance training (RT) interventions; 4) studies in human adults with no heart disease; 5) studies published only in English language; and 6) studies with pre and post flow-mediated dilation (FMD) measurement. The electronic search was performed in six databases (PubMed, Springer Link, Science Direct, SAGE Journals, Sport Discus and Nature), cross-referencing, and hand searching, using the following combinations of words "Acute exercise FMD", "endothelial exercise function", "vascular exercise endothelium", and "FMD exercise". Hedge's standardized mean difference effect size (ES) was calculated for each result; then, ESs pooled using random-effects models. Non-overlapping 95% confidence intervals ($CI_{95\%}$) were considered statistically significant. Heterogeneity was assessed using Q and I^2 , while funnel plots and Egger's regression test were used to assess small-study effects (potential bias). **RESULTS:** A total of 13 studies were meta-analyzed and 40 ESs computed from 378 (245 men and 133 women) participants. Of the 40 ESs, 27 were on AE, 9 on RT and 4 on control groups (no exercise). The AE training revealed no significant effect on artery diameter ($ES = 0.26$; $CI_{95\%} = 0.00, 0.52$; $Q = 14.2$; $p = 0.11$; $I^2 = 0\%$). The RT interventions indicated no significant effect ($ES = 0.29$; $CI_{95\%} = -0.08, 0.66$; $Q = 0.38$; $p = 0.25$; $I^2 = 0\%$). **CONCLUSIONS:** Neither aerobic or resistance training elicited an acute response on vascular function. More research is needed to better understand the physiological mechanisms responsible for this response.

2835 Board #355 June 2 9:30 AM - 11:00 AM
Dietary Nitrate and Pulse Wave Analysis: Preliminary results
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Nitric Oxide (NO) is a vasodilator naturally produced by an oxygen dependent pathway. In addition, an oxygen independent pathway may also produce NO by the digestion of a dietary nitrate. Lower than normal levels of NO are associated to an increase in central blood pressure. Thus, an increase in dietary nitrates might improve central blood pressure. **PURPOSE:** To determine the effectiveness of an acute dietary nitrate supplement in central blood pressure measured via pulse wave analysis (PWA). **METHODS:** A double-blind, cross-over study design was performed in nine young, healthy subjects (18 to 35 years old). Four lab visits were scheduled within 10 days; the first 2 visits in back to back days and the last 2 visits one week after. Subjects were asked to follow a low-nitrate diet for 3 days (NHLBI: 7 East Low-Nitrate Diet), starting two days prior to the first and third lab visits. Two hours before visits 2 and 4, subjects were asked to drink 800 mg of nitrate or placebo (solutions randomly assigned, both from Beet it, James White Drinks Limited, UK). Values of Central

Systolic Blood Pressure (cSBP), Central Diastolic Blood Pressure (cDBP), Central Augmented Pressure (cAP), Central Pulse Pressure (cPP), Augmentation Index (Aix) and Aix normalized at a heart rate of 75 bpm (Aix@75bpm) were measured with a cuff-based PWA device (SphygmoCor Xcel®). A two-way repeated measurements ANOVA (time x drink) was performed and significance was set at $\alpha = 0.05$. **RESULTS:** There was no significant interaction (time x drink) for any of the studied variables. However, a significant main time effect showing a decrease in cSBP, cAP, Aix, and Aix@75bpm (all $p < 0.05$) was observed.

	Placebo Baseline	Placebo 2 hrs post drink	Nitrate Baseline	Nitrate 2 hrs post drink	ANOVA (time effect)
cSBP (mm Hg)	106 ± 10	104 ± 10	107 ± 8	104 ± 9	< 0.05
cDBP (mm Hg)	71 ± 4	69 ± 9	73 ± 7	69 ± 4	0.12
cAP (mm Hg)	2.6 ± 5.9	3.6 ± 6.7	3.7 ± 6.1	5.5 ± 6.8	< 0.05
cPP (mm Hg)	36 ± 9	35 ± 10	34 ± 9	35 ± 9	0.75
Aix (%)	6.3 ± 13.7	7.7 ± 16.3	9.1 ± 13.3	13.8 ± 13.1	< 0.05
Aix@75bpm (%)	-1.6 ± 15.8	-0.2 ± 18.2	1.5 ± 15.1	6.2 ± 13.74	< 0.05

CONCLUSION: These preliminary results show that dietary nitrate supplement, on average, has minimal effects on central blood pressure and PWA in young healthy individuals. Trends on some decrease of cSBP, cAP, Aix, and Aix@75bpm after drinking dietary nitrate might improve if increasing the sample size.

2836 Board #356 June 2 9:30 AM - 11:00 AM
Impact of Prolonged Sitting on Central Cardiovascular Hemodynamics and Aortic Vascular Stiffness
 Anna K. Downey¹, Edward T. Kelley¹, Jaume Padilla², Daniel P. Credeur¹. ¹University of Southern Mississippi, Hattiesburg, MS. ²University of Missouri, Columbia, MO.
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 (No relationships reported)

Recent studies demonstrate that single bouts of prolonged, uninterrupted sitting (3-6 hours) can negatively impact peripheral vascular health (i.e., decreased endothelial function and reduced blood flow-induced shear stress in legs). It is unknown whether or not prolonged, uninterrupted sitting can have a similar impact on central cardiovascular hemodynamics and vascular stiffness. **PURPOSE:** To test the hypothesis that prolonged sitting will increase central blood pressure, aortic pulse wave reflection and vascular stiffness in healthy, college-aged individuals. **METHODS:** In 6 subjects (Age=23±1 yrs, BMI=30±kg/m², 3 males and 3 females), brachial artery pulse wave analysis was performed before (baseline-BL), during (10, 60, 120, and 180 mins), and immediately after 3 hours of uninterrupted sitting. Aortic pulse wave velocity (PWV, an index of vascular stiffness) was also examined before and after sitting using carotid applanation tonometry coupled with oscillometry performed on the upper-thigh. **RESULTS:** Over the course of sitting, no significant change was noted for heart rate ($P > 0.05$). Peripheral (brachial) systolic blood pressure (BP) and mean arterial pressure (MAP) were greater than central (aortic) systolic BP and MAP across all time points; however, both exhibited a biphasic response to sitting, characterized by an initial decrease at 60 mins, with a return to baseline at 180 mins (e.g., MAP at BL=90±4; vs. 60 mins=82±4, $P = 0.001$; vs. 180 mins sitting=87±3 mmHg, $P > 0.05$). No change was noted for peripheral and central diastolic BP across all time points ($P > 0.05$). Augmentation pressure (AP) and index (Aix), wave reflection height (Pb) and magnitude (RM%) all exhibited a significant decrease over the course of 3 hours sitting, most notable at 180 mins (e.g., Aix at BL=7±6, vs. 180 mins sitting=-8±3%, $P = 0.03$). No change was observed for aortic PWV in response to sitting ($P > 0.05$). **CONCLUSION:** These preliminary findings indicate that a single bout of prolonged, uninterrupted sitting results in a significant alteration in central cardiovascular hemodynamics (i.e., decreased aortic pulse wave reflection), with no change occurring in aortic vascular stiffness.

2837 Board #357 June 2 9:30 AM - 11:00 AM
Vascular and Temperature Changes During and After Applications of Superficial Heat Therapy
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 (No relationships reported)

Although superficial heat treatments—such as moist heat pack (MHP) and warm whirlpool (WLP)—are common for musculoskeletal injuries, treatment effects of MHP and WLP in terms of vascular and temperature responses are not clear. **PURPOSE:** To assess changes vascular (volume, diameter, and velocity of blood flow) and temperature (skin and inner tissue—2.5 cm deep) reaction on ankle joint during and

after applications of MHP and WLP. **METHODS:** Nineteen healthy adults underwent one of three treatment sessions (45 °C of MHP or WLP, or control: no treatment for 20-min). Vascular reactions were measured using a Doppler ultrasound (4 MHz) at the posterior tibial artery (10 cm above the medial malleolus). Temperature probes (60 Hz) were attached on the skin of lateral foot (1 cm below from the lateral malleolus for skin and inner tissue—insulated by neoprene fabric. After baseline measurements, each treatment was randomly applied to the area just below from the right lateral malleolus. Each measurement was recorded at baseline and every 3-min thereafter until the end of the protocol (total time: 42-min). To test treatment effects over time, 3×16 mixed model ANOVAs and Tukey-Kramer post-hoc tests were performed ($p<0.05$). **RESULTS:** From the baseline values, WLP immediately increased volume (50%, $p<0.0001$) and velocity (46%, $p<0.0001$) of blood flow, and increased values were maintained during treatment ($F_{30,846}=3.6$, $p<0.0001$). After the removal of WLP, increased values were maintained for 13-min as compared to baseline ($p=0.02$). MHP did not produce any change in vascular reaction. Both MHP (2 °C, $p<0.0001$) and WLP (6 °C, $p<0.0001$) immediately increased skin temperature, and increased temperatures were maintained until the removal of both treatments ($F_{30,846}=47.6$, $p<0.0001$). Both MHP (4 °C, $p<0.0001$) and WLP (6 °C, $p<0.0001$) took 3-min to increase temperature in the inner tissue ($F_{30,846}=52.9$, $p<0.0001$). An increased temperature (2 °C from baseline) was maintained for 10-min (MHP) and 12-min (WLP) after the removal of each treatment. **CONCLUSIONS:** When treating tissues, especially located in 2.5 cm deep (e.g. ankle sprain), WLP may produce a similar effect as deep thermotherapy since it increases vascular response and inner tissue temperature. Application of MHP should be reconsidered as it does not affect vascular reaction at all.

E-41 Free Communication/Poster - Women-Exercise Responses

Friday, June 2, 2017, 7:30 AM - 12:30 PM
Room: Hall F

2838 Board #358 June 2 11:00 AM - 12:30 PM Effects of Aquarobic Exercise on Senior Fitness, Prostaglandin I₂, and Thromboxane A₂ in Elderly Korean Women

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¹Pusan National University, Busan, Korea, Republic of. ²Busan National University of Education, Busan, Korea, Republic of.
(No relationships reported)

South Korea is fast approaching an aging society phase, as 9.5% the population was aged 65 and older in 2006, and is expected to be 14.3% in 2018 and 20.8% in 2026, entering the aging society and the ultra-aging society phases, respectively, based on the United Nation's standard.

PURPOSE: The purpose of this study was to analyze the effects of aquarobic exercise on senior fitness, prostaglandin I₂ (PGI₂), and thromboxane A₂ (TXA₂) in elderly Korean women. **METHODS:** Thirty two healthy elderly, women aged 74.11 ± 4.12 years, were randomly assigned to aquarobic exercise group (EX; n = 11) trained for 12-week or to a “non-exercise” control (Con; n = 11) group. The variables of senior health-related fitness, PGI₂, and TXA₂ were measured in all the participants before and after the 12-week study. This intervention trial was designed to compare pre- and post-exercise intervention variables. Changes from baseline to the end of the intervention were determined by a paired *t*-test and independent *t*-test.

RESULTS: The results of the present study were consistent with the findings of the previous studies, as the cardiorespiratory endurance (492.55±73.92 vs. 414.50±19.87 m), muscular strength (24.99±1.93 vs. 19.29±1.96 kg), muscular endurance (24.05±5.38 vs. 19.38±5.39 times/30sec), and flexibility (13.32±5.00 vs. 11.56±5.04 cm) increased significantly in the aquarobic exercise group ($p < 0.05$). The results of the present study show no changes in prostaglandin I₂ and thromboxane A₂ levels in any group; however, the program participation led to the balance between PGI₂ and TXA₂, which is consistent with the finding of previous research. This result likely reflects the positive effect of the sustained aquarobic exercise on senior physical fitness and functioning.

CONCLUSIONS: The findings of this study discussed so far indicate that aquarobic exercise has a positive effect on senior health-related fitness, highlighting the importance of aquarobic exercise for elderly women.

2839 Board #359 June 2 11:00 AM - 12:30 PM

Total Workload And Energy Expenditure During And After A Bodypump Session In Overweight Women

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(No relationships reported)

PURPOSE: Resistance training is part of the physical activity recommendations for overweight and obese individuals, and the health- and fitness industry is a popular venue to perform resistance training. Group exercise sessions, like BodyPump, is a popular alternative with over 5 million participants weekly, as well as individual heavy load resistance training. BodyPump is a high-repetition low- to moderate load session, claimed to burn up to 540 calories each session. The purpose of this study was to estimate total exercise workload and energy expenditure during a one-hour session with BodyPump, and to compare these outcomes with a time-matched session of traditional individual heavy load resistance training. **METHODS:** Eighteen previously untrained, overweight women participated in the study (mean age 36.4 years ±10.1, BMI 29.8 kg/m²±4.6), ten exercising BodyPump and eight heavy resistance training (8 repetition maximum [RM] x 3 set). Exercise workloads were estimated by multiplying load (kg) x repetitions x sets, and energy expenditure was assessed with indirect calorimetry, during the sessions. RMR was estimated before and twice after the sessions (0-20 min and 120-140 min). **RESULTS:** The participants exercising BodyPump lifted significantly more loads than the heavy resistance training group (19485 kg ±2258 vs 15616 kg ±2976, $p=0.006$), while the energy expenditure was similar with 302 kcal ±67 in BodyPump and 289 kcal ±69 in the heavy resistance training group ($p=0.69$). With no group differences, RMR 0-20 min post-exercise increased by 31% after BodyPump, and 27% after heavy resistance training. **CONCLUSION:** One session of BodyPump resulted in a higher total workload compared to traditional heavy load resistance training. In contrast, the energy expenditure during exercise and changes in RMR were similar between the groups. With a modest energy expenditure of approximately 300 calories, the women did not reach the claimed energy costs during a BodyPump session.

2840 Board #360 June 2 11:00 AM - 12:30 PM

Can The Lamberts Submaximal Cycle Test Reflect Overreaching In Professional Female Cyclists?

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(No relationships reported)

Purpose: The Lamberts and Lambert Submaximal Cycle Test (LSCT) consists of 3 stages during which cyclists cycle for 6 minutes at 60%, 6 minutes at 80% and 3 minutes at 90% of their maximal heart rate, followed by one minute recovery. It was the aim of this study to determine if the LSCT is able to reflect a state of functional overreaching in professional female cyclists during an 8 day training camp and the following recovery days.

Methods: Six professional female cyclists performed an LSCT on day 1, day 5 and day 8 of the training camp and 3 days after the training camp. During each stage of the LSCT, power output and rating of perceived exertion (RPE) were determined. Training diaries and profile of mood status (POMS) were also completed and results were analyzed by repeated measures ANOVA to verify differences between day 1, day 5, day 8 and day +3. To investigate differences in performance parameters (P60, P80, P90, RPE, HRR), a contemporary approach of data analysis using magnitude-based inferences was employed, where chances for meaningful changes (larger than normal day-to-day variability) were assessed as “likely” (> 75-95%), “very likely” (> 95-99%) and “most likely” (> 99%).

Results: Power output and RPE during the 2nd stage of the LSCT were “likely” higher on day 5 and “very likely” (power) and “most likely” (RPE) higher on day 8, compared to day 1. During the 3rd stage of the LSCT, power output and RPE were “likely” higher on day 5 and “very likely” (power) and “likely” (RPE) higher on day 8, compared to day 1. On day 8, increased power output and RPE during these stages were accompanied by the inability to reach 90% of their maximal heart rate. All athletes reported increased feelings of fatigue ($F(2,10)=17.43$; $p=.001$) and muscle soreness ($F(2,10)=6.5$; $p=.02$). No significant changes were found in any of the parameters of the POMS (anger, vigor, fatigue, depression), nor in the energy-balance (vigor-fatigue) during and after the training camp. After 3 days of recovery, all parameters of the LSCT returned to baseline, indicating a state of functional overreaching during the training camp.

Conclusion: The LSCT can be used to reflect a state of functional overreaching in elite professional female cyclists during an 8 day training camp and the following recovery days.

2841 Board #361 June 2 11:00 AM - 12:30 PM
Acute Inflammatory and Blood Pressure Response to Episodic Resistance Exercise in Young, Healthy Females
 Katherine LeWine, Elizabeth Mullin, Brian Thompson, Samuel A.E Headley, FACSM. *Springfield College, Springfield, MA.*
 (Sponsor: Dr. Samuel Headley, FACSM)
 (No relationships reported)

Several chronic illnesses are characterized by low-grade chronic inflammation, resulting in increased levels of circulating pro-inflammatory cytokines. Exercise has been shown to reduce the levels of circulating cytokines, as well as create an anti-inflammatory environment through the release of interleukin-6 from skeletal muscle. **PURPOSE:** The current study was designed to investigate whether or not family history of hypertension affected levels of interleukin-6 (IL-6) and systolic blood pressure (SBP) in young, physically active females, in response to an acute bout of resistance exercise. **METHODS:** A total of 14 females (age = 23.14 ± 2.28 years) completed the study. Subjects were split into two groups of seven based on familiar pre-disposition of hypertension. Subjects completed a resistance protocol of three sets of 10 at 67% of 1 repetition maximal. Blood samples and SBP was taken pre-exercise, post-exercise, and 1-hr post exercise. **RESULTS:** No significant interaction ($p > .05$) was found for levels of IL-6 or SBP between both groups. No change in IL-6 was found from pre to post exercise ($p = .942$). A significant main effect ($p < .05$) was found for SBP across the time periods. Post-systolic blood pressure was higher immediately following exercise ($p = .000$, $M_{pre} = 110.28$, $M_{post} = 123.00$) and decreased to baseline or lower after 60-minutes of recovery ($p = .000$, $M_{pre} = 123.00$, $M_{60post} = 107.71$). **CONCLUSIONS:** The results of this study indicate that family history of hypertension does not affect the levels of IL-6 or SBP in young, healthy females following resistance exercise. However, systolic blood pressure can decrease following a 60-minute recovery, after an acute bout of resistance exercise to levels at baseline or below.

2842 Board #362 June 2 11:00 AM - 12:30 PM
Effect of Combined Exercise on Urinary Incontinence in Postmenopausal Women
 Sun Young Na¹, Nan Hee Lee², Chung Moo Lee¹, John D. Smith², Sukho Lee². ¹*Sookmyung Women's University, Seoul, Korea, Republic of.* ²*Texas A&M University San Antonio, San Antonio, TX.*
 (No relationships reported)

The risk factors of stress urinary incontinence (SUI) are obesity, diabetes, metabolic syndrome, and pelvic floor dysfunction in postmenopausal women. Combined exercise with aerobic and resistance training included core exercise would be effective intervention for the SUI. **PURPOSE:** To investigate the effect of combined exercise program (CEP) on SUI in postmenopausal women. **METHODS:** This study was conducted with stratified random sampling, random assignment and a pre-post test design. Forty-two postmenopausal women with SUI (58.95 ± 4.16 years old) were divided into an exercise group (EG) and control group (CG) and categorized for metabolic syndrome (MEG, N=7; MCG, N=7), obesity (OEG, N=7; OCG, N=7), and normal (NEG, N=7; NCG, N=7) conditions, respectively. The CEP consisted of 12 weeks aerobic (40-75 % of Heart Rate Reserve and 11-13 based on Rate of Received Exertion, 50-70 minutes, 3 times/week) and resistance training to strengthen the core muscles for total body training. Control groups maintained their normal daily lifestyle. Vaginal contraction, HOMA-IR, estradiol (E_2), and body composition were assessed. Repeated measures ANOVAs were used to determine differences between each condition. **RESULTS:** Duration of vaginal contraction ($F=15.410$, $p=.002$) and HOMA-IR ($F=5.729$, $p=.034$) in the MEG were significantly improved compared with MCG. Peak pressure of vaginal contraction ($F=14.706$, $p=.002$), average pressure of vaginal contraction ($F=20.839$, $p=.001$), and % fat ($F=134.440$, $p=.000$) in the OEG were significantly improved compared with OCG. **CONCLUSION:** The CEP has efficacy for SUI prevention and alleviation by increasing pelvic floor muscle contraction, specifically for postmenopausal women with metabolic syndrome and obesity, as improving insulin resistance and body fat.

2843 Board #363 June 2 11:00 AM - 12:30 PM
Effect of Etiologically Mediated Cardiorespiratory Dysfunction on Resistance to Fatigue in Women with Systemic Lupus Erythematosus (SLE)
 Liana C. Wooten, Monira I. Aldhahi, Randall E. Keyser, FACSM, FACSM. *George Mason University, Fairfax, VA.*
 (No relationships reported)

Impaired cardiorespiratory function can mediate reductions in resistance to fatigue during physical activity. Women with systemic lupus erythematosus (SLE) incur excessive levels of fatigue (SLE-fatigue) with previously reported evidence of cardiorespiratory limitations that are etiologically mediated. The potential cardiorespiratory endurance limitations have yet to be investigated in this population. **Purpose:** To characterize cardiorespiratory endurance in women with SLE using submaximal, sustained work rate exercise testing. **Methods:** 15 subjects, 7 women with SLE (39.7±7.5 years; 69.2±7.6 Kg) and 8 sedentary but otherwise healthy controls (40.1±2.9; 73.4±17.7 Kg) completed a 5-MET sustained work rate endurance test ending at volitional exhaustion or when 60 minutes of treadmill walking time had accrued. VO_2 kinetics transition constant (Kt) and amplitude (ΔVO_2) were measured. Data were analyzed using independent t-tests and statistical significance was set at $p < 0.05$. **Results:** There were no significant differences in cardiorespiratory function between groups at baseline. Total time duration on the treadmill (27.5±9.6 vs 57.4±7.0 min; $p > 0.01$), Kt (8.4±2.8 vs 13.4±4.4; $p = 0.02$), and ΔVO_2 (0.65±0.17 vs 0.85±0.17 Liters, $p = 0.04$) were decreased in the SLE group compared to controls. **Conclusion:** Previous studies have characterized relationships between overall patient-perceived fatigue severity, performance fatigability and etiologically mediated cardiorespiratory dysfunction in women with SLE. The current study expands on this evidence suggesting that decreased cardiorespiratory endurance may be mediated through delayed metabolic transition during physical activity in these women. The inability to sustain the energy requirements requisite for a 5-MET work rate accentuate the severity of functional limitations ultimately impacting health-related quality of life in this population. NIH/NICHD 1R03HD39775

F-01 Highlighted Symposium - Move to the Rhythm: Circadian Orchestration of Exercise and Muscle Biology

Friday, June 2, 2017, 1:00 PM - 3:00 PM
Room: 201

2844 **Chair:** John C. Quindry, FACSM. *University of Montana, Missoula, MT.*

(No relationships reported)

2845 June 2 1:10 PM - 1:40 PM

Keynote - Can Circadian Clocks Anticipate Periods of Activity and Energetic Demand?

Martin E. Young, *University of Alabama at Birmingham, Birmingham, AL.*

Reported Relationships: M.E. Young; *Consulting Fee; Merck.*

2846 June 2 1:40 PM - 1:55 PM

Does the Cardiomyocyte Circadian Clock Influence Size of the Heart?

Graham R. McGinnis, John C. Chatham, Martin E. Young, *University of Alabama at Birmingham, Birmingham, AL.*

(No relationships reported)

Circadian clocks, driven by the transcription factors Clock (circadian locomotor output cycles kaput) and Bmal1 (brain and muscle arnt-like 1), are sophisticated mechanisms that regulate 24-hr rhythms in numerous physiological processes ranging from gene expression to behavior. The cardiomyocyte clock has been shown to regulate cardiac metabolism and function, and its disruption decreases lifespan. However, the role of the circadian clock in regulating cardiomyocyte growth remains unknown. **PURPOSE:** To determine the role of the cardiomyocyte circadian clock in regulating hypertrophic growth of the heart. **METHODS:** We used mice with genetically disrupted clocks specifically within the heart (Cardiomyocyte-specific Bmal1 Knockout; CBK) and littermate control mice (CON) to investigate the role of the cardiomyocyte circadian clock on cardiac growth/size. Signaling was assessed through Western blotting, while rates of protein synthesis were measured using radiolabeled tracers (both in vivo and ex vivo). Rapamycin feeding (14 ppm and 42 ppm, 10 days) was utilized to pharmacologically inhibit mTOR. **RESULTS:** We found that disruption of the cardiomyocyte circadian clock leads to increased activation of the Akt/mTOR/S6 signaling axis in the heart. Rates of protein synthesis displayed a diurnal rhythm in CON mice (highest at ZT0) in vivo, which was chronically elevated in CBK mice; the same genotype effect was seen in ex vivo perfused hearts. CBK hearts exhibited increased heart size (relative to CON hearts), which was normalized by rapamycin feeding. **CONCLUSION:** Genetic disruption of the cardiomyocyte circadian clock leads to chronic activation of the Akt/mTOR/S6 signaling axis in the heart, associated with increased protein synthesis and size.

2847 June 2 1:55 PM - 2:25 PM

Keynote - Time of Exercise as a Muscle Clock Setter

Karyn A. Esser, FACSM. *University of Florida, Gainesville, FL.*

(No relationships reported)

2848 June 2 2:25 PM - 2:40 PM

Regulation of the Skeletal Muscle Circadian Transcriptome by the Master Myogenic Regulatory Factor, Myod1

Brian A. Hodge¹, Xiping Zhang², Karyn A. Esser, FACSM². ¹*Buck Institute for Research on Aging, Novato, CA.* ²*University of Florida, Gainesville, FL.*

(No relationships reported)

Molecular clocks are comprised of interlocking transcriptional:translational feedback loops that promote circadian rhythms in physiology through controlling downstream gene expression in a temporal and tissue-specific fashion. The mechanisms in which the core clock factors (ubiquitously expressed in all tissues) target skeletal muscle specific genes are poorly understood. **PURPOSE:** Here we investigate the role of the muscle specific factor MYOD1 in regulating skeletal muscle circadian gene expression. **METHODS:** Dual-luciferase assays and real-time bioluminescence (Lumicycle) were performed in C2C12 myotubes to determine transcriptional responses and rhythmic expression patterns of the muscle specific circadian gene, Titin-cap (Tcap), with over expression of the core-clock genes BMAL1:CLOCK with

MYOD1. To identify genome-wide binding sites for BMAL1:CLOCK and MYOD1 we performed chromatin immunoprecipitation and ultra-high throughput sequencing (ChIP-Seq) in wildtype C57BL/6 quadriceps and C2C12 myotubes. HOMER software was utilized for Next-Gen sequencing analysis. **RESULTS:** We utilized a bioinformatics approach to identify Tcap as a skeletal muscle specific, circadian gene. Interestingly, we found that MYOD1 transactivates Tcap in a synergistic fashion with BMAL1:CLOCK and enhances Tcap's circadian amplitude. Three e-box elements within the Tcap promoter are required for cooperativity between the clock factors and MYOD1. ChIP-Seq analysis in skeletal muscle indicated that MYOD1 targets a large subset of the skeletal muscle circadian transcriptome. **CONCLUSION:** These findings support the hypothesis that MYOD1 is a key regulator of circadian gene expression in skeletal muscle.

June 2 2:40 PM - 3:00 PM

Overall Discussion

F-08 Basic Science World Congress - Thematic Poster - Neuroplasticity and Cerebral Perfusion

Friday, June 2, 2017, 1:00 PM - 3:00 PM
Room: 304

2875 **Chair:** Hirofumi Tanaka, FACSM. *University of Texas at Austin, Austin, TX.*

(No relationships reported)

2876 Board #1

June 2 1:00 PM - 3:00 PM

Habitual Physical Activity Mitigates the Adverse Effects of Metabolic Syndrome on Arterial Stiffness and Cerebral White Matter Integrity

Evan P. Pasha, Alex C. Birdsill, Stephanie Oleson, Andreana P. Haley, Hirofumi Tanaka, FACSM. *The University of Texas at Austin, Austin, TX.* (Sponsor: Hirofumi Tanaka, FACSM)

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(No relationships reported)

PURPOSE: Metabolic syndrome (MetS) adversely affects the vasculature and cerebral white matter integrity. Arterial stiffening has been associated with diminished cerebral white matter integrity. Habitual physical activity (PA) can ameliorate components of MetS and subsequently affect arterial stiffening and white matter integrity. Our aim was to determine the role of habitual PA on mitigating the adverse influence of MetS on arterial stiffness and cerebral white matter integrity. **METHODS:** Sixty-six middle-aged adults (40-62 years) composed of 27 healthy, 18 sedentary MetS (Sed MetS), and 21 physically active MetS individuals (Active MetS) were studied. Carotid artery stiffness was assessed via simultaneous ultrasound and tonometry. Cerebral white matter integrity was measured using diffusion tensor imaging through metrics of fractional anisotropy (FA) and mean diffusivity (MD). **RESULTS:** Carotid β -stiffness index in Active MetS was lower than Sed MetS but was not different from Healthy controls (6.6 ± 1.5 , 7.7 ± 2.1 , and 5.6 ± 1.6 au, $p=0.001$). The same group pattern was observed with white matter microstructural integrity in regions of interest (ROIs). Mean ROI FA was significantly greater in Active MetS compared with Sed MetS but was not different from Healthy controls (0.54 ± 0.03 , 0.51 ± 0.02 , and 0.53 ± 0.02 au, $p=0.012$). Mean ROI MD was significantly lower in Active MetS compared with Sed MetS but was not different from Healthy controls (0.85 ± 0.05 , 0.89 ± 0.05 , and 0.86 ± 0.05 mm²/s, $p=0.019$). **CONCLUSION:** Middle-aged individuals with MetS who habitually perform PA demonstrated lower arterial stiffness and more favorable cerebral white matter integrity than their sedentary peers, indicating that habitual exercise may be effective in mitigating the adverse effects of MetS on the vasculature and brain at midlife.

This work was supported by grants from the NIH, NINDS (to APH) and the NSF (to AB).

2877 Board #2 June 2 1:00 PM - 3:00 PM
Changes in Brain Perfusion Following Weight Loss are Associated with Changes in Body Mass Index

Chelsea M. Stillman¹, Jennifer C. Watt², Renee J. Rogers³, John M. Jakicic, FACSM³, Kirk I. Erickson³. ¹University of Pittsburgh School of Medicine, Pittsburgh, PA. ²University of Pittsburgh, Pittsburgh, PA. ³University of Pittsburgh, Pittsburgh, PA.
 (Sponsor: John Jakicic, FACSM)
 (No relationships reported)

PURPOSE: Being overweight or obese, defined as having a body mass index (BMI) of 25 or greater, is associated with brain hypoperfusion. However, it is unknown to what extent obesity-related hypoperfusion can be reversed following weight loss. Further, the relative contributions of diet and physical activity (PA) on brain perfusion are poorly understood. The aim of the present study was to examine changes in brain perfusion following weight loss, and to relate changes in perfusion to changes in BMI. **METHODS:** 121 healthy adults (M±SD = 44.3±8.6 years old; 95 female) completed a 12-month randomized controlled trial involving an energy restricted diet (diet-only), a diet + 150 minutes of moderate intensity PA per week (Mod-PA), or diet and 250 minutes of moderate intensity PA per week (High-PA). Participants also completed MRI scans before and after the intervention, including a pseudocontinuous arterial labeling (pcASL) scan. Changes in brain perfusion were assessed with a voxelwise linear regression to examine regions where changes in brain perfusion covary with changes in BMI. Results were corrected for multiple comparisons at a threshold of $p < .05$, $k > 15$. **RESULTS:** There was a significant reduction in BMI following the intervention, suggesting that it was effective at facilitating weight loss, regardless of group ($M(SD) = 2.4 \pm 3.3$ kg/m², $p < .001$). Brain perfusion following the intervention increased across the brain, particularly in the medial temporal lobe and prefrontal cortex. Changes in BMI were correlated with baseline-to-post intervention increases in brain perfusion in two clusters in the right medial prefrontal cortex ($r(105) = .21$, $p = .03$, peak MNI xyz = 43, 98, 40, $k = 42$; $r(105) = .21$, $p = .03$, peak MNI = 42, 80, 27, $k = 37$). **CONCLUSIONS:** A 12-month intervention involving diet alone, or diet combined with PA effectively increased brain perfusion across the brain. Collapsing across intervention groups, the magnitude of weight loss (via changes in BMI) was positively correlated with changes in prefrontal brain perfusion. The regional specificity of this later finding is important as it suggests that weight-loss may have the greatest effects on brain health in regions that are particularly vulnerable to obesity. Future work will identify whether these effects are being driven by changes in PA, diet, or both.

2878 Board #3 June 2 1:00 PM - 3:00 PM
Effect of Sex on arterial hemodynamics and Cerebral Blood Flow Dynamics Following Acute Resistance Exercise.

Alexander J. Rosenberg, Sang Ouk Wee, Elizabeth C. Schroeder, Kanokwan Bunsawat, Georgios Grigoriadis, Badeia M. Saed, Bo Fernhall, FACSM, Tracy Baynard, FACSM. University of Illinois at Chicago, Chicago, IL.
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 (No relationships reported)

Resistance exercise (RE) is recommended for men and women and is important for improving cardiovascular (CV) and metabolic disease risk factors. High-intensity RE acutely increases arterial stiffness and blood pressure (BP), coupled with reduced cerebral blood flow velocity (CBFv) and greater flow pulsatility in the cerebral circulation, which may be detrimental to cerebral microvasculature. Because females have different CV control mechanisms, it is important to assess potential sex differences in cerebral vascular responses to acute RE. **PURPOSE:** To examine the effect of sex on hemodynamics and cerebral vascular responses following acute RE in young recreationally active men and women. **METHODS:** Healthy men ($n = 11$, 28 yrs, BMI = 24.6) and women ($n = 9$, 25 yrs, BMI = 23.2) performed RE (3 sets of 10 repetitions of isokinetic concentric/concentric unilateral knee flexion/extension). Measurements were obtained at baseline and post-exercise (1, 5, 30 min). Beat-to-beat heart rate (HR), brachial BP (bSBP, bDBP, bMAP), cardiac output (CO), stroke volume (SV) and end-tidal CO₂ were collected. CBFv was measured by transcranial Doppler. Carotid BP (cSBP, cDBP, cMAP) measurements were obtained using applanation tonometry. Central pulse wave velocity (PWV) was measured by an automated ambulatory BP monitor. **RESULTS:** See table. Mean CBFv increased 1-min post-exercise and decreased below baseline 5-min post-exercise ($p < 0.01$) in both groups. CBFv pulsatility increased following RE and was elevated above baseline 5-min post-exercise ($p < 0.01$) in both groups. PWV increased 1-min post-exercise ($p < 0.01$) in both groups. Most variables returned to baseline at 30 min. **CONCLUSION:** RE increased central arterial stiffness, mean CBFv and CBFv pulsatility similarly for both sexes. Although CO increased at 5-min, CBFv dropped below baseline and pulsatility continued to rise above baseline. This temporary disruption in cerebral autoregulation may impact brain health in both sexes.

2879 Board #4 June 2 1:00 PM - 3:00 PM
Effects Of Exercise-induced Hypohydration On Brain Structure And Function, A MRI Study

X. r. Tan¹, Ivan C. C. Low¹, Mary C. Stephenson², T. Kok², Heinrich W. Nolte³, T. W. Soong¹, Jason K. W. Lee, FACSM⁴. ¹National University of Singapore, Singapore, Singapore. ²Agency for Science, Technology Research, Singapore, Singapore. ³ERGOnomics TEChnologies, Pretoria, South Africa. ⁴DSO National Laboratories, Singapore, Singapore.
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 (No relationships reported)

Hypohydration exceeding 2% body mass is known to impair endurance capacity. It is hypothesized that the central nervous system, specifically the brain, is negatively affected by hypohydration, leading to a decline in endurance capacity.

PURPOSE:

To investigate the effects of exercise-induced hypohydration on the brain.

METHODS:

Ten trained endurance males (mean±sd: age 23.3±1.1 years; body fat 10.5±2.4%; VO_{2peak} 65±5 ml kg⁻¹ min⁻¹) were dehydrated to -3% body mass by running on a treadmill at 65% VO_{2peak} in a 25°C environment, before drinking to replace 100% or 0% of fluid losses in two randomized, counterbalanced trials. Participants underwent MRI scans at baseline and post-fluid replacement to examine brain volume, functional activity and cerebral perfusion. Magnetic resonance spectroscopy was used to measure brain temperature (at primary motor cortex) before and during the dehydration run. Endurance capacity was assessed by running to exhaustion at 75% VO_{2peak}. Results were assessed using paired sample T-test with $p < 0.05$ considered significant.

RESULTS:

MRI results demonstrated a reduction in total brain volume in hypohydration (HH) as compared to euhydration (EU) trials (EU: 1.007, HH: 0.993; $p = 0.003$). BOLD (blood-oxygen-level dependent) activation in the primary motor (M1) and somatosensory cortex (S1) during a plantar flexion task were similar between conditions (M1: $p = 0.314$, S1: $p = 0.332$). Global and regional cerebral perfusion remained unchanged between conditions (Global: $p = 0.055$, M1: $p = 0.447$, S1: $p = 0.458$). Brain temperature measured at baseline was higher than core temperature (Brain: 37.7±0.5°C, Core: 36.7±0.3°C; $p < 0.0001$). However, both temperatures were similar during exercise (Brain: 38.2±0.4°C, Core: 38.6±0.3°C; $p = 0.110$). Endurance capacity was reduced with hypohydration (EU: 45.2±9.3 min, HH: 38.4±10.7 min; $p = 0.033$).

CONCLUSION:

Under hypohydration, the endurance capacity is impaired and total brain volume is reduced. Brain functional activity and cerebral perfusion are notably well-preserved. Brain temperature could be regulated within a narrower homeostatic range than the core temperature.

Supported by DIRP Grant, PA No. 9015102335 and funding from ERGOTECH, South Africa.

2880 Board #5 June 2 1:00 PM - 3:00 PM
Cerebral Blood Flow during Dynamic Exercise Correlates with Blood Pressure in Autonomic Brain Regions

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PURPOSE: During dynamic exercise changes in cerebral blood flow (CBF) has been demonstrated. While global CBF remains stable in the prolonged exercise via cerebral autoregulation, alterations in BP would be associated with fluctuation of regional CBF (rCBF). However, association between rCBF and BP during exercise has not been elucidated. The aim of the present study is to examine changes in rCBF evoked by dynamic exercise using positron emission tomography (PET) and to identify brain regions where rCBF correlates with BP. **METHODS:** Twelve healthy young males performed 20 min cycling exercise and rCBF were measured using oxygen-15-labeled water and PET (Discovery PET/CT, GE) at the baseline (Rest), during and after exercise. Heart rate (HR) and mean blood pressure (MBP) were monitored. With the accumulated image and the measured arterial input function, rCBF was calculated using the autoradiographic method. For an anatomical reference, individual brain MRI scans were acquired and the image data were analyzed using SPM software and the quantitative analysis of rCBF was performed using Dr. View software. **RESULTS:** During exercise HR and MBP increased to 119 ± 8 bpm and 107 ± 13 mmHg, respectively, at the endpoint of exercise. At 20 min after exercise, MBP significantly decreased compared to Rest, from 91 ± 8 to 86 ± 10 mmHg ($P < 0.05$). rCBF increased in the sensorimotor cortex and cerebellar vermis during exercise ($P < 0.001$, uncorrected). Following exercise rCBF decreased in the frontal lobe in the

($P < 0.005$, uncorrected). rCBF increased by 35 % during exercise and decreased by 12 % at 20 min after exercise compared with Rest. Regression analysis revealed that rCBF in the midbrain, left hippocampus and right anterior cingulate gyrus over the course of exercise ($P < 0.05$, corrected).

CONCLUSIONS: The present study suggest that dynamic exercise induced fluctuation in rCBF as well as BP. The regression analysis implies that brain regions including brainstem hippocampus and cingulate gyrus might be susceptible to changes in BP. As light- to moderate-intensity exercise evoked post exercise hypotension, these findings are associated with brain center of autonomic function which is regulated via connection between brainstem regions and cardiovascular structures, the central baroreflex network.

2881 Board #6 June 2 1:00 PM - 3:00 PM
Fitness, Independent Of Physical Activity Is Associated With Cerebral Blood Flow In Older Adults At-risk For Alzheimer's Disease

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Cardiorespiratory fitness (CRF) and physical activity (PA) are positively associated with cognition and may mitigate pathological changes that occur with age and Alzheimer's disease (AD). However, there is limited information on the interaction between CRF and PA in predicting brain health in older adults. Throughout aging and the AD cascade, patterns of decreased cerebral blood flow (CBF) are apparent and vascular health abnormalities have been postulated as a precursor to downstream pathologies such as amyloid-beta accumulation and neuronal dysfunction. Limited research suggests that CRF is positively associated with CBF. However, no study to date has examined CRF and PA concomitantly with CBF. **Purpose:** To determine the unique contributions of CRF and moderate-vigorous physical activity (MVPA) when predicting CBF in an older adult population at-risk for AD. **Methods:** 159 cognitively healthy (MMSE ≥ 24) adults (mean age = 63.8, SD = 5.4) from the Wisconsin Registry for Alzheimer's Prevention participated in this study. Participants performed a graded maximal exercise test to measure CRF (VO_{2peak} , ml/kg/min) and wore a triaxial accelerometer on their hip for seven consecutive days to quantify their PA behaviors. Participants also underwent MRI scanning where CBF was measured using pseudocontinuous ASL. CBF was sampled from 5 brain regions implicated in AD using the Alzheimer's Disease Neuroimaging Initiative FDG Meta-ROI suite. **Statistical analyses:** Pearson correlation was used to examine the association between CRF and MVPA. Multiple linear regression was used to determine whether CRF and/or MVPA were significant and independent predictors of CBF. **Results:** CRF and MVPA were moderately correlated ($r = .37$; $p < .05$), suggesting these two constructs may provide unique contributions to CBF. Regression analysis revealed CRF was significantly and positively associated with CBF while accounting for minutes of MVPA, accelerometer wear time, age, gender, and global cerebral blood flow ($p < .05$). **Conclusions:** Results suggest fitness level, independent of physical activity, is associated with greater CBF in regions that decline with aging and AD. Cardiorespiratory fitness appears to be an important physiological component of brain health in older adulthood that is not explained by physical activity behaviors.

2882 Board #7 June 2 1:00 PM - 3:00 PM
Resting-state Connectivity Differences In Alzheimer's Disease Risk: Effects Of An 8-month Exercise Intervention

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Apolipoprotein E (APOE) $\epsilon 4$ allele carriers (carriers) are at high risk for Alzheimer's Disease (AD). Evidence suggests that carriers have altered resting-state brain connectivity (rs-conn), which may be a precursor to cognitive decline and pathological changes. Exercise, however, has been shown to be beneficial for cognitive function and is capable of changing rs-conn. **Purpose:** Our purpose was to assess differences in rs-conn between carriers and non-carriers before and after an exercise intervention. **Methods:** Participants completed resting-state fMRI scans at the beginning (pre) and end (post) of a 3 day/week, 8-month, moderate-intensity exercise program ($n=12$; 8 carriers & 4 non-carriers; mean age = 59.5 yrs). Independent samples t tests with a false discovery rate correction for multiple comparisons were used to determine differences in rs-conn between carriers and non-carriers (contrast=carriers > non-carriers) at pre and post with alpha set a priori at $\alpha=.05$. **Results:** Before

intervention, the carriers exhibited significantly more rs-conn as compared to non-carriers between cerebellum 10 (left (L)) and the middle frontal gyrus (L) ($t(10)=7.88$, $p=.002$), planum temporale (L) ($t(10)=5.82$, $p=.01$), anterior cingulate ($t(10)=4.99$, $p=.02$), and cerebellum 4/5 (L) ($t(10)=4.8$, $p=.02$). There was also significantly more rs-conn for the carriers as compared to non-carriers between the anterior parahippocampal gyrus (right (R)) and the frontal orbital cortex (L) and between the occipital pole (L) and cerebellum 10 (R) (p 's $< .05$). In contrast, carriers had less rs-conn compared to the non-carriers in the paracingulate gyrus (L) and the occipital fusiform gyrus (R) ($t(10)=-5.97$, $p=.02$). Following treatment, however, there were no group differences in rs-conn in the aforementioned regions ($p > .05$). **CONCLUSION:** We found significantly more rs-conn in various motor and attention regions before the exercise intervention in the APOE $\epsilon 4$ carriers suggesting a compensatory mechanism. These differences were no longer evident after an 8-month exercise intervention suggesting that exercise may reorganize carriers' neural connectivity towards that of non-carriers. Since alterations in rs-conn have been suggested as a precursor to AD, exercise interventions may be especially beneficial for APOE $\epsilon 4$ carriers.

2883 Board #8 June 2 1:00 PM - 3:00 PM
Assessing Cerebrovascular Responsiveness: Comparing Functional Magnetic Resonance Imaging With Doppler Ultrasound

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Cerebrovasculature responsiveness (CVR) to alterations in arterial carbon dioxide (PCO_2) content is a common test to assess brain health. Traditionally, higher CVR is associated with higher aerobic fitness, while natural aging and brain-related diseases are associated with lower CVR. However, recent findings challenge some of these relations, but may be related to inconsistent neuroimaging methodologies. **PURPOSE:** 1) to examine fitness effects on CVR between active and sedentary individuals using functional magnetic resonance imaging (fMRI) and transcranial Doppler (TCD), and 2) compare different stimulus concentrations for CVR measures between fMRI and TCD. **METHODS:** Fourteen volunteers participated (26 ± 7 yrs; 8 active, 6 sedentary), with 10 pair-matched for age and sex to examine fitness effects (5 active, 5 sedentary). Following medical screening, participants completed an aerobic fitness test (VO_2 max) and the CVR protocol familiarisation. Participants then completed two experimental sessions on separate days (randomized and counter-balanced). For both sessions, CVR was assessed using two concentrations of CO_2 via the same Douglas bag open circuit (4-min cycles of room air, 5% CO_2 , room air, 7% CO_2). CVR was measured using fMRI (EPI-based sequence allowing simultaneous acquisition of blood-oxygen level dependent and perfusion responses) and TCD (middle cerebral artery flow velocity). CVR measures were correlated (Pearson's) with fitness and differences between stimulus concentration within and between approaches compared. **RESULTS:** 1) Higher VO_2 max was associated with higher CVR derived from 5% and 7% CO_2 stimuli, but were higher for fMRI (5%: $r=.640$, $p=.06$; 7%: $r=.690$, $p=.04$) than TCD (5%: $r=.209$, $p=.30$; $r=.365$, $p=.17$). 2) When comparing CVR between fMRI and TCD, values obtained from the 5% stimulus correlated ($r=.626$, $p < .05$); while there was no correlation between values obtained from the 7% stimulus ($r=.252$, $p=.46$). Paired t -tests comparing CO_2 concentration (5% vs 7% CO_2) revealed no difference for fMRI-derived CVRs ($p=.93$), but a trend between TCD-derived CVRs ($p=.10$). **CONCLUSION:** Both fMRI and TCD-CVR approaches differentiated active and sedentary groups. The CVR measure between and within neuroimaging approaches was differentially influenced by CO_2 concentration.

F-09 Thematic Poster - Cardiovascular Regulation

Friday, June 2, 2017, 1:00 PM - 3:00 PM
Room: 403

2884 Chair: Russell S. Richardson. *University of Utah, Salt Lake City, UT.*

(No relationships reported)

2885 Board #1 June 2 1:00 PM - 3:00 PM

Are Vascular Conductance and Muscle Blood Flow During Exercise Affected by Hypoxia and Arterial Perfusion Pressure?

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(No relationships reported)

PURPOSE: To investigate the combined effect of hypoxia and altered arterial perfusion pressure on vascular conductance (VC), muscle blood flow (MBF), and O₂ delivery (DO_{2ext}) during exercise. **METHODS:** Ten healthy volunteers repeated plantar flexion contractions at 20% (low power output = LPO) and 30% (higher power output = HPO) of their maximal voluntary contraction in 35° head-down-tilt (HDT) and 45° head-up-tilt (HUT) to modify muscle perfusion pressure (MPP) while breathing normoxic and then hypoxic air. Popliteal diameter and muscle blood flow velocity were measured by ultrasound to determine MBF. VC was estimated by dividing MBF by MPP, and DO_{2ext} was estimated from MBF and saturation. **RESULTS:** From normoxia to hypoxia in LPOHUT, there were no changes in VC (0.9 ± 0.4 mL.min⁻¹.mmHg⁻¹ and 0.8 ± 0.4 mL.min⁻¹.mmHg⁻¹) and MBF (127.2 ± 58.8 mL.min⁻¹ and 119.5 ± 53.2 mL.min⁻¹), resulting in reduced DO_{2ext} (123.9 ± 57.2 mL.O₂.min⁻¹ and 109.6 ± 48.5 mL.O₂.min⁻¹, p < 0.05). In LPOHDT, there was an increase in VC from 2.9 ± 0.8 mL.min⁻¹.mmHg⁻¹ in normoxia to 3.3 ± 0.8 mL.min⁻¹.mmHg⁻¹ in hypoxia (p < 0.05) and MBF from 146.3 ± 34.2 mL.min⁻¹ in normoxia to 167.3 ± 38.1 mL.min⁻¹ in hypoxia (p < 0.05), maintaining DO_{2ext} (142.2 ± 33.2 mL.O₂.min⁻¹ and 152.6 ± 34.3 mL.O₂.min⁻¹). From normoxia to hypoxia during HPOHUT, there were no changes in VC (1.4 ± 0.5 mL.min⁻¹.mmHg⁻¹ and 1.4 ± 0.6 mL.min⁻¹.mmHg⁻¹), MBF (203.3 ± 74.3 mL.min⁻¹ and 210.3 ± 84.2 mL.min⁻¹), and DO_{2ext} (197.0 ± 72.4 mL.O₂.min⁻¹ and 190.8 ± 75.0 mL.O₂.min⁻¹). During HPOHDT, there was an increase in VC from 3.6 ± 1.0 mL.min⁻¹.mmHg⁻¹ in normoxia to 4.1 ± 1.2 mL.min⁻¹.mmHg⁻¹ in hypoxia (p < 0.05), MBF from 186.8 ± 55.4 mL.min⁻¹ in normoxia to 221.6 ± 68.7 mL.min⁻¹ in hypoxia (p < 0.05), and DO_{2ext} (180.9 ± 53.3 mL.O₂.min⁻¹ and 201.0 ± 60.8 mL.O₂.min⁻¹, p < 0.05). In hypoxia, VC reached its upper functional limit and the consequence was revealed by increased muscle activation. **CONCLUSION:** During HPOHDT in hypoxia, a functional limitation for the recruitment of VC constrained MBF and DO_{2ext}, which contribute to a greater metabolic stress and advance of muscle fatigue. During LPOHDT, LPOHUT and HPOHUT in hypoxia, changes in VC compensated for the alterations in O₂ availability and MPP with no apparent functional limitation in the VC recruitment, which would allow further rises in MBF to maintain DO_{2ext}.

2886 Board #2 June 2 1:00 PM - 3:00 PM

Blood Flow Regulation and Oxygen Uptake during High Intensity Forearm Exercise

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(No relationships reported)

The vascular strain is very high during heavy handgrip exercise, but the intensity and kinetics to reach peak blood flow, and peak oxygen uptake, are uncertain. **PURPOSE:** We included 9 young (25±2yr) healthy males to evaluate blood flow and oxygen uptake responses during continuous dynamic handgrip exercise with increasing intensity. **METHODS:** Blood flow was measured using Doppler-ultrasound and venous blood was drawn from a deep forearm vein to determine arteriovenous oxygen difference (a-vO_{2diff}) during 6-minutes bouts of 60, 80 and 100% of maximal work rate (WR_{max}), respectively. **RESULTS:** Blood flow and oxygen uptake increased (p<0.05) from 60%WR_{max} (557±177(SD) mL.min⁻¹; 56.0±21.6 mL.min⁻¹) to 80%WR_{max} (679±190 mL.min⁻¹; 70.6±24.8 mL.min⁻¹), but no change was seen from 80%WR_{max} to 100%WR_{max}. Blood velocity (49.5±11.5 cm.sec⁻¹ to 58.1±11.6 cm.sec⁻¹) and brachial diameter (0.49±0.05cm to 0.50±0.06 cm) showed concomitant increases (p<0.05) with blood flow from 60% to 80%WR_{max}, while no differences were observed in a-vO_{2diff}. Shear rate also increased (p<0.05) from 60% (822±196 s⁻¹) to 80% (951±234 s⁻¹) of WR_{max}. The mean response time (MRT) was slower (p<0.05) for blood flow (60%WR_{max}:50±22s; 80%WR_{max}:51±20s; 100%WR_{max}:51±23s) than a-vO_{2diff} (60%WR_{max}:29±9s; 80%WR_{max}:28±5s; 100%WR_{max}:20±5s), but not different

from oxygen uptake (60%WR_{max}:44±25s; 80%WR_{max}:43±14s; 100%WR_{max}:41±32s). No differences were observed in MRT for blood flow or oxygen uptake with increased exercise intensity. **CONCLUSION:** When approaching maximal intensity, oxygen uptake appeared to reach a critical level at ~80% of WR_{max} and be regulated by blood flow. This implies that high, but not maximal, exercise intensity may be an optimal stimulus for shear stress-induced small muscle mass training adaptations.

2887 Board #3 June 2 1:00 PM - 3:00 PM

Regional Cerebral Blood Flow Responses to Graded Sympathetic Activation in Young Healthy Subjects

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Numerous studies have investigated cerebral blood flow (CBF) responses during orthostatic stress, primarily using middle cerebral artery (MCA) blood velocity. Due to methodological limitations associated with this measurement, there has been a recent transition towards measuring blood flow in vertebral (VA), internal carotid (ICA) and external carotid arteries (ECA) using duplex Doppler ultrasound. Limited studies have simultaneously characterized the response of all these cerebral vessels to simulated orthostatic stress. Likewise, previous studies examining the influence of the sympathetic nervous system on the cerebral vasculature have also relied mainly on MCA velocity measures, primarily performed during infusion of α-adrenergic receptor agonists or antagonists. **PURPOSE:** To investigate regional CBF responses to a moderate and high level of reflex-mediated sympathetic activation via lower body negative pressure (LBNP) at -10 and -40 Torr, respectively. **METHODS:** In 8 young men, beat-to-beat arterial pressure (finger photoplethysmography), heart rate (ECG), VA, ICA, ECA and brachial artery blood flow (duplex Doppler ultrasound) and MCA blood velocity (transcranial Doppler) were measured at rest and during 5 min of -10 and -40 Torr LBNP performed in random order. Conductance was calculated as blood flow of the respective artery/mean arterial pressure. **RESULTS:** In both LBNP trials, there was a significant decrease in brachial artery blood flow and conductance (-10 Torr: -26.0±10.6 % baseline; -40 Torr: -42.3±4.4 % baseline, p=0.006). In contrast, VA, ICA and ECA blood flow and conductance were unaffected (e.g., VA conductance, -10 Torr: -5.8±4.6 % baseline; -40 Torr: -0.03±2.5 % baseline, p=0.654). MCA blood velocity was also unchanged by LBNP (p=0.648). **CONCLUSION:** Despite the large sympathetically-mediated reductions in brachial artery conductance, cerebral vascular conductance, assessed in multiple arteries, was unaffected by graded sympathetic activation with LBNP. These preliminary data suggest minimal direct effect of reflex-mediated elevations in sympathetic nerve activity on CBF. Supported by NIH grant 1 RO1 HL 127071.

2888 Board #4 June 2 1:00 PM - 3:00 PM

Muscle Blood Flow Responses to Dynamic Handgrip Exercise in Young Obese Adults

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INTRODUCTION: Exercise intolerance is a hallmark characteristic of obesity, which may be related to an impaired ability to appropriately increase blood flow to the contracting muscles. Limited evidence suggests that steady-state vasodilator responses to dynamic forearm exercise are preserved or even increased in young obese humans compared with lean peers, but this topic still remains poorly understood. **PURPOSE:** To evaluate exercise-induced changes in hemodynamics in young obese adults compared with lean adults. **METHODS:** Thirteen lean (female=6; 26±1 yrs; 22.4±0.5 kg/m²) and 14 obese adults (female=7; 27±1 yrs; 32.6±0.6 kg/m²) performed 2-min of dynamic forearm exercise at 15 and 30% of maximal voluntary contraction (1-s contraction; 2-s relaxation). Ultrasonography [brachial diameter, forearm blood flow (FBF), forearm vascular conductance (FVC)], and beat-to-beat hemodynamics [mean arterial pressure (MAP), heart rate (HR), stroke index (SI), systemic vascular resistance index (SVRI), cardiac index (CI), systemic arterial compliance index (SACI)] were collected. FBF and FVC were normalized to lean forearm mass, and hemodynamics were indexed to body surface area. **RESULTS:** There were no group differences in any variable at baseline. Brachial artery diameter, FBF, FVC, and HR increased from baseline at 15% and 30% of MVC similarly in both groups (P<0.05). There was an interaction for SVRI (P<0.05), where SVRI decreased from baseline at 15% and 30% MVC only in the lean group (P<0.05). **CONCLUSION:** Although young obese adults did not exhibit an impairment in exercise-induced increases in

blood flow, systemic vascular resistance did not decrease with exercise in obese adults. Future studies in an older population may reveal more consistent obesity-related impairments, whereas our current cohort is young and lack comorbidities.

Variable	Group	Baseline	15MVC	30MVC
Brachial Artery Diameter (mm) *	Lean	3.46±0.15	3.51 ±0.15	3.64 ±0.14
	Obese	3.62±0.14	3.69 ±0.14	3.76 ±0.14
FBF (mL/min*100 g tissue) *	Lean	11 ±1	13±1	30±2
	Obese	10±1	14±1	27±2
FVC (mL/min*100mmHg*100 g tissue) *	Lean	11±1	14±1	30±2
	Obese	10±1	13±1	27±2
MAP (mmHg)	Lean	101±2	103±2	102±3
	Obese	100±2	99±2	103±3
HR (bpm) *	Lean	62±2	66±2	67 ±2
	Obese	64±2	63±2	67±2
SI (mL/min/m ²)	Lean	53±3	54±3	55±3
	Obese	48±3	46±3	47±3
CI (L/min/m ²)	Lean	3.3±0.2	3.5±0.2	3.7±0.2
	Obese	3.0±0.2	2.9±0.2	3.2±0.2
SVRI (L/min/mmHg/m ²) †	Lean	32.2±1.9	30.2±2.0*	29.2 ±1.8*
	Obese	33.9±1.8	35.4±1.9	33.8±1.8
SACI (mL/mmHg/m ²)	Lean	0.96±0.04	0.97±0.04	0.99±0.04
	Obese	0.88±0.04	0.86±0.04	0.86±0.04

Data are mean±SE. * $P<0.05$, time effect. † $P<0.05$, interaction. ‡ $P<0.05$, different from baseline.

2889 Board #5 June 2 1:00 PM - 3:00 PM

Reduced Skeletal Muscle Blood Flow In Persons With Multiple Sclerosis Exhibiting Autonomic Nervous System Dysfunction

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Multiple Sclerosis (MS) is a demyelinating disease of the central nervous system characterized by a variety of symptoms including fatigue, reduced exercise capacity, and autonomic nervous system (ANS) dysfunction. **PURPOSE:** The purpose of this study was to determine whether persons with MS (PwMS) demonstrate reduced skeletal muscle blood flow during exercise compared to age matched controls.

METHODS: The first analysis included 7 PwMS (age: 52.0 ± 9.8, 6 women) and 6 controls (age: 49.2 ± 9.8, 4 women). ANS function was assessed in both groups using the 31 item Composite Autonomic Symptom Score (COMPASS-31) questionnaire. A subset of 3 women with MS exhibiting ANS dysfunction (age: 55.3 ± 7.0, Patient Determined Disease Steps: 1-3) were then age, sex, and workload matched with controls (age: 51.3 ± 9.5) for the second analysis. Mean blood velocity was measured (Doppler Ultrasound) and femoral blood flow (FBF) and conductance (FVC) were calculated during submaximal single leg knee extension with a modified cycle ergometer on the right leg at 20% and 40% of work-rate max (WRmax). FBF and FVC were normalized per 100g of thigh fat free mass. Comparisons for analysis 1 were made with unpaired 1-tailed T-Tests and comparisons for analysis 2 with paired 1-tailed T-Tests.

RESULTS: Analysis 1: FVC tended to be lower in the MS group at 20% WRmax ($P = 0.13$) and 40% WRmax ($P = 0.13$). However, there was no difference in FVC when absolute workloads were matched (MS 40% WRmax vs. Con 20% WRmax: MS: 6.3 ± 1.0 watts, Con: 5.0 ± 0.8 watts) between groups ($P = 0.41$). Analysis 2: Absolute and relative workloads were matched for each group (20% WRmax, MS: 4.2 ± 0.8 watts, Con: 4.0 ± 1.0 watts; 40% WRmax, MS: 8.3 ± 1.7 watts, Con 8.0 ± 2.0 watts). FBF was lower at 40% WRmax ($P = 0.05$), while FBF at 20% WRmax ($P = 0.13$) and FVC at both workloads tended to be lower in MS (20% WRmax, $P = 0.13$, 40% WRmax, $P = 0.14$).

CONCLUSIONS: These results suggest that PwMS exhibiting ANS dysfunction may have reduced blood flow during exercise at similar relative and absolute workloads compared to age/sex matched controls. These findings warrant further investigation into the regulation of skeletal muscle blood flow in PwMS to determine whether impaired blood flow contributes to common symptoms of MS such as reduced exercise capacity and fatigue.

2890 Board #6 June 2 1:00 PM - 3:00 PM

Oxygen Extraction Reserve Immediately After Ramp Incremental Maximal Exercise: Beyond the Deoxy-hemoglobin Breaking Point

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(No relationships reported)

Towards the end of a ramp incremental (RI) test to exhaustion, the near-infrared spectroscopy (NIRS)-derive deoxygenated hemoglobin ([HHb]) signal plateaus, suggesting an upper limit in oxygen (O_2) extraction. However, it is unknown whether this plateau is the highest level of O_2 extraction, or if a "reserve" in O_2 extraction exists, such that the plateau in the [HHb] in the presence of a still raising O_2 utilization (VO_2) towards the end of a RI test is indicative of a local increase in blood flow.

PURPOSE: To assess the existence of a "reserve" in O_2 extraction immediately at the end of a RI cycling test to exhaustion.

METHODS: Nine male participants (27 ± 4.6 yrs; 79.9 ± 8.6 kg) performed a RI (30W·min⁻¹) test to exhaustion on a cycle ergometer (Velotron Dynafit Pro, Seattle, WA, USA) to determine the VO_2 (Quark CPET, Cosmed, Rome, Italy) and the [HHb] (Oxiplex TS, ISS, Champaign, USA) responses. The [HHb] signal was measured on the Vastus Lateralis (VL) muscle. An automatic rapid inflation cuff was used to occlude blood flow to the leg (300 mmHg), at the upper portion of the thigh, for two minutes immediately at test failure. A paired samples t-test was used to compare the VO_2 (onset of the plateau in the [HHb] signal and end-exercise) and the normalized (0-100% of the response during RI test) [HHb] signal (plateau and peak value obtained during occlusion).

RESULTS: The end-exercise VO_2 (VO_{2max} ; 4.35 ± 0.57 L·min⁻¹) was larger than that observed at the onset of the plateau in the [HHb] response (3.77 ± 0.52 L·min⁻¹; $p < 0.05$). Post-exercise peak [HHb] (following occlusion) was higher compared to its plateau value ($p < 0.05$), with a mean difference of 38.1 ± 18.9 %.

CONCLUSIONS: This study demonstrated the existence of a "reserve" in O_2 extraction, despite a continuous increase in the VO_2 response towards the end of a RI cycling test. These data suggest that the observed plateau in the [HHb] response is not related to O_2 extraction reaching its upper limit, but likely due to increased local blood flow.

2891 Board #7 June 2 1:00 PM - 3:00 PM

The Exercise Pressor Reflex in Hyper- and Hypo-Responsive Humans

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The exercise pressor reflex has been hypothesized to help preserve muscle perfusion (i.e., a flow-maintaining reflex rather than a pressure-raising reflex). Therefore, people with a hyper-responsive exercise pressor reflex should be better able to sustain exercise when blood flow is compromised. **PURPOSE:** To compare exercise tolerance in people with exaggerated and blunted exercise pressor reflexes. **METHODS:** From a large cohort of college age men and women we recruited groups of subjects identified as high (>75th percentile) and low (<25th percentile) blood pressure responders to static exercise (30% maximal voluntary contraction for 3 min). The groups were matched for body size, grip strength, and resting blood pressure. Subjects initiated rhythmic handgrip exercise (30 contractions/minute) at 10% MVC for 3 min and continued exercising while blood flow was progressively restricted with a cuff gradually inflated on the upper arm (3 mmHg/15 sec). Blood pressure (Finometer), heart rate (ECG) and blood flow (Doppler ultrasound) were measured continuously. Exercise ended when a rating of perceived exertion (Borg scale) of 19-20 was reached, or when blood flow was less than 10% of the steady-state exercise flow. **RESULTS:** Each group stopped exercising at a similar RPE and with similar blood flow. As expected, the high responder group had approximately double the increase in mean arterial pressure at the end of exercise and during post-exercise circulatory arrest when compared to the low responder group (31±12 vs. 15±7 and 29±13 vs. 12±6 mmHg respectively, $P<0.02$). The high responder group was able to exercise for 14±1 min, but exercise duration was significantly less for the low responder group (12±1 min, $P<0.05$). **CONCLUSIONS:** Inter-individual variation in the exercise pressor reflex has functional effects. People with an exaggerated exercise pressor reflex may be able to better maintain perfusion and exercise intensity.

2892 Board #8 June 2 1:00 PM - 3:00 PM
Determining The Window Of Effect In The Human Vasculature For The Nitric Oxide Synthase Inhibitor N(G)-monomethyl-L-arginine (L-NMMA)

Andrew C. Kithas, Ryan M. Broxterman, Joel D. Trinity, Jayson R. Gifford, Oh-Sung Kwon, Jay R. Hydren, Ashley D. Nelson, Jacob E. Jessop, Amber D. Bledsoe, David E. Morgan, Russell S. Richardson. *University of Utah, Salt Lake City, UT.*
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(No relationships reported)

Purpose: As nitric oxide (NO) is both an important vasodilator and considered antiatherogenic, inhibiting nitric oxide synthase (NOS), to assess the role and bioavailability of NO, is commonplace. However, the physiologic window of effect in the human vasculature for the often used NOS inhibitor, L-NMMA, has not been well characterized and hence, this form of NOS inhibition is typically employed last in experimental protocols or on a separate day. Therefore, this study sought to quantify the duration of the measurable physiologic effects of L-NMMA in the peripheral vasculature. **Methods:** The passive leg movement (PLM) assessment of vascular function, which has been documented to be predominantly NO mediated, was performed in 7 young male subjects under baseline conditions, immediately following L-NMMA infusion (0.24 mg/dl/min) into the common femoral artery and then again at 45-60 and 90-105 minutes post infusion. The leg blood flow (LBF) response to PLM, assessed with Doppler ultrasound and expressed as the change from baseline to peak (Δ LBF_{peak}) and area under the curve (AUC), was utilized to assess the effect of L-NMMA on NO-mediated vascular function over the course of the experiment. **Results:** Immediately after the L-NMMA infusion, Δ LBF_{peak} and LBF AUC were significantly attenuated by 38% and 69%, respectively. However, within 45-60 minutes following the L-NMMA infusion neither PLM-induced Δ LBF_{peak} nor LBF AUC were significantly different from baseline and this was still the case at 90-105 minutes post infusion. **Conclusions:** These findings reveal that the potent reduction in NO bioavailability afforded by NOS inhibition with L-NMMA has a window of effect of less than 45-60 minutes in the human vasculature. These data can be used to guide experimental design using this pharmacological approach.

F-10 Thematic Poster - Don't be a Cry Baby: Research in Pregnancy, Child Birth, and Early Life

Friday, June 2, 2017, 1:00 PM - 3:00 PM
 Room: 505

2893 **Chair:** James M. Pivarnik, FACSM. *Michigan State University, East Lansing, MI.*

(No relationships reported)

2894 Board #1 June 2 1:00 PM - 3:00 PM
Longitudinal Trends for Pregnancy Physical Activity as Assessed through Objective and Self-Report Methods

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(No relationships reported)

Previous investigations have suggested an overall decrease in physical activity (PA) as pregnancy progresses. Longitudinal investigations of these trends are scarce and have primarily utilized self-report assessments, rather than objective methods. **PURPOSE:** To 1) longitudinally examine month-specific trends in PA during pregnancy and to 2) compare self-report and objective methods of assessing month-specific PA. **METHODS:** Pregnant women (N=23) were recruited to participate in a longitudinal investigation examining anthropometric change, dynamic balance, and PA levels throughout gestation. The assessment of PA occurred each month of pregnancy via two methods: 1) wearing a validated pedometer for seven days and 2) taking an online survey. Following each monthly visit to our laboratory for testing, participants were provided with the pedometer and wearing instructions. Pedometer data included number of steps and amount of time (minutes) each participant was active each day. For analytic purposes, data for a minimum of three week days and one weekend day (converted to steps/day) was used to represent participant activity each month. The monthly online survey queried participants on typical moderate and vigorous-intensity physical activity (MVPA) per day (converted to minutes/week). Month-to-month contrasts and trend analyses were conducted for both pedometer steps/day and minutes/week of MVPA. **RESULTS:** Participants had a mean age 28.7 years at recruitment, with 55.2% being first-time mothers. Mean pedometer-recorded steps/day during pregnancy was 5,491 \pm 2,086 and mean self-reported minutes/week of MVPA was 106.8 \pm 150.6. Mean steps/day significantly differed month-to-month as pregnancy progressed ($F(7, 56)=4.79$, $p<0.001$), with a reduced overall trend. Specifically, steps/

day recorded for pregnancy months five and eight were significantly lower ($p<0.05$) than month four. Our findings reveal a reduced overall trend for MVPA minutes/week as pregnancy progressed, but no significant differences were found month-to-month ($F(7, 56)=1.37$, $p=0.236$). **CONCLUSION:** Pregnant women become less active in the later months of pregnancy according to both objective and self-report methods. Clear variability exists between objective and self-reported PA among pregnant women.

2895 Board #2 June 2 1:00 PM - 3:00 PM
Wrist-Worn Accelerometry Usage in Primiparous Early Postpartum Women

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(No relationships reported)

The early postpartum period (6 weeks) presents major lifestyle change to new parents. Is wearing a wrist-worn accelerometer acceptable to first-time mothers in early postpartum? **PURPOSE:** To describe wrist-worn accelerometry usage in primiparous, early postpartum women.

METHODS: We analyzed wear characteristics, including mean (\pm SD) days of wear and the mean minutes (\pm SD) of wear/day, of women enrolled in the first year of the Motherhood And Pelvic Health Study and determined the proportion of women who met the wear time standards of large published surveillance studies. We asked women to wear a tri-axial accelerometer continuously on the non-dominant wrist (1440 minutes=24 hours) over two specific 7-day periods, 12 to 25 days (T1) and 33 to 46 days (T2) postpartum. Study staff delivered accelerometers to women and verbally reinforced the protocol. We used the Choi et al. (2011) algorithm to determine wear/non-wear time. We assigned 0 days and 0 minutes of wear to women who wore the device outside of prescribed time periods. We excluded from analysis women that we were unable to contact before T1/T2 and those who had device failure.

RESULTS: For T1, 201 were eligible; 17 could not be contacted and 6 had device failures, leaving 178 women for analysis. For T2, 161 were eligible; 10 could not be contacted and 5 had device failures, leaving 146 women for analysis. At T1, most women (N=166, 93.3%) wore the device for 7 days (mean=6.8 \pm 1.0 days) with an average wear time of 1348.0 \pm 135.8 minutes/day. A slightly lower proportion of women (N=126, 86.3%) wore the device for 7 days (mean = 6.7 \pm .88 days) at T2 with an average wear time of 1311.3 \pm 148.0 minutes/day. Two women at T2 and 1 woman at T1 did not wear the device during the prescribed time intervals. Nineteen women at T1 and 17 at T2 averaged 1440 minutes per day (perfect wear). At T1, 96.1% (N=171) and at T2, 93.2% (N=136) of women met the NHANES wear standards. At T1, 90.4% (N=161) and at T2, 82.2% (N=120) of women met the Whitehall II Study wear standards.

CONCLUSION: Despite the challenges inherent in conducting research about physical activity in newly postpartum women, our results indicate that adherence to wrist-worn accelerometry in this population is high.

Supported by NIH Grant Number 1P01HD080629 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development

2896 Board #3 June 2 1:00 PM - 3:00 PM
Physical Activity Monitor Accuracy Among Pregnant Women During Overground Walking

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(No relationships reported)

Various physical activity monitors have demonstrated respectable step-count accuracy when worn by pregnant women during treadmill walking, particularly at faster speeds. However, it is unclear if this accuracy extends to overground walking, a far more common free-living modality. **PURPOSE:** This study examined the step-count accuracy of five commonly-used physical activity monitors among pregnant women during overground walking at self-paced speeds. **METHODS:** Twenty-nine pregnant women (19 second trimester, 10 third trimester) completed six overground walking trials while wearing three consumer-grade activity monitors (FB, OM, NL) and two research-grade activity monitors (AG, SW). All walking trials consisted of 100 steps, as measured by a hand-tally counter, which served as our criterion measure. Participants were instructed to walk the first three trials at a "normal pace" and the final three trials at a "brisk pace". Steps recorded during each trial were recorded or downloaded for each device in order to calculate mean absolute percentage error (MAPE) ([|criterion measure - monitor measure| / criterion measure] x 100). One-way ANOVAs were performed to determine whether MAPE differed between monitors and also whether pregnancy trimester affected monitor accuracy. Pairwise comparisons with Bonferroni adjustments were performed to explore specific differences between monitors. **RESULTS:** Significant differences were found between monitor MAPE

for normal-pace walking trials ($F(4, 140)=8.66, p<0.001$) and also brisk-pace trials ($F(4, 140)=30.07, p<0.001$). For normal-pace trials, MAPE for the SW (2.67%), NL (4.61%), and OM (4.82%) was significantly lower/better ($p<0.05$) than that for the AG (12.34%) and FB (13.66%). For brisk-pace trials, MAPE for the SW (2.01%) was significantly lower ($p<0.05$) than that for the NL (4.95%), AG (10.64%), and FB (24.61%), but not the OM (2.74%). Trimester was not found to significantly affect accuracy of any monitor at either normal or brisk paces.

CONCLUSIONS: The research-grade SW monitor is highly accurate for overground walking during pregnancy. The OM and NL, while not research-grade, are also accurate tools for overground walking and represent a cost-effective alternative for the consumer or for future pregnancy walking intervention trials.

2897 Board #4 June 2 1:00 PM - 3:00 PM
The Effects of Childbirth on Activity Levels in a Cohort of Adolescent Girls

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 (No relationships reported)

Reduced Physical activity (PA) levels have been associations with female-specific life events including pregnancy. Studies in adult women suggest that decreases in PA may persist after childbirth. However, there is little understanding of post-birth PA trends in adolescent females.

Purpose: To examine changes in PA after childbirth in adolescents.
Methods: The Pittsburgh Girls Study collected time-stamped step count data for 7 days, annually from 2010-2013 with a validated monitor, in a local population representative sample of 1045 adolescent females in Pittsburgh, PA (baseline age: 14-17 years). This analysis examines PA in the 95 participants with ≥ 3 days of valid step data who gave birth for the first time between 2009 and 2013. Change in average total steps/day over the 4 years was determined with mixed models (using a step down approach). All models were adjusting for, age cohort, winter wear time (y/n), weekend wear time (y/n), and average daily wear time (minutes/day). The effects of age at pregnancy and race/ethnicity [Non-Hispanic African American (NHAA)/ All Others] were also examined.

Results: At baseline, girls that gave birth during the study period were more likely to identify as NHAA, have lower socio-economic status (all $p<0.001$), and were slightly older (mean [sd] age 16 [.98] vs. 15.4 [1.1] years) than girls who did not give birth. The mean (sd) age at pregnancy was 17 (1.3) years. The final model included the *a priori* covariates and race/ethnicity. Adjusted mean (sd) step counts/day were 7260(577) in the year before pregnancy. The adjusted mean (sd) change in step counts/day from the year before to the year after pregnancy was -2065 (735); $p=0.004$. Overall, 61% of the girls recorded < 5000 mean steps/day in the year after pregnancy versus 41% in the year before pregnancy. There was a non-significant upward trend in mean step counts in subsequent post-pregnancy years. For comparison, girls not experiencing a pregnancy had little change in step counts over the 4 year follow-up (adjusted mean [sd] change: -152 [140], $p=0.05$).

Conclusions: There was a significant drop in PA levels post-pregnancy in this cohort. More than half of these girls could be considered *sedentary* post-pregnancy (<5000 steps/day). Based on this cohort, efforts to improve post-pregnancy PA levels are warranted in adolescent mothers.

2898 Board #5 June 2 1:00 PM - 3:00 PM
Comparison of Physical Activity Obtained Via Questionnaire and Accelerometry During Pregnancy and Postpartum

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 (No relationships reported)

The Pregnancy Physical Activity Questionnaire (PPAQ) is a commonly used tool to assess pregnant women's current physical activity levels. However, few studies have evaluated the level of agreement between the PPAQ and physical activity measurement devices during free living conditions at multiple time points throughout pregnancy.

PURPOSE: The purpose of this study was to compare the PPAQ and device based physical activity assessment across phases of pregnancy and postpartum.
METHODS: Physical activity behaviors of 38 women were quantified by the PPAQ and accelerometers worn at the right hip and ankle, at approximately 21 and 32 weeks of pregnancy, and 12 weeks postpartum. Women were evaluated at least eight hours

per day for at least five days of a week. Percent time spent in light, moderate, and vigorous physical activity were compared between the PPAQ and accelerometers using a two-way repeated measures analysis of variance (ANOVA).

RESULTS: Percent of total physical activity time spent in light and moderate activity levels was similar between hip (93.1, 5.7%, respectively) and ankle (89.4, 5.7%, respectively) accelerometers, compared to 47.8, 40.3%, respectively, for the PPAQ ($P<0.01$). Specifically, the PPAQ results indicated significantly less time in light physical activity and more time in moderate activity. In addition, the hip and ankle accelerometers and the PPAQ showed significantly different percent of total physical activity time spent in vigorous activity (1.0, 4.7, 11.8%, respectively, $P<0.01$).

CONCLUSIONS: In free living conditions, accelerometer placement at hip and ankle resulted in similar percent wear time among physical activity intensities, regardless of pregnancy time point. In contrast, greater moderate and vigorous physical activity was recorded via PPAQ survey. These results are similar to those found with nonpregnant adults (Troiano et al., 2008). Researchers should use caution when utilizing and comparing the results of these two physical activity measurement modalities during pregnancy and the postpartum period.

2899 Board #6 June 2 1:00 PM - 3:00 PM
Mother's Smoking Status during Pregnancy on Child's Motor Development: A Propensity Score Analysis

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 (No relationships reported)

PURPOSE: To determinate the impact of a mother's smoking status during pregnancy on a child's motor development using a propensity score (PS) analysis, a statistical method for evaluating treatment effects when using nonexperimental or observational data.

METHODS: Five NHANES National Youth Fitness Survey 2012 data sets, "Demographic Variables," "Physical Functioning," "Early Childhood," in which mother's smoking status during pregnancy was asked, "Physical Activity," and "Test of Gross Motor Development (TGMD-2)" were merged. By matching 10 variables, including "Sex of the child," "At least one adult aged 60 years or older living in the participant's household," "the household reference person's sex," "Weight at birth, pounds," "Your child was overweight," "Crawl, walk, run, play limitations," "Impairment requiring special equipment," "Receive Special Ed or Early Intervention," "Days physically activity least 60 min," and "Hours watch TV or video past 30 days," a regression model was employed for the PS analysis (with inverse probability weighting adjustment and greedy algorithms with 1:1 matching; the covariate adjustment were used to estimate the effect of "Did biological mother smoke at any time while she was pregnant" on a child's gross motor development). The full sample weights were used for the analysis. **RESULTS:** The negative impacts of a mother smoking while pregnant on their child's motor development, with and without the PS analysis, are summarized below:

	Total		Loco Motor		Objective control	
	No-PS	PS	No-PS	PS	No-PS	PS
Smoked	91.18 ±14.30	91.18 ±14.30	26.09 ± 11.28	26.09± 11.28	18.33 ±7.89	18.33± 7.89
Didn't-Smoke	96.06 ±14.57	99.27 ±12.32	28.62± 10.26	29.06± 8.81	21.64 ±8.42	22.51± 7.81
Difference	4.88	8.09	2.53	2.96	3.31	4.18
t-value	-1.85	-2.65	-1.23	-1.25	-2.27	-2.16
p-value	0.07	0.01	0.22	0.21	0.02	0.03
ES	0.34	0.60	0.23	0.29	0.40	0.53

CONCLUSION: By applying the PS analysis, the negative impact of mothers smoking status during pregnancy on children's gross motor development was further confirmed.

2900 Board #7 June 2 1:00 PM - 3:00 PM
Early Pregnancy Leisure Time Physical Activity and Circulating MicroRNAs
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Leisure time physical activity (LTPA) during pregnancy is associated with pregnancy complications and fetal outcomes. Epigenetic mechanisms potentially play key roles in these associations. Few studies have investigated epigenetic biomarkers in relation to LTPA.

Purpose: To determine if maternal LTPA in early pregnancy is associated with candidate circulating microRNAs (miRNAs), epigenetic biomarkers with post-transcription regulatory roles.

Methods: This was a cross-sectional study conducted among participants (N=74) of the Omega study, a pregnancy cohort study. Participants self-reported LTPA duration (hours/week) and energy expenditure (MET-hours/week) during an interview in early pregnancy (16 weeks gestation, on average). LTPA was considered both as a continuous variable and categorized according to current American College of Sports Medicine recommendations for physical activity (not active, active<150 minutes/week, active≥150 minutes/week). Levels of circulating microRNAs (miR-126-3p, 146b-5p, miR-155-5p, miR-21-3p, miR-210-3p, miR-222-3p, miR-223-3p, miR-517-5p, miR-518a-3p, miR-29a-3p), selected based on their role in pathophysiological pathways (e.g. inflammation, oxidative stress, and placental function) related to pregnancy complications and outcomes, were measured using qRT-PCR. Linear regression adjusted for maternal age and gestational age at blood draw was used to determine beta estimates and 95% confidence intervals.

Results: Each additional hour or MET-hour/week of LTPA was not associated with levels of circulating miRNAs (all P>0.05). Compared to women who were not active, women who were active but did not meet recommendations had higher levels of circulating miR-517-5p (β=0.24; 95% CI: 0.06, 1.0; P=0.05). Compared to women who were active below recommended levels, meeting or exceeding recommendations was associated with higher levels of circulating miR-517-5p (β=3.7; 95% CI: 0.99, 14; P=0.05). Early pregnancy LTPA was not associated with levels of other circulating miRNAs.

Conclusion: Maternal LTPA in early pregnancy may be associated with circulating levels of miR-517-5p, a placenta-specific miRNA related to placental growth, development, and function.

2901 Board #8 June 2 1:00 PM - 3:00 PM
Step-Count Accuracy of Physical Activity Monitors During Pregnancy in Free-Living Conditions
 Jordana B. Dahmen¹, Christopher P. Connolly¹, Alexander H. K. Montoye². ¹Washington State University, Pullman, WA. ²Alma College, Alma, MI. (Sponsor: James M. Pivarnik, FACSM)
 (No relationships reported)

Previous studies have assessed the validity and reliability of physical activity monitors worn by pregnant women under laboratory conditions. However, physical activity monitors have not been assessed under free-living conditions in pregnant women.

PURPOSE: 1) Determine the step-count accuracy of four commercially-available physical activity monitors worn by pregnant women under free-living conditions and 2) examine the effect of pregnancy trimester on monitor accuracy. **METHODS:** Participants were pregnant women (n=28) in their second or third trimesters who were 18-40 years of age and free of contraindications to exercise during pregnancy. Participants wore three consumer-grade activity monitors (FB, OM, NL) and two research-grade activity monitors (AG, SW) for three days of free-living activity during all waking hours. Steps recorded over the three days for the FB, OM, NL, and AG were compared to SW recorded steps (the criterion measure) in order to calculate percentage of actual steps taken ([measured steps / actual steps] x 100). Paired-samples t-tests were performed to determine differences in accuracy between monitors and one-way ANOVAs were utilized to determine whether pregnancy trimester affected monitor accuracy. **RESULTS:** The analytical sample consisted of 18 women in their second trimester and 10 women in their third trimester with an overall mean gestational age of 23.9 ± 8.19 weeks and a mean daily step-count of 9354.3 ± 3363.9 steps (as determined by SW). Steps taken per day did not significantly differ between second and third trimester women (F(1, 26)=0.69, p=0.42). The FB and NL were most accurate with mean percentage of actual steps taken recorded at 69.9% and 69.5% respectively. The AG (t(27)=-3.13, p<0.01) and OM (t(27)=-6.27, p<0.001) performed significantly worse with 62.7% and 52.1% of actual steps. Trimester did not significantly affect monitor accuracy. **CONCLUSION:** Compared to the criterion, all other monitors underestimated actual steps taken, with the FB and NL demonstrating smaller underestimations than the AG and OM in a free-living environment. Accuracy of these monitors appears to be worse during pregnancy free-living conditions compared to results of studies performed in controlled laboratory conditions.

F-11 Thematic Poster - Hydration
 Friday, June 2, 2017, 1:00 PM - 3:00 PM
 Room: 404

2902 **Chair:** Sam Cheuvront, FACSM. U.S. Army Research Institute of Environmental Medicine, Natick, MA.
 (No relationships reported)

2903 Board #1 June 2 1:00 PM - 3:00 PM
Voluntary Drinking Cessation Is Associated With Recovery Of Plasma Osmolality But Not Of Thirst Perception, Usg, Or Body Mass
 Catalina Capitan-Jimenez, Luis Fernando Aragon-Vargas, FACSM. University of Costa Rica, San Jose, Costa Rica. (Sponsor: Luis Fernando Aragon-Vargas, FACSM)
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 (No relationships reported)

Post-exercise rehydration has been widely studied, with special emphasis on retention of ingested fluid; little research has been done on why we drink more or less. **Purpose:** To identify if voluntary drinking cessation coincides with a return to pre-exercise physiological values. **Methods:** 9 males consented to participate. They exercised intermittently (30 min bicycle-30 min treadmill, at 70-80% HRmax) in the heat (WBGT= 28.1±0.7°C), to a dehydration of 3.6±0.3% body mass (BM). Upon exercise termination, participants were instructed to drink as long and as much as they needed while monitoring water intake. When intake was less than 100mL in 15 min, that was considered the point of voluntary drinking cessation. Urine color (U_{color}), specific gravity (USG), and osmolality (U_{osm}), plasma osmolality (P_{osm}), fullness, and thirst perception (TP) were measured pre- and post-exercise, and post-rehydration. Matched pairs analyses were performed to compare pre-exercise and post-rehydration. **Results:** At the point of drinking cessation, participants had recovered 58.7±12% (1445-2427mL, min-max) of body mass loss.

Variable	Pre-exer (mean±SD)	Post- rehy (mean±SD)	t	p
P _{osm}	289.5±2.3	287.3±5.4	-1.11	0.300
U _{osm}	870.7±2.3	763.7±193.9	-1.49	0.175
Thirst	36.2±19.1	25.0±18.2	-2.32	0.049
BM	83.0±12.6	81.8±12.0	-3.99	0.004
USG	1.022±0.004	1.029±0.004	5.82	0.0004
U _{color}	3.4±0.7	6.3±1.1	6.83	0.0001
Fullness	3.1±0.9	2.1±1.1	-1.80	0.1080

Conclusion: the results suggest that voluntary drinking cessation coincided with a return to pre-exercise values of P_{osm}, U_{osm}, and fullness, even though rehydration was under 60%. Nevertheless, body weight, thirst perception, urine color and USG had not returned to pre-exercise values at the same point

2904 Board #2 June 2 1:00 PM - 3:00 PM
Dehydration Impairs Exercise Performance Independent of Thirst Perception: A Blinded Study
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 (No relationships reported)

Hypohydration >2% body mass loss impairs endurance exercise performance, but the majority of previous studies are confounded by the lack of subject blinding. Previous blinding hydration studies have used intravenous infusion methods which bypass the oropharyngeal receptors and gastrointestinal tract which seems to play an important role on thirst, thermoregulation, and performance. **PURPOSE:** The purpose of this study was to examine the effect of hypohydration on exercise performance in a blinded manner using intra-gastric water delivery to manipulate hydration status, while thirst was matched between trials. **METHODS:** Seven male cyclists (weight: 71±8 kg, body fat: 14±6%, VO_{2peak}: 59.4±6 ml/kg/min) exercised for 2 hours on a cycle ergometer at 55% VO_{2peak} in a hot-dry environment (35 °C, 30% rh), with a nasogastric (NG) tube under euhydrated (EUH) and hypohydrated (HYP) conditions. In both trials, thirst was matched by drinking 25 mL every 5 min (300 mL/h). In the EUH sweat losses fully were replaced via the NG tube (calculated from the familiarization visit). Following the 2 hours of steady state, the cyclists completed a 5-kilometer cycling time trial at 4% grade. **RESULTS:** Following 2 hours of steady state cycling, post-exercise body mass loss for EUH trial was -0.1% compared to the HYP trial which was -2.2%. Thirst (28±11 vs. 42±12 mm) and stomach fullness (41±8 vs. 38±8 mm) did not

differ between EUH and HYP trials ($P>0.05$). Cyclists completed the 5km time trial faster in the EUH trial compared to the HYP trial (777 ± 47 vs. 822 ± 55 sec, $P<0.05$), while producing higher power output (295 ± 29 vs. 270 ± 26 W, $P<0.05$). During the 5 km time trial, core temperature was higher in the HYP trial (39.2 ± 0.3 °C) compared to the EUH trial (38.8 ± 0.2 °C; $P>0.05$). **CONCLUSIONS:** These data indicated that hypohydration decreased cycling performance and impaired thermoregulation in the absence of thirst, while the subjects were unaware of their hydration status.

2905 Board #3 June 2 1:00 PM - 3:00 PM
Thirst Modulates Cycling Performance in the Heat in Dehydrated Males
 Yasuki Sekiguchi¹, J.D Adams², Adam Seal², Hyun-Gyu Suh², Cameron Sprong², Lisa Jansen², Stavros A. Kavouras, FACSM².
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 (No relationships reported)

It has been suggested that thirst can influence exercise performance independently of hydration.

PURPOSE: Therefore, the purpose of this study was to examine the effect of thirst on exercise performance during cycling exercise in the heat in dehydrated subjects. **METHODS:** Six male cyclists (weight: 71 ± 8 kg, body fat: $14\pm 6\%$, VO_{2peak} : 59.4 ± 6 ml/kg/min) exercised for 2 hours on a cycle ergometer at 55% VO_{2peak} , in a hot-dry environment (35 °C, 30% rh), while wearing a nasogastric tube. Two experimental trials were performed: a) Dehydration without thirst (DEH-NT) which participants drank 25 mL every 5 min (300 mL/h) with no infusion in nasogastric tube, and b) Dehydration with thirst (DEH-T) which participants were infused with 25 mL every 5 min via nasogastric tube but without drinking. Following the 2 hours of steady state, the cyclists completed a 5-kilometer cycling time trial at 4% grade. During the study, cyclists were unaware of the trial that were participating, the amount of water infused via the nasogastric tube and could not get any feedback regarding their cycling performance or their heart rate. **RESULTS:** Following 2 hours of steady state cycling, post-exercise body mass loss for the DEH-NT trial was $-2.2\pm 0.4\%$ compared to the DEH-T trial which was $-2.8\pm 0.3\%$. Thirst (42 ± 12 mm vs. 61 ± 15 mm; $P=0.007$) and stomach fullness (35 ± 8 mm vs. 54 ± 10 mm; $P=0.007$) were both significantly different between DEH-NT and DEH-T trials. Finishing time in the 5-km time trial was faster in the DEH-NT trial (784 ± 35 s) compared to the DEH-T trial (795 ± 47 s), however, two out of six participants in the DEH-T trial felt exhausted and could not even start the 5 K, time trial following 2 hours of steady state cycling. **CONCLUSION:** The data suggested that thirst had detrimental effect on cycling performance independent of hydration.

2906 Board #4 June 2 1:00 PM - 3:00 PM
Effects of Dose Timing on Fluid Retention during Sodium-Aided Hyperhydration Protocols
 David Morris¹, Shelby Greene¹, Elizaveta Roslanova². ¹University of Texas, Odessa, TX. ²University of Texas, odessa, TX.
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 (No relationships reported)

Co-consumption of sodium and water has been shown to be superior in promoting hyperhydration compared to consumption of an equal amount of water alone. Most sodium-aided hyperhydration studies have provided subjects with a bolus of fluid followed by a urine collection period. However the effect of providing equal amounts of fluid in a single vs. multiple doses over time on fluid retention has not been systematically studied. **PURPOSE:** To compare the effects of different dosing strategies on urine excretion levels following the consumption of consistent amounts of sodium and water. **METHODS:** Urine excretion was measured during three separate 2-hr hyperhydration protocols in 10 well hydrated male subjects (23 ± 3 yr, 176.1 ± 10.1 cm, 82.2 ± 19.4 kg) who were free from known renal, digestive, and cardiovascular disease. Each protocol began with a complete bladder void and assessment of urine specific gravity (USG). Subjects then consumed 20 mL $H_2O \cdot kg^{-1}$ and 110 mg $NaCl \cdot kg^{-1}$ in three different dosing strategies: the entire dose was consumed at the beginning of the period (1X), $\frac{1}{2}$ of the dose was consumed at the beginning and $\frac{1}{2}$ consumed after 60 min (2X), and $\frac{1}{3}$ of the dose was consumed at the beginning and $\frac{1}{3}$ was consumed after 45 and 90 min (3X). Protocols were administered in a randomized, crossover fashion. Total urine excretions (TUE) during the 2 hr collection periods were expressed as a percent of the H_2O consumed. USG and TUE were compared using repeated-measures ANOVA and Sidak *post hoc* analyses. **RESULTS:** USGs were 1.006 ± 0.004 (1X), 1.007 ± 0.003 (2X), and 1.008 ± 0.005 (3X) ($P=0.20-0.78$) indicating that subjects were well and similarly hydrated for each trial. TUE expressed as a percentage of H_2O consumed were $76\pm 15\%$ (1X), $68\pm 12\%$ (2X) and $55\pm 15\%$ (3X). No significant difference in TUE was detected between 1X and 2X ($P=0.25$) but significant differences were observed between 1X and 3X ($P=0.02$) and 2X and 3X ($P=0.01$). **CONCLUSION:** The data suggest that

hyperhydration is better achieved when water and sodium are consumed in three equal doses over 90 min when compared to consuming an equal amount of a sodium and water dose in a single bolus or in two equal doses over a 60 min period.

2907 Board #5 June 2 1:00 PM - 3:00 PM
Time-course Of Diuresis During Sodium-aided Hyperhydration Protocols With And Without Caffeine
 Elizaveta Roslanova, David M. Morris. University of Texas, Odessa, TX. (Sponsor: Alan Utter, FACSM)
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 (No relationships reported)

When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Caffeine, when used in conjunction with SAH, promotes diuresis, but hyperhydration is still achieved, albeit at lower levels. Caffeine has been shown to be ergogenic when taken as little as 5 min, or as much as 6 hr prior to the start of exercise. Thus, determining the temporal aspects of caffeine induced diuresis when used in conjunction with SAH may lead to superior pre-exercise nutritional strategies. **PURPOSE:** To investigate the time-course of caffeine-induced diuresis during a 90 min SAH protocol. **METHODS:** Subjects were 15 males (21 ± 2 yr, 176 ± 6 cm, 80.2 ± 10.1 kg) free from known renal, digestive, and cardiovascular disease. Each underwent 2 hyperhydration strategies in a randomized, double-blind fashion. Both protocols began with a complete bladder void and measurement of urine specific gravity (USG) followed immediately by ingestion of a bolus of 20 mL $H_2O \cdot kg^{-1}$ combined with either 110 mg $NaCl \cdot kg^{-1}$ (Na) or 5 mg caffeine $\cdot kg^{-1}$ + 110 mg $NaCl \cdot kg^{-1}$ (CafNa). Subjects then rested quietly for 90 min, performing a measured bladder void every 15 min. Urine excretions were expressed as a percentage of the total fluid consumed during each of the hyperhydration protocols. USG and total urine excreted (TUE) during the trials were compared using paired t-tests. Urine excretion (UE) for each of the 15 min collection periods for the two conditions were compared using a two-way repeated measures ANOVA with Sidak *post hoc* analyses. Levels of significance were set *a priori* at $P<0.05$. **RESULTS:** USGs were 1.007 ± 0.003 (Na) and 1.005 ± 0.004 (NaCaf) ($P=0.34$). TUE were $62.7\pm 13.2\%$ (Na) and $78.7\pm 12.5\%$ (NaCaf) ($P=0.001$). UE for the Na and NaCaf for each collection period were $13.1\pm 7.5\%$, $21.9\pm 12.9\%$ (15 min, $P=0.001$), $11.7\pm 3.3\%$, $13.8\pm 3.8\%$ (30 min, $P=.30$), $13.2\pm 2.8\%$, $15.3\pm 2.4\%$ (45 min, $P=0.32$), $12.2\pm 4.1\%$, $13.7\pm 5.1\%$ (60 min, $P=0.46$), $8.4\pm 6.3\%$, $8.9\pm 4\%$ (75 min, $P=0.80$) and $4.7\pm 3.6\%$, $4.4\pm 2.8\%$ (90 min $P=0.87$). **CONCLUSIONS:** Results indicated that both protocols resulted in hyperhydration. TUE was significantly higher in NaCaf compared to Na; however, increased diuresis in NaCaf occurred only during the initial 15 min following consumption of the treatments.

F-12 Thematic Poster - Neuromechanics of Concussion

Friday, June 2, 2017, 1:00 PM - 3:00 PM
 Room: 101

2908 **Chair:** Kevin Guskiewicz, FACSM. University of North Carolina, Chapel Hill, NC.
 (No relationships reported)

2909 Board #1 June 2 1:00 PM - 3:00 PM
The Effect of Tackling Form on Head Accelerations Experienced by Youth Football Players
 Eric Schussler¹, Richard Jagacinski², John Buford³, Ajit Chaudhari, FACSM², Susan White², James Onate². ¹Old Dominion University, Norfolk, VA. ²The Ohio State University, Columbus, OH.
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 (No relationships reported)

A head-up tackling style has been recommended to decrease head contact experienced during tackling. Specific performance metrics have been set to describe and instruct this tackling style including: extended neck position, vertical trunk, head across the front of the target, short steps, and low center of gravity. However, limited information exists regarding the effectiveness of the components of this tackling style on the head accelerations experienced by youth tacklers. **PURPOSE:** Determine the effect of components of a head up, tackling style on head accelerations. **METHODS:** Youth football players ages 9-13 (11.8 ± 0.8 age, 2.5 ± 2 years of experience) were fitted with the xPatch monitoring system (X2 Biosystems, Seattle WA) and tackled a weighted dummy in a laboratory setting. Out of 470 tackles the xPatch system recorded 231 tackles with a peak head acceleration over 6g. Motion data during these tackles were analyzed for cervical angle, trunk angle, pelvic height, step length, and head

and pelvic velocity. Correlational analyses were performed between each movement variable and peak linear acceleration (PLA), peak rotational acceleration (PRA) and Head Impact Criterion over 15ms (HIC15) measures from the xPatch. **RESULTS:** Significant correlations were found between: shoulder extension and PLA ($r=-.141$, $r^2=.020$, $p=.033$), trunk angle and PLA ($r=-.224$, $r^2=.050$, $p=.001$), trunk angle and PRA ($r=.202$, $r^2=.040$, $p=.002$), trunk angle and HIC15 ($r=.156$, $r^2=.023$, $p=.018$), step length and PLA ($r=.138$, $r^2=.019$, $p=.037$) and step length and HIC15 ($r=.131$, $r^2=.018$, $p=.048$). **CONCLUSIONS:** Despite significant correlations between measures of head acceleration and shoulder extension, trunk angle and step length the linear relationship between these values appears clinically negligible. The low strength of these relationships indicate these performance variables may not be responsible for the amount of head acceleration in low speed tackles. Additional analysis on this data should be completed to identify non-linear relationships and identify the interdependence of these variables. Measurements of live tackles during games and identification of other biomechanical parameters best correlated with head acceleration should also be determined, which could lead to more specific and effective tackling instruction.

2910 Board #2 June 2 1:00 PM - 3:00 PM
Isometric Cervical Muscle Strength Does Not Affect Head Impact Kinematics in High School Boys' Lacrosse
 Patricia Kelshaw¹, Nelson Cortes¹, Amanda Caswell¹, Andrew Lincoln², Shane Caswell¹. ¹George Mason University, Manassas, VA. ²MedStar Sports Medicine, Baltimore, MD.
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 (No relationships reported)

Male high school lacrosse has the second highest incidence of concussion in high school sports. Limited research has identified modifiable risk factors that may reduce head impact kinematics. Cervical muscle strength is a proposed modifiable risk factor for head impact kinematics.

PURPOSE: To assess the effects of isometric cervical muscle strength (ICMS) on head impact kinematics in high school boys' lacrosse. **METHODS:** Thirteen male high school varsity lacrosse players volunteered for this study (age = 16.5 ± 1.3 years, height = 1.76 ± 0.1 m, mass = 69.9 ± 10.6 kg). ICMS was measured for forward flexion, extension, and bilateral flexion. Data were collected for neck circumference, head circumference, and neck length. Participants' helmets were instrumented with an accelerometer for an entire season of game play. Video of all game play was captured and time synchronized with accelerometer data. All ICMS measures were normalized to the participants' body mass. Normalized ICMS tertiles were calculated and compared to impact kinematic data using a MANOVA. The relationship of neck anthropometric data and ICMS was investigated using a Pearson's correlation. An alpha level 0.05 was used for all analyses.

RESULTS: 12 games with 367 confirmed impacts (linear acceleration = 54 ± 36 g, rotational velocity = 1362 ± 1258 °/s) were recorded during the 2015 season. Neck circumference showed a positive moderate to strong relationship with ICMS in extension ($r=.63$, $p=.02$). No significant difference existed between ICMS tertiles for linear acceleration and rotational velocity ($p>0.05$).

CONCLUSIONS: Our findings contradict previous research that identified ICMS as a modifiable risk factor for mitigating head impact kinematics. Results suggest that cervical muscle strengthening programs for the reduction of head impact kinematics are not indicated at this time. However, our sample size was small and cervical muscle strengthening may have other potential benefits. Therefore, cervical muscle strengthening programs and potentially modifiable risk factors for reducing head impact kinematics should be further investigated. Supported by the US Lacrosse Sports Science and Safety Committee.

2911 Board #3 June 2 1:00 PM - 3:00 PM
Head Impact Density A Better Estimator Of Concussion Than Threshold
 Steven P. Broglio, FACSM¹, Andrew Lapointe¹, Kathryn O'Connor¹, Michael McCrea². ¹University of Michigan, Ann Arbor, MI. ²Medical College of Wisconsin, Milwaukee, WI.
 (No relationships reported)

PURPOSE: Researchers have sought to identify a single or set of biomechanical variables that can accurately identify a concussive impact *in vivo*. The majority of this work has focused on the final impact prior to injury, failing to account for the influence of prior head impacts over time. This investigation sought to evaluate the relationship between both number and magnitude of head impacts over time in relation to concussion risk. **METHODS:** As part of an ongoing investigation of head impact mechanics, concussions in 29 high school football athletes (16.2 ± 0.9 years, 180.4 ± 5.9 cm, 83.5 ± 12.5 kg, and 0.8 ± 1.2 prior concussions) were captured between 2007 and 2014. Matched control athletes ($n=29$, 16.2 ± 0.7 years, 179.9 ± 9.0 cm, 94.0 ± 12.1 kg, and 0.4 ± 1.2 prior concussions) were selected based on similar final impact linear and rotational acceleration and the prior number of impacts in the season. Impact

magnitude occurring in the 24 hours prior to injury was evaluated using multivariate analyses of variance between groups. Impact counts were evaluated using visual inspection for the 24 hours prior to injury and independent samples *t*-tests in the final three hours. **RESULTS:** In the 24 hours prior to injury, there was no difference between groups in impact number, nor were there differences in cumulative linear or rotational acceleration magnitudes ($p>0.05$). Impact Density (ie impact magnitude divided by time from previous impact) was significantly greater for linear ($p=0.01$) and rotational ($p=0.04$) acceleration among the concussed athletes. **CONCLUSION:** This investigation is the first to account for both impact magnitude and time from previous impact in a concussion estimation model. The findings suggest that concussion tolerance may not be solely dependent on impact magnitude, but also influenced by time. That is, each impact may lower the concussion threshold, but the biological drive to return to homeostasis allows for recovery given enough time before the next impact. This investigation was funded by *The National Institutes of Health: National Institute of Neurological Disorders and Stroke* (1R15NS081691-01)

2912 Board #4 June 2 1:00 PM - 3:00 PM
Concussion History And Kinematics Of Dynamic Balance In Division I Athletes: A Pilot Study
 Moira K. Pryhoda, Jenna Powell, Hammam Belgasem, Connor Landusky, Kevin B. Shelburne, Ann-Charlotte Granholm-Bentley, Bradley S. Davidson. *University of Denver, Denver, CO.*
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A concussion is one of the most complex injuries in sports and can have potentially catastrophic results if not treated correctly. The central nervous system (CNS) integrates visual, proprioceptive, and vestibular sensory information to maintain balance during all movements. Ample clinical evidence exists that a concussion disrupts normal function of the CNS and results in postural instability. However, the long-term effects of concussion on balance control, particularly during dynamic functional movements, are not clear. **PURPOSE:** To determine the effects of concussion history on the kinematics of athletes performing dynamic balance tasks on dynamic balance on athletes. **METHODS:** Division I athletes without ($n=5$; 20.0 ± 1.0 yrs) and with a history of concussion ($n=5$; 19.4 ± 0.9 yrs 1.5 ± 1.2 yrs post injury) performed dynamic balance tasks including gait, gait while stepping over an obstacle, get up and go (GUG), and GUG with a dual task. Speed was recorded for each task, and straightness of trajectory was calculated for normal gait and stepping over an obstacle as a root mean square (RMS) of the mediolateral deviation of the pelvis trajectory from a straight line. Cohen's *d* effect sizes between groups were bootstrapped given the small sample size. Effect sizes greater than 0.8 were considered large, 0.5-0.8 moderate, and less than 0.5 as no effect. **RESULTS:** Athletes with history of concussion performed the dual task GUG 1.7 m/s slower than the control (large effect size: $d=0.90$). In addition, those with history of concussion performed normal gait with an RMS deviation of 30.9 cm compared to 25.1 cm in control (mod effect size: $d=0.66$) when instructed to maintain a straight trajectory. No effect of concussion history occurred for normal gait speed, speed of stepping over an obstacle, speed of GUG without dual task, or mediolateral deviation when stepping over an obstacle. **CONCLUSIONS:** Deficits in dynamic balance control during functional movements in Division I athletes were evident even as long as 1.5 years following concussion event. These data are part of a large prospective investigation (current enrollment: $n=207$), and athletes who sustain a concussion over the course of the study will be re-evaluated at regular intervals to observe changes in postural control during recovery.

2913 Board #5 June 2 1:00 PM - 3:00 PM
The Relationship Between Post-Concussion Neurocognitive Performance and Postural Control
 Katelyn Grimes¹, Emily Lasko¹, Megan E. Mormile¹, Brian J. Szekeley¹, Barry A. Munkasy¹, Douglas W. Powell², Nicholas G. Murray¹. ¹Georgia Southern University, Statesboro, GA. ²University of Memphis, Memphis, TN.
 (No relationships reported)

Executive function (EF) is characterized as an individual's ability to control complex cognition during non-routine tasks. While EF is comprised of several cognitive domains, the ability to maintain task goals and decision making, and to direct attention, known as working memory, is one of the critical components. If a task has sufficient cognitive load to tax working memory, individual's compromise speed for accuracy, known as speed accuracy trade-off (SAT). However, the effect of concussion on SAT, and the ability to perform a physical task has not been well studied. **PURPOSE:** To identify the relationship between neurocognitive and postural control deficits post-concussion. **METHODS:** 15 NCAA Division I athletes (11 male, 4 female; 20.5 ± 1.1 yrs) with diagnosed concussions underwent computerized neurocognitive testing, and a postural control assessment battery within 24-48 hrs of injury. The postural control assessment consisted of 3 trials of eyes open (EO) and eyes closed (EC) quiet standing for 30 sec and the Wii Fit Soccer Heading Game (WFS). The WFS requires

participants to shift their weight in the appropriate medial-lateral direction to hit targets and avoid obstacles. As such, the WFS provides a sport relevant task while simultaneously exerting a cognitive load. Raw Center of Pressure (CoP) was collected using a force platform (1000Hz). From the raw CoP data 95% Confidence Ellipse (CE), along with Peak Excursion Velocity (PEV), and Sample Entropy (SampEn) in anteroposterior (AP) and mediolateral (ML) directions were calculated. **RESULTS:** The results of a Pearson's Product Correlation, indicate a negative relationship between verbal memory (VBMC) and EO PEV ML ($r=-0.611$, $p=.016$), and 95% Confidence Ellipse (CE) ($r = -0.555$, $p= 0.016$). There was a positive relationship ($r = 0.778$, $p= 0.001$) between impulse control and EO PEV AP. During WFS there was a positive relationship between PEV ML and VBMC ($r= 0.532$, $p= 0.041$), and visual motor speed ($r = 0.532$, $p= 0.041$) and CE ($r = 0.531$, $p= 0.042$). Finally, a negative relationship was observed found during the WFS between SampEn ML and Total Symptom Score ($r= -0.582$, $p= 0.023$). **CONCLUSIONS:** The results of the study suggest that participants did have a SAT, sacrificing postural stability for enhanced memory processing while attempting to accomplish an unfamiliar task.

2914 Board #6 June 2 1:00 PM - 3:00 PM
Gender Specific Differences In Knee Kinematics Between Participants With And Without A Concussion History

Andrew P. Lapointe, Luis Nolasco, Aniela Sosnowski, Eva Andrews, Douglas N. Martini, Deanna H. Gates, Steven P. Broglio, FACSM. *University Of Michigan, Ann Arbor, MI.*
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PURPOSE: To evaluate differences in knee kinematics during the impact phase between young adult participants with and without a concussion history.
METHODS: 10 controls (6 males, 4 females) and 9 concussed (4 males, 5 females) between the ages of 18 and 26, capable of completing a jump cut motion. All participants were former high school athletes and right foot dominant. Concussed subjects were tested on average 3.3 years post-injury ($SD=0.65$ years). Measures of knee rotation were taken in the X, Y and Z orientation during single limb support of a cutting maneuver. All values are presented as the mean and standard error of the mean.
RESULTS: An initial analysis of variance showed a significant group by gender interaction in peak right knee abduction/adduction [$F=82.0$, $p<.01$] and peak internal/external rotation [$F=17.9$, $p<.01$] between control and concussed groups. Accordingly, post-hoc tests were performed, adjusting for all pairwise comparisons using a Bonferroni correction. The aforementioned post-hoc tests revealed that males and females with a concussion history were differentially affected; with concussed males showing increased peak abduction (Controls: 9.7 ± 0.5 degrees, Concussed: 3.2 ± 0.3 degrees) and females showing increased peak adduction (Controls: 5.6 ± 0.3 degrees, Concussed: 7.2 ± 0.5 degrees). Concussed males showed an increase in peak internal rotation (Controls: 3.1 ± 0.3 degrees, Concussed: 5.5 ± 0.3 degrees) whereas concussed females showed a slight increase in peak external rotation of the knee (Controls: 7.3 ± 0.4 degrees, Concussed: 6.4 ± 0.5 degrees).
CONCLUSION: Our findings, showing small but significant gender specific changes between groups, advise future researchers to use prudence when generalizing post-concussive kinematics across genders as they may not be equally affected. This may have implications for injury risk, however further work is needed, especially in the understudied female population. Collectively, these findings cautiously provide a possible biomechanical underpinning to support recent reports that individuals are at a much higher risk of lower body injuries post-concussion.

2915 Board #7 June 2 1:00 PM - 3:00 PM
Assessments Of Standing Balance In Division I Athletes With History Of Concussion: A Pilot Study

Jenna J. Powell, Moira K. Pryhoda, Hammam Belgasem, William Sanders, Kevin B. Shelburne, Ann-Charlotte Granholm-Bentley, Bradley S. Davidson. *University of Denver, Denver, CO.*
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Concussion, an especially common injury in athletes, can result in notable balance dysfunction arising from disturbance of the somatosensory and vestibular neural networks. Although standing balance is known to be deficient in acute concussion, the rate at which postural control is recovered after symptoms have subsided is not well studied. Center of pressure (COP) can be utilized to quantify balance dysfunction arising from these neural impairments. Current NCAA concussion assessment includes the Balance Error Scoring System (BESS), which is arguably less sensitive than COP variations to detect long term effects.

PURPOSE: To assess measures of standing balance in athletes with recent history of concussion and non-concussed athlete controls.

METHODS: Division I athletes without ($n=5$; 19.4 ± 0.8 yrs) and with a history of concussion ($n=5$; 20.0 ± 1.0 yrs; 1.5 ± 1.3 yrs post injury) performed the BESS tasks while standing on 2 force platforms. COP was recorded during the 4 bipedal BESS

conditions: eyes open versus closed, and hard surface versus memory foam. Average COP velocity and 95% confidence ellipse area were calculated. Trials were also scored per BESS clinical criteria. Cohen's d effect sizes between groups were bootstrapped given the small sample size.

RESULTS: COP velocity was 1.3 mm/s higher (moderate effect size: $d=0.62$) in the concussion group than controls during eyes closed, hard surface, while BESS score was 10 for all athletes in both conditions. The remaining variables indicated no deficits in the concussion group.

CONCLUSIONS: Differences between concussed and control groups in the eyes closed condition may suggest continuing low-grade vestibular impairment detectable when visual feedback is removed, even after clinical symptoms have resolved. Past work indicates changes in COP velocity are related to vestibular dysfunction. In addition, these data allude to a higher sensitivity of COP measures than clinical BESS scoring when assessing balance deficits, particularly these deficits are subtle. These data are part of a large prospective investigation (current enrollment: $n=207$), and athletes who sustain a concussion over the course of the study will be re-evaluated at regular intervals to observe changes in postural control during recovery.

2916 Board #8 June 2 1:00 PM - 3:00 PM
Postural and Gaze Stability Deficits Following Concussion

Nicholas G. Murray¹, Brian Szekely¹, Megan E. Mormile¹, Peter Chrysosferidis¹, Katelyn Grimes¹, Barry A. Munkasy¹, Douglas Powell². ¹*Georgia Southern University, Statesboro, GA.* ²*University of Memphis, Memphis, TN.*
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 (No relationships reported)

Postural instability and visual system dysfunction are two of the highest reported signs immediately following a sport-related concussion. However, little research has examined both systems simultaneously using sensitive measurements techniques following concussion in the same sample. **PURPOSE:** To investigate and compare postural and gaze stability between a control group of healthy non-injured athletes (NORM) and a group of athletes with concussions (CONC) 24-48 hours post-injury. **METHODS:** 18 post-concussed NCAA Division I athletes (20 ± 1.3 years of age) and 18 matched athletes (19 ± 0.9 years of age) completed two trials of a sport-like antisaccade postural control task, the WiiFit Soccer Heading Game (WFS). During play, all participants were instructed to minimize gaze deviations away from a central fixed area, while simultaneously swaying in a medial-lateral direction to direct an on screen avatar to meet the demands of the game. Monocular raw ocular point of gaze coordinates (240Hz, Argus Science) and raw center of pressure (1000Hz, AMTI) data were collected simultaneously and further analyzed using a custom algorithm. Independent t-tests analyzed gaze Resultant Distance (RD), Prosaccade Errors (PE), Peak Horizontal Velocity (HV), and Vertical Horizontal Velocity (VV) along with center of pressure Root Mean Square (RMS) and Peak Velocity (PV) in the anteroposterior (AP) and mediolateral (ML) directions between groups. **RESULTS:** CONC had a significantly greater RD (CONC= 6.98 ± 0.5 pixels, NORM= 5.2 ± 0.3 pixels; $p=.013$), PE (CONC= 7.11 ± 1.2 errors, NORM= 2.5 ± 0.7 errors; $p=.040$), HV (CONC= 2075 ± 415.4 pixels/s, NORM= 1078 ± 135.6 pixels/s; $p=.018$), and VV (CONC= 2128 ± 481 pixels/s, NORM= 979 ± 144.6 pixels/s; $p=.044$) when compared to NORM. No significant differences were observed for RMS in the AP ($p=.838$) and ML ($p=.543$) directions and PV in the AP ($p=.288$) and ML ($p=.115$) directions between groups. **CONCLUSION:** These results suggest that CONC gaze travelled a greater distance and had less control of gaze in the horizontal and vertical directions during play of the WFS. Conversely, no postural deficits were present during play of the WFS. This could indicate that gaze instability is present even in the absence of postural instability following concussion when comparing CONC to NORM.

F-13 Free Communication/Slide - Cardiovascular Assessment and Training Responses

Friday, June 2, 2017, 1:00 PM - 3:00 PM
Room: 402

2917 **Chair:** Mark A. Sarzynski, FACSM. *University of South Carolina, Columbia, SC.*
(No relationships reported)

2918 **June 2 1:00 PM - 1:15 PM**
Effect of Prolonged Endurance Training on Ambulatory Systolic Blood Pressure and Arterial Function

Erin J. Howden¹, Justin S. Lawley², Mitchel Samels³, Dean Palmer³, Braden Everding³, Sheryl Livingston³, Satyam Sarma², Benjamin D. Levine, FACSM². ¹*Baker IDI Heart and Diabetes Institute, Melbourne, Australia.* ²*UT Southwestern Medical Center, Dallas, TX.* ³*Texas Health Presbyterian Dallas, Dallas, TX.* (Sponsor: Benjamin D Levine, FACSM)
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Healthy, sedentary aging is associated with marked increased risk for developing (systolic) hypertension, which is partially driven by changes in arterial stiffness. In contrast, lifelong exercise training mitigates the effects of aging on arterial stiffness. **Purpose:** We compared the effects a prolonged, intensive supervised exercise training intervention to two-years of sedentary aging on arterial function and ambulatory BP. **Methods:** Sixty one healthy subjects (52.4±5.1 years, 46% male) were randomized to either non-exercise control (Con; n=27) or aerobic exercise training (ExT; n=34). A comprehensive assessment of arterial function including aortic PWV and indices derived from the central BP waveform, plus resting hemodynamics were performed at baseline (Pre), 10 months (Mid) and two-years (Post). Ambulatory blood pressure was measured at Pre and Post. **Results:** There was excellent adherence to the training intervention (89±9%) resulting in a 21% increase in VO₂max, with no change in Con. Ambulatory systolic BP was significantly increased, while ambulatory and resting HR were significantly reduced in the ExT group (Table 1). In contrast to our hypothesis, large artery function (AIx75, time to reflected wave, aortic PWV) was not improved following exercise training. **Conclusion:** Despite improved exercise capacity and excellent training adherence, large artery function was not improved in the ExT group. Consequently, ambulatory systolic BP was significantly increased, partially due to the lack of change in stiffness and the increased stroke volume associated with training.
Supported by NIH Grant R01 AG017479

Table 1. Effect of two-years of supervised endurance training on hemodynamics and arterial function

	Control			ExT		
	Pre	Mid	Post	Pre	Mid	Post
24 hr SBP, mmHg	123 ± 2	-	125 ± 2	120 ± 1	-	124 ± 2*
24 hr DBP, mmHg	74 ± 1	-	74 ± 2	72 ± 1	-	73 ± 2
24 hr HR, bpm	75 ± 2	-	77 ± 2	73 ± 2	-	68 ± 1*
Brachial SBP, mmHg	104 ± 2	106 ± 2	105 ± 2	104 ± 2	103 ± 2	104 ± 2
Brachial DBP, mmHg	67 ± 2	71 ± 1	68 ± 2	66 ± 1	67 ± 1	66 ± 1
HR, bpm	63.9 ± 1.6	63.1 ± 1.9	65.3 ± 1.8	65.4 ± 1.6	58.7 ± 1.6*	58.7 ± 1.8*
aPWV, m/sec	7.2 ± 2.4	7.6 ± 2.1	7.5 ± 2.1	7.1 ± 2.6	7.2 ± 1.9	7.0 ± 2.0
AIx HR75, %	16.6 ± 2.0	18.8 ± 1.7	19.0 ± 1.9	18.1 ± 1.7	18.4 ± 1.9	17.6 ± 1.6.8
T _{IR} , ms	150.4 ± 13.2	147.6 ± 9.7	145.3 ± 9.5	151.9 ± 16.1	152.1 ± 16.2	146.8 ± 14

Values are mean ± SEM, * P< 0.05 compared to Pre. SBP, systolic blood pressure; DBP diastolic blood pressure; HR, heart rate; bpm, beats per minutes; PWV, pulse wave velocity; AIxHR75, augmentation index heart rate corrected; T_{IR}, time to reflected wave

2919 **June 2 1:15 PM - 1:30 PM**
Safety, Detection and Hemodynamic Effects of Acute Xenon Inhalation: Implications for Athletic Doping Practices

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(No relationships reported)

PURPOSE: Xenon is an inhalation anesthetic, which has the potential to increase plasma erythropoietin, red cell mass and thus endurance performance. This study aimed to describe the sedative effects, detection rates and cardiovascular responses of an open circuit breathing system to deliver increasing concentrations of Xenon. **METHODS:** On three occasions, participants breathed increasing concentrations of xenon (Xenon, 30% for 20 min; Xenon, 50% for 5 min; Xenon, 70% for 2 min and oxygen, 21% with balance Nitrogen) in a non-blinded design. Xenon inhalation has been completed in 6 (30%), 5 (50%) and 4 (70%) subjects to date. The level of sedation was monitored by a board certified anesthesiologist (Richmond Agitation and Sedation Scale (RASS)). Over 48 hours post administration, Xenon was measured in blood and urine by gas chromatography-mass spectrometry. All reported beat-by-beat hemodynamics were measured continuously by photoplethysmography (Nexfin; BMEYE, Netherlands) for 10 minutes prior to and throughout xenon administration. **RESULTS:** Xenon caused variable levels of sedation and restlessness between subjects (e.g. 50% xenon RAAS, -2, briefly awakens to voice to +2 frequent nonpurposeful movements), with the greatest symptoms occurring at 50 and 70%. Xenon was detected, albeit in trace amounts, up to 6 hours post xenon inhalation in blood (e.g. 30% 6 hours post, 2.2±2.7 nmol/mL) and urine (e.g. 30% 1.5±0.82 nmol/mL) in all subjects. Over the first minute, xenon cause a substantial reduction in total peripheral resistance (Δ2.7±0.49,mmHg·L·min), which caused a reflex increase in cardiac output (Δ2.7±0.54, L·min). By the end of xenon inhalation, hypertension was observed after all three dosages (MAP: 30%, Δ7±11; 50% Δ12±2; 70%, Δ19±5 mmHg). **CONCLUSIONS:** We show that three different conceivable dosages of xenon inhalation cause a level of sedation incompatible with self-operation of breathing apparatus and a persistent hypertensive state. Dispute begin acute (<5 mins), high dosages (50 and 70%) of xenon caused near anesthesia and thus could present a life threatening condition in the absence of an anesthesiologist. Xenon can be reliability detected in blood and urine up to 6 hours post dosing. These studies were supported in part by funding from the Partnership for Clean Competition Research Collaborative.

2920 **June 2 1:30 PM - 1:45 PM**
Prevalence Of Vo2max Low Response Across Nine Aerobic Exercise Interventions

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(No relationships reported)

There is considerable inter-individual variation in the ability to improve VO_{2max} in response to regular exercise. Thus, identifying individuals who do not experience clinically significant gains in cardiorespiratory fitness with aerobic training (i.e., VO_{2max} low response) is of interest. **PURPOSE:** To assess the prevalence of VO_{2max} low response across nine large aerobic exercise interventions. **METHODS:** The prevalence of VO_{2max} low response was examined in 1,432 previously sedentary adults (461 males, 971 females) who completed one of nine exercise programs from five exercise training studies: DREW (n=361), E-MECHANIC (n=117), Energy Flux (n=65), GERS (n=171), and HERITAGE (n=715). The training programs ranged from doses of 4-35 kcal·kg⁻¹·week⁻¹ (KKW); intensities of 50-85% VO_{2max}; and durations of 20-24 weeks. Baseline and post-training VO_{2max} was assessed via maximal exercise testing. VO_{2max} low response was defined in both absolute (gain <120 ml/min from baseline value) and relative (gain < 5% of study-specific baseline average VO_{2max}) terms based on technical error and coefficient of variation values derived from three repeatability studies in HERITAGE. **RESULTS:** All studies showed significant mean increases in VO_{2max} with training. Using the above definitions, 32.6% (absolute) and 21.3% (relative) of the total sample

was considered low responsive for $\text{VO}_{2\text{max}}$. The distribution of low response across the individual exercise programs is shown in Table 1. Prevalence of low response ranged from 7.4% (HERITAGE) to 84% (DREW 4 KKW).

CONCLUSION: Our study found a high prevalence of $\text{VO}_{2\text{max}}$ low response across five diverse exercise training studies, which differed based on how low response was defined. These results underscore the need for further investigation to refine the identification of $\text{VO}_{2\text{max}}$ low response to enhance future exercise program development.

2921 June 2 1:45 PM - 2:00 PM

Skeletal Muscle Mitochondrial and Whole-Body Metabolic Performance After An Ultra Endurance Mountain Bike Race

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(No relationships reported)

At the annual Colorado Trail Race (CTR), participants cycled for up to 24 hours per day to complete 70,000 feet of elevation gain over 500 miles between the altitudes of 5,500 to 13,200 feet. **PURPOSE:** To characterize skeletal muscle mitochondrial and whole-body metabolic performance after prolonged stress (exercise, sleep deprivation, hypoxia). **METHODS:** One race participant (43yr male; $\text{VO}_{2\text{Max}}$, 58 ml/kg/min; BMI, 21 kg/m²) was studied before and after completing >360 miles of the CTR and a normal activity period (control) separated by 45 days. Each visit the participant arrived fasted overnight for a skeletal muscle biopsy followed by an oral glucose (75g) tolerance test (OGTT). High-resolution respirometry was performed on permeabilized skeletal muscle fibers using 3 different substrate-uncoupler-inhibitor-titration (SUIT) protocols. SUIT1 examined maximal fatty acid-supported respiration with sequential addition of complex I- and complex II-linked carbohydrate substrates and FCCP to determine substrate-specific coupled oxidative phosphorylation (OXPHOS) and uncoupled electron transport system (ETS) capacity. SUIT2 was designed to investigate carbohydrate-supported respiration without fat supply during maximal OXPHOS and ETS capacity. SUIT3 used an ADP titration to determine mitochondrial ADP sensitivity followed by maximal OXPHOS and ETS flux. **RESULTS:** In each SUIT protocol, ETS capacity was >200 pmol/s/mg tissue which are amongst the highest values published for human muscle. Despite the high ETS capacity, carbohydrate linked OXPHOS and ETS capacity (SUIT2) was severely decreased after the CTR. However, the decrease in respiration appeared to be attenuated during fatty acid-linked respiration (SUIT1). Conversely, ADP sensitivity was increased after the CTR and was accompanied by a lower glucose and insulin area under the curve during the OGTT. **CONCLUSIONS:** This study provides a comprehensive characterization of skeletal muscle mitochondrial respiration after an ultra endurance event. The highly trained participant presented with preeminent mitochondrial capacity but was unable to maintain maximal mitochondrial respiration when faced with the extreme stress of an ultra endurance mountain bike race.

2922 June 2 2:00 PM - 2:15 PM

Monitoring Cardiovascular, Hepatic, Renal, And Hematological Markers Of Health In Collegiate Soccer Players

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Clinical biomarkers of general health status may indicate health impacts of overtraining in athletes attempting to optimize performance using long-term tracking tools.

PURPOSE: To test the hypothesis that biomarkers of cardiovascular, liver, kidney and hematological function reflect athlete health and performance over the course of a collegiate soccer season.

METHODS: 20 NCAA Division I male soccer players (mean±SD; height, 181±6cm; body mass, 77.9±6.2kg; BF%, 11.9±2.4%; $\text{VO}_{2\text{max}}$, 52.9±6.1 mL·kg⁻¹·min⁻¹) provided blood samples for a test panel of 53 biomarkers at 5 time points: before preseason (PS), week 1 (W1), week 4 (W4), week 8 (W8), and week 12 (W12). Significant changes were assessed via repeated measures ANOVA and post hoc testing ($p \leq 0.05$).

RESULTS: Markers of potential organ damage markers aspartate amino transferase (AST) (U·L⁻¹) and creatinine (mg·dL⁻¹) were elevated at W1 (AST, creatinine; 29±11, 1.11±0.13), W8 (31±11, 1.11±0.11), and W12 (28±11, 1.15±0.13) vs. PS (18±4, 1.02±0.13, all $p < 0.05$). Alanine amino transferase (ALT) (U·L⁻¹) levels were also significantly higher at W8 (24±8) and W12 (24±9) vs. PS (18±5, both $p < 0.05$). Hematocrit (%) measures were significantly reduced at W1 (45.5±2.3, $p = 0.015$) vs.

PS (47.2±2.8); W4 (46.4±2.6) and W12 (46.4±3.1) values suggest that values returned to PS levels ($p > 0.05$) later in season. Additional markers of anemia, mean corpuscular volume, mean corpuscular hemoglobin concentration, red cell distribution width were reduced at W12 vs. all time points (all $p < 0.007$). We observed reductions in cardiovascular/metabolic health markers (mg·dL⁻¹) LDL, LDL:HDL (no unit), non-HDL, direct LDL, and Apolipoprotein B at W1 (77±20, 3.2±0.5, 106±24, 96±25, and 71±17) than at PS (87±22, 2.8±0.5, 93±22, 81±22, and 64±15, all $p < 0.017$). HDL (mg·dL⁻¹) was significantly greater at W4 (56±10), W8 (55±10), and W12 (58±11) than at PS (50±8, all $p < 0.05$). Total cholesterol (mg·dL⁻¹) was significantly elevated at W8 (163±28, $p = 0.012$) and W12 (168±31, $p = 0.007$) vs. W1 (145±26).

CONCLUSIONS: Our panel detected a decrease in HCT beginning at W1, but improved cardiovascular/metabolic health throughout the season. Ongoing analysis aims to optimize this general health panel for practical use by correlational analysis to performance data.

2923 June 2 2:15 PM - 2:30 PM

Stretching Combined With Tens Or Self-massage Has Differential Effects On Ankle Flexibility

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(No relationships reported)

Many studies evaluating the effect of stretching conclude that gains in flexibility are primarily due to improved stretch tolerance (discomfort). Under this rationale, use of pain reduction therapies while stretching should provide greater improvements in flexibility than stretching alone. Transcutaneous electrical nerve stimulation (TENS) is a modality commonly used to mitigate pain. Self-massage with a foam roller, which may modulate the mechanical properties of connective tissues, has been shown to improve flexibility.

Purpose: To compare the influence of TENS and self-massage on ankle joint flexibility and force capacity of the plantar flexor muscles after a stretching intervention.

Methods: 20 healthy young adults (10M, 10F, mean (SD) age 25 (3) y) underwent 3 sessions of ankle plantar flexor stretching: stretching alone (SS), stretching with concurrent application of TENS (TS), and stretching after self-massage using yoga therapy balls (BS). Each visit was separated by one week. All subjects performed SS at the first visit; the remaining 2 visits were counterbalanced. At every visit, subjects performed isometric maximum voluntary contractions (MVCs) for the plantar flexors before and after the intervention. Stretching involved three 30-s standing calf stretches, separated by 30-s rest. TENS was applied at a comfortable current without muscle contraction for 1-min prior to, and for the duration of stretching. Massage with yoga balls was performed for 60-s immediately prior to each of the 3 stretches. Ankle dorsiflexion range of motion (ROM) was assessed before, immediately after, and at 1, 5, 10, and 15 min after the intervention.

Results: All 3 interventions significantly increased ankle dorsiflexion ROM (all $p = 0.00$). The mean (SD) change in ROM was 13 (9)%, 9 (7)%, and 25 (17)% for SS, TS, and BS, respectively. The mean (SD) change in ankle torque was -1(13)%, -3 (10)%, and 16 (11)% for SS, TS, and BS, respectively. In contrast to TENS (TS), the use of yoga therapy balls significantly increased ROM and MVC torque (both $p = 0.00$, effect size 0.40, 0.58 for ROM, torque).

Conclusion: The addition of TENS to a stretch intervention did not improve ankle joint range of motion or alter MVC force. In contrast, self-massage with yoga therapy balls prior to stretching significantly improved range of motion and MVC force.

2924 June 2 2:30 PM - 2:45 PM

Lower Limb POWER Training to Enhance Locomotor and Muscular Function Poststroke

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Training to improve muscle power generation has functional benefits beyond strength training in an aging population. Individuals following stroke show pronounced deficits in muscle power generation as well as function (i.e. gait speed), though data on specific adaptations following muscle power training are not available. **PURPOSE:** The purpose of this analysis was to determine the effects of the Poststroke Optimization of Walking Using Explosive Resistance (POWER) training on the paretic limb's contribution to walking. **METHODS:** Twenty individuals (13 male; 51 yrs; 36 mos poststroke) with chronic poststroke hemiparesis participated in this study. Subjects completed 24 training sessions that included a series of progressive, intensive leg press and jump training exercises, sit-to-stands, step-ups, and calf raises. Subjects also performed progressive overground fast walking to emphasize task-specific lower extremity power generation. Kinetic data was collected via a split-belt instrumented treadmill during three walking trials at self-selected (SSWS) and fastest comfortable walking speeds (FCWS). Using the anterior-posterior ground reaction forces (A-P

GRFs), the percentage of total propulsion generated by the paretic limb was calculated by dividing the propulsive impulse of the paretic leg by the sum of the paretic and nonparetic propulsive impulses. Other outcomes included overground SSWS and FCWS, maximum voluntary isometric contractions (MVIC), and peak isotonic power of the knee extensors. Subjects underwent pre-testing, post-testing, and 12-week follow-up testing. One-way repeated measures ANOVAs were used to determine main effects of time. **RESULTS:** Significant effects for time were observed for SSWS ($p<0.01$), FCWS ($p=0.01$), and nonparetic knee extensor MVIC ($p=0.05$) and power ($p<0.01$). Although peak A-P GRFs of the paretic limb significantly increased following training ($p=0.01$), no changes were observed in paretic propulsion. **CONCLUSION:** Subjects improved gait speed, but those improvements were not accompanied by enhanced symmetry following POWER training. Future data will look into other potential underlying kinetic and kinematic mechanisms contributing to the significant and clinically meaningful improvements in gait speed (>0.16 m/s) observed in this cohort.

2925 June 2 2:45 PM - 3:00 PM

Acute Effects of Speed-Dependent Interval Training Versus Continuous Training on Post-Stroke Locomotor Function

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(No relationships reported)

The benefits of interval training (IT) compared to continuous training (CT) have been shown on a variety of functional and health-related outcomes. To date, the feasibility of IT has been demonstrated in individuals following stroke, though investigations of its effectiveness are still lacking. **Purpose:** To compare acute changes in locomotor function following single bouts of continuous (CT) and interval (IT) treadmill training, matched for total work, in ambulatory individuals with chronic stroke. **Methods:** Participants completed 20 minute sessions of CT and IT treadmill exercise separated by a minimum of 48 hours. Overground self-selected walking speed (SSWS) was used for CT while IT involved a 1:1 ratio (1 min slow : 1 min fast walking) with the goal of fast walking at 150% of SSWS and slow walking at 50% of SSWS. If subjects could not achieve 150% SSWS then speed was reduced and slow walking speed was adjusted to ensure matched-work between conditions. Overground SSWS was assessed prior to, immediately following as well as 20, 40 and 60min post-training. Subjects also walked at self-selected speed on a split-belt, instrumented treadmill to collect ground-reaction force data at the same time points. **Results:** Six subjects completed both sessions. Average CT treadmill speed was 0.92 m/s; average IT speeds were 0.57 m/s (slow) and 1.26 m/s (fast). Immediate post-training increases in SSWS were realized following CT (+6%) but not IT (-2%). SSWS following CT remained 6% faster than pre-training SSWS over time. In contrast, IT showed a delayed increase in speed with 7% improvement in SSWS at 20min, 11% at 40min, and 6% at 60min. Improvements in peak paretic propulsive (Pp) force were realized immediately post-training for the CT condition (+10.3 N; +21%) and persisted over time (20min +24%, 40m +23%, 60m +19%). IT improved peak Pp force immediately post-training (+6.9 N; +14%) and remained elevated post-training (20m +18%, 40m +16%, 60m +11%). **Conclusion:** These preliminary results suggest single bouts of IT and CT treadmill walking appear to elicit acute increases in SSWS as well as propulsive forces in individuals following stroke. The potentially greater relative improvements following IT suggest its potential effectiveness over CT if changing walking function is the goal. Funding source NIH COBRE Stroke Study P20-GM109040

F-14 Free Communication/Slide - Exercise and Chronic Disease

Friday, June 2, 2017, 1:00 PM - 3:00 PM
Room: 401

2926 **Chair:** Matthew Harber, FACSM. *Ball State University, Muncie, IN.*

(No relationships reported)

2927 June 2 1:00 PM - 1:15 PM

Exercise Training Improves Ventilatory Efficiency in Patients With Small Abdominal Aortic Aneurysm: A Randomized Controlled Study

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(No relationships reported)

PURPOSE: To investigate the effects of exercise training on ventilatory efficiency and other physiological responses to submaximal exercise in subjects with small abdominal aortic aneurysm (AAA).

METHODS: Sixty five patients (72.3±7.0 yr) were randomized to exercise training (n=33) or usual care groups (n=32). Exercise subjects participated in a training program for 3 months. Cardiopulmonary exercise testing was performed before and after the study period and peak $\dot{V}O_2$, the ventilatory threshold (VT), the oxygen uptake efficiency slope (OUES) and the $\dot{V}_E/\dot{V}O_2$ slope were identified. Baseline work rates at VT were matched to examine cardiopulmonary responses before and after training. ANOVA was used to assess time by group interactions.

RESULTS: Significant interactions indicating improvements in the exercise group were observed for time ($p<0.01$), $\dot{V}O_2$ ($p<0.01$), and work rate ($p<0.01$) at the VT. At peak effort, significant interactions were noted for time ($p<0.01$) and work rate ($p<0.01$), while borderline significance was noted for absolute ($p=0.07$) and relative ($p=0.04$) $\dot{V}O_2$. Significant interactions were observed for the OUES both when using all exercise test data (Exercise: 2.03 to 2.16, and Usual care: 2.10 to 1.98; p for interaction =0.04) and when calculated up to the VT (Exercise: 2.07 to 2.23, and Usual care: 2.13 to 1.95; p for interaction <0.01). For the $\dot{V}_E/\dot{V}O_2$ slope, significance was only noted when calculated up to the VT (Exercise: 30.4 to 29.5, and Usual care: 29.2 to 30.3; p for interaction=0.04). After training, heart rate (104.5 to 97.3 bpm), \dot{V}_E (34.2 to 32.0 L/min), $\dot{V}CO_2$ (1013.6 to 910.6 ml/min) and respiratory exchange ratio (0.85 to 0.82) were significantly attenuated for the same baseline workrate in the exercise group (all $p<0.01$), but no changes were observed in the usual care group.

CONCLUSIONS: Exercise training improves ventilatory efficiency in patients with small AAA. In addition, exercised patients exhibited less demanding cardiorespiratory responses to submaximal effort, with potential clinical significance for activities of daily living.

2928 June 2 1:15 PM - 1:30 PM

Associations Between Perceptual and Ventilatory Responses to Exercise: Effect of Sympathetic Blockade

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(No relationships reported)

Previous studies have shown that the first and second lactate threshold are associated with a rating of perceived exertion (RPE) of 11 and 14 on the Borg 6-20 RPE scale. However, it remains unclear how the RPE is associated with the ventilatory breakpoints and whether this relationship is altered by sympathetic blockade.

Purpose: To determine the association between the RPE and ventilatory breakpoints, and whether the relationship is altered by acute sympathetic blockade. **Methods:** The oxygen uptake ($\dot{V}O_2$) at the ventilatory threshold (VT) and respiratory compensation point (RCP) were determined from a graded exercise test in eleven healthy participants (6 male, 26±5 y) under a β_2 receptor antagonist and placebo. Treadmill speed increased by 2 km·h⁻¹ every two minutes until exhaustion. The $\dot{V}O_2$ was measured continuously and RPE recorded in the final 10s of each min. Linear regression modelled the RPE: $\dot{V}O_2$ relationship and predicted the RPE associated with VT and RCP. The $\dot{V}O_2$ associated with RPE 13 and 15 were also predicted and expressed relative to the VT and $\dot{V}O_{2peak}$. Paired samples t-tests assessed differences between conditions.

Results: The $\dot{V}O_2$ at VT and peak exercise were significantly lower under β -blockade (32±3 vs 30±3 and 52±5 vs 49±7 mL·kg⁻¹·min⁻¹, $p<0.05$), while the $\dot{V}O_2$ at RCP

remained unchanged. The RPE associated with VT and RCP were 13 ± 1 and 17 ± 1 , respectively, and not significantly different during β -blockade (13 ± 1 and 18 ± 0.6 respectively; $p > 0.05$). The VO_2 associated with RPE 13 was significantly lower under β -blockade compared to control (28 ± 6 vs 32 ± 6 mL \cdot kg $^{-1}$ \cdot min $^{-1}$; $p < 0.05$). However, when expressed relative to VT (94 ± 15 and $99 \pm 14\%$) and $\text{VO}_{2\text{peak}}$ (58 ± 8 and $62 \pm 10\%$) differences were no longer significant (all $p > 0.05$). For RPE 15, associated VO_2 was significantly lower during β -blockade (35 ± 6 vs 39 ± 6 mL \cdot kg $^{-1}$ \cdot min $^{-1}$; $p < 0.05$), but no longer significant when expressed relative to VT (116 ± 13 and $120 \pm 13\%$; $p > 0.05$) and $\text{VO}_{2\text{peak}}$ (72 ± 6 and $75 \pm 8\%$; $p > 0.05$). **Conclusion:** Despite changes in the VT and $\text{VO}_{2\text{peak}}$ with β -blockade, the RPE associated with VT and RCP remain constant. Further, the exercise intensity associated with RPE 13 and 15 appear to scale in accordance with changes in VT and $\text{VO}_{2\text{peak}}$.

2929 June 2 1:30 PM - 1:45 PM

Cardiorespiratory Fitness Versus Physical Activity as Predictors of All-Cause Mortality in Men

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A limited number of studies have examined the interaction between cardiorespiratory fitness (CRF), physical activity (PA) and all cause-mortality.

PURPOSE: To assess the independent and combined associations of PA, CRF and all-cause mortality in 11,610 male veterans aged 20 to 89 (mean \pm SD, 58.5 ± 11.2 years) who were referred for exercise testing at the Veterans Affairs Medical Center in Washington, DC, or Palo Alto, CA.

METHODS: CRF was assessed by a maximal exercise treadmill test and PA was measured by self-reported questionnaire obtained at the time of the exercise test. There were 2876 deaths during a mean (\pm SD) follow-up of 9.8 (5.9) years. Cox proportional hazard models were used to assess the independent associations between CRF, PA and mortality. To further explore the interaction between PA and CRF with mortality, we dichotomized the cohort into fit and unfit groups, defined by a CRF threshold of 7 METS. Within the fit and unfit groups, active individuals (meeting 150 minutes of moderate or higher intensity PA per week) and inactive individuals (not meeting 150 minutes of moderate or higher intensity PA per week) were matched, 1:1, for CRF, age and BMI. Hazard ratios [HRs] compared inactive subjects (reference) with active subjects. All analyses were adjusted for age, BMI, smoking status, family history of risk factors, medication use, history of stroke, and presence or absence of hypertension, diabetes, hypercholesterolemia, or cardiovascular disease.

RESULTS: CRF was inversely associated with mortality after adjusting for clinical variables (HR: 0.88; 95% confidence interval [CI]: 0.87 – 0.89), and remained a strong predictor of mortality after further adjusting for PA; the risk reduction per 1-MET increase in CRF was 15% (HR: 0.85; CI: 0.83 – 0.87). PA was a significant predictor of mortality after controlling for clinical variables (HR: 0.83; CI: 0.75 – 0.93), however the association was eliminated after further adjusting for CRF (HR: 0.98; CI: 0.88 – 1.10). Further, within both the fit (HR: 0.91; CI: 0.74 – 1.11) and unfit groups (HR: 0.98; CI: 0.83 – 1.15), meeting the PA guidelines (Active) was not significantly associated with mortality compared to the reference group (Inactive).

CONCLUSION: In adult male, US veterans, CRF is associated with mortality risk independent of PA, whereas the reverse is not true.

2930 June 2 1:45 PM - 2:00 PM

Can A Prediction Formula Accurately Predict Cardiorespiratory Fitness In Fibromyalgia Patients?

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Cardiorespiratory fitness (CRF) is often estimated using prediction formulas when clinicians do not have access to a metabolic cart. Unfortunately, using prediction formulas could potentially over or under estimate the CRF of patients with a chronic disease. Improving the accuracy of CRF in fibromyalgia (FM) patients is important considering that it has been reported that they have a lower CRF when compared to match controlled healthy participants. **PURPOSE:** To assess if a commonly used formula is accurate to predict CRF ($\text{VO}_{2\text{peak}}$ or METs) in women living with FM. **METHODS:** Twelve FM women (age: 50.5 ± 7.9 years; weight: 69.3 ± 16.0 kg; BMI: 26.4 ± 7.1) were submitted twice to a maximal exercise test (BSU/Bruce ramp), with a 24 hours' interval, until participants achieved volitional exhaustion. Gas exchange (Ergogard, Medisoft) and ECG (Quinton) was continuously monitored throughout

the test. $\text{VO}_{2\text{peak}}$ was considered as the highest O_2 uptake averaged over a 30 second period during the test and the highest value obtained between the first test (T1) and second (T2). Predicted $\text{VO}_{2\text{peak}}$ was determined by the formula integrated in the Quinton ECG system and the highest value between T1 and T2. The Metabolic equivalent of task (METs) was determined by using $\text{VO}_{2\text{peak}}$ values divided by 3.5 ml O_2 \cdot kg $^{-1}$ \cdot min $^{-1}$. **RESULTS:** No significant differences were found between both $\text{VO}_{2\text{peak}}$ (T1; 25.5 ± 5.3 vs. T2; 26.5 ± 5.3 ml O_2 \cdot kg $^{-1}$ \cdot min $^{-1}$, $p > 0.05$) tests. However, measured $\text{VO}_{2\text{peak}}$ (27.2 ± 5.6 ml O_2 \cdot kg $^{-1}$ \cdot min $^{-1}$) was significantly lower than predicted $\text{VO}_{2\text{peak}}$ (32.4 ± 5.6 ml O_2 \cdot kg $^{-1}$ \cdot min $^{-1}$, $p < 0.05$). In fact, the prediction formula overestimated the CRF by 1.5 ± 1.1 METs or 19.1%. When participants were divided by the severity of their disease, CRF was overestimated by 1.2 ± 0.8 METs in the mild ($n=5$) and by 1.6 ± 1.3 METs in the moderately-to-severely ($n=7$) affected FM participants, but did not attain statistical difference between groups. **CONCLUSION:** Our results show that system based prediction formula commonly used in the clinical setting overestimate cardiorespiratory fitness in women with fibromyalgia and should be used with precaution.

2931 June 2 2:00 PM - 2:15 PM

The Immediate Antihypertensive Effects of Aerobic Exercise: A Meta-Analysis

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Acute aerobic exercise (AE) produces immediate but transient blood pressure (BP) reductions that persist for up to 24 hr, termed *postexercise hypotension* (PEH). PEH is strongly correlated with the BP response to AE training. Surprisingly, 33 meta-analyses exist on the BP response to AE training, but none on PEH. **PURPOSE:** To perform a meta-analysis to determine the effectiveness of PEH as antihypertensive lifestyle therapy among adults with hypertension. **METHODS:** Databases were searched for controlled PEH trials that included: adults (>19 yr) with hypertension (systolic BP [SBP]/diastolic BP [DBP] ≥ 140 and/or ≥ 90 mmHg and/or on BP medication), and BP measured pre- and post-acute AE and control. Study quality was determined using a modified Downs and Black checklist. Analyses incorporated random-effects assumptions. **RESULTS:** Ten studies and 17 interventions qualified. Subjects ($N=260$) were middle-aged (41.8 ± 4.2 yr), overweight (28.9 ± 2.3 kg \cdot m $^{-2}$) adults (24% women, 76% men) with hypertension (SBP/DBP= $140.6 \pm 9.2/89.2 \pm 4.4$ mmHg). The AE bout was performed at moderate intensity (5.4 ± 1.3 metabolic equivalents [METs], $\sim 55\%$ maximal oxygen consumption) for 38.0 ± 8.7 minutes, typically on a cycle ergometer (61.9%, $k=13$). Awake ambulatory BP consisted of 3.1 ± 0.6 measurements/hr at 18.2 ± 4.9 minute intervals over 11.7 ± 4.7 hr. Overall, PEH occurred over the awake hr (SBP/DBP: d , [95% CI]= -0.76 [$-1.03, -0.49$]/ -0.33 [$-0.50, -0.17$]; $-5.42/-2.12$ mmHg), but effect sizes lacked homogeneity (P [95% CI]= 85.0% [77.4%, 90.1%]/67.9% [46.9%, 80.6%]). PEH was of greater magnitude following higher than lower intensity (>6 - <9 METs, $-11.4/-5.6$ versus 4 METs, $-1.6/-0.5$ mmHg, $p=0.04$, respectively), independent of resting BP. For DBP only, PEH was of greater magnitude among trials of lower than higher study quality (-4.0 versus -0.4 mmHg, $p=0.03$). **CONCLUSIONS:** On average, the magnitude of PEH was equal to the magnitude of the BP reductions that are reported after AE training (~ 5 - 7 mmHg). Furthermore, PEH was of greater magnitude among trials of higher intensity (SBP, ~ 11 mmHg) and lower quality (DBP, ~ 4 mmHg). Of note, the antihypertensive benefits of PEH occurred during the awake hr when BP is typically at its highest levels. Future trials are warranted to confirm the effectiveness of PEH as antihypertensive therapy.

2932 June 2 2:15 PM - 2:30 PM

Effect of Differential Exercise Intensities on Interleukin-22 in Metabolic Syndrome

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Elevated serum interleukin-22 (IL-22) concentration is independently associated with the incidence of type 2 diabetes and coronary artery disease. Individuals with metabolic syndrome (MetS) are at increased risk of developing both conditions. Paradoxically, evidence also exists demonstrating that IL-22 may have a role in the alleviation of MetS.

PURPOSE: We investigated the impact of moderate-intensity continuous training (MICT) and different volumes of high-intensity interval training (HIIT) on IL-22.

METHODS: This was a sub-study of the 'Exercise in prevention of Metabolic Syndrome' (EX-MET) multi-center randomized trial, based on data collected at the Brisbane site. Thirty-nine MetS individuals were randomized to one of three 16-wk interventions: i) MICT (n=10, 30min at 60-70%HRpeak, 5x/wk); ii) 4HIIT (n=13, 4x4min at 85-95%HRpeak, interspersed with 3min of recovery at 50-70%HRpeak, 3x/wk); or iii) 1HIIT (n=16, 1x4min at 85-95%HRpeak, 3x/wk). Serum IL-22 concentration was measured following a 12-hr fast via enzyme linked immunosorbent assays, before/after the intervention. MetS severity, cardiorespiratory fitness (CRF), insulin resistance (IR), and visceral adipose tissue (VAT) were also measured via MetS z-score, HOMA-IR, dual-energy x-ray absorptiometry, and indirect calorimetry, respectively.

RESULTS: The median (IQR) IL-22 percent changes from pre- to post-intervention in the MICT, 4HIIT, and 1HIIT groups were -17% (-43.0%; 31.3%), +16.5% (-18.9%; 154.9%), and +15.9% (-28.7%; 46.1%) respectively. Although there was no significant between-group difference in IL-22 change, there was a medium-to-large group x time interaction effect on this cytokine [$F(2,35)=2.08$, $p=0.14$, $\eta^2=0.14$]. There were similar reductions in MetS severity (MICT, -0.5±1.8; 4HIIT, -0.5±0.9; 1HIIT, -1.3±1.8), IR (MICT, -2.1±2.7; 4HIIT, -0.8±1.4; 1HIIT, -1.0±2.0), and VAT (MICT, -47.2±152.6g; 4HIIT, -68.2±106.0g; 1HIIT, -44.9±102.7g) following all interventions. 4HIIT (+5.7±4.7ml/kg/min) significantly improved CRF more than MICT (+2.7±1.9ml/kg/min) and 1HIIT (+2.9±2.2ml/kg/min).

CONCLUSION: Although there was no significant between-group difference in IL-22 change, the study suggests that different exercise intensities may have different effects on IL-22 in MetS individuals.

2933 June 2 2:30 PM - 2:45 PM

Effects Of Aerobic & Resistance Training On Cardiorespiratory Fitness In People Living with HIV. A Meta-analysis

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The life expectancy of people living with HIV (PLWH) is increasing due to advancements in anti-retroviral drug therapy. For this reason, PLWH are increasingly facing age-related comorbidities. Higher cardiorespiratory fitness is associated with lower risks for cardiovascular and metabolic diseases. Prior meta-analyses have focused on the effect of exercise in PLWH investigating VO_{2max} in a small amount of available studies. This meta-analysis represents a large number of included studies and will be the first investigating the 6-Minute Walk Distance additionally.

PURPOSE

To assess the effects of aerobic exercise alone or in combination with resistance training on cardiorespiratory fitness (Maximal Oxygen Consumption (VO_{2max}) and performance in the 6-minute walk test (6MWT) in PLWH.

METHODS

Two authors (CPC and PAZ) independently performed a systematic literature search for relevant articles in six web-based databases. Only randomized controlled trials (RCTs) were included. The Physiotherapy Evidence Database-Scale (PEDro-scale) was used to rate the quality level of the studies and to assess the risk of bias. A meta-analysis was performed and standardized mean differences (SMDs) were calculated for each outcome and assessed for heterogeneity.

RESULTS

A total of 335 articles were found. After screening, a total of 14 articles were selected with three more articles added after cross referencing, leading to a total of 17 included studies (n=617 subjects after intervention). Only 8 of the selected studies had a PEDro-

Score ≥ 6 after quality assessment. 13 studies assessed VO_{2max} and 4 studies 6MWT. The random-effect model was used. Exercise significantly improved VO_{2max} (SMD = 0.61 ml·kg⁻¹·min⁻¹, 95% CI: 0.35-0.88, $z = 4.47$, $p < 0.001$). After exercise intervention, 6MWT distance also increased significantly (SMD = 0.59 meters, 95% CI: 0.08-1.11, $z = 2.25$ ($p = 0.02$)). Heterogeneity of VO_{2max} and 6MWT between included studies was $I^2 = 50\%$ and $I^2 = 63\%$, respectively.

CONCLUSION:

Performing aerobic exercise alone or in combination with resistance training can lead to significant improvements in outcomes of cardiorespiratory fitness (VO_{2max} and 6MWT) in PLWH and could therefore be a protective factor for PLWH dealing with multiple comorbidities.

2934 June 2 2:45 PM - 3:00 PM

Role Of Physical Activity In Closing The Life Expectancy Gap of People With Mental Illness

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PURPOSE: People experiencing mental illness are at high risk of poor lifestyle factors such as physical inactivity, which contributes to a 15 to 25-year gap in life expectancy. To develop an international consensus statement on behalf of Exercise & Sports Science Australia (ESSA), the American College of Sports Medicine (ACSM) and Sport and Exercise Science New Zealand (SESNZ) on the role of exercise interventions as a key component of a global strategy towards achieving a 50% reduction in the life expectancy gap of people experiencing mental illness by 2032.

METHODS: The statement was sent to all signatory organizations for review and endorsement. **RESULTS:** Three factors were identified including i) culture change with psychiatric facilities to allow for the integration of exercise practitioners within routine care, ii) advocating for appropriate infrastructure for the provision of exercise interventions regardless of treatment setting, age, diagnosis or physical health status, and iii) prioritizing training of exercise practitioners to ensure adequate mental health literacy and competency to work within psychiatric facilities. Similarly, training of mental health professionals regarding the role of exercise practitioners within mental health must be addressed. **CONCLUSIONS:** The organisations that endorse this consensus statement commit to promoting the role of exercise interventions as a key component of a global strategy towards achieving a 50% reduction in the life expectancy gap of people experiencing mental illness by 2032. We believe that enhanced training of our members, working with our medical, other allied health and health policy partners to facilitate culture change within mental health services and advocating for the provision of required infrastructure are the cornerstones of achieving this goal.

F-15 Free Communication/Slide - Perception of Effort, Pain and Fatigue

Friday, June 2, 2017, 1:00 PM - 3:00 PM
Room: 103

2935 **Chair:** Dane B. Cook, FACSM. University of Wisconsin-Madison, Madison, WI.
(No relationships reported)

2936 June 2 1:00 PM - 1:15 PM

Resistance Exercise Performed With The Same Load In Self-selected And Imposed Intensities Promote Different Affective And Perceptual Responses

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PURPOSE: to compare the perceptual and affective responses to self-selected and imposed load resistance exercise performed with the same load. **METHODS:** 15 young male college students with at least 6 months experience in resistance training (age: 24.5 ± 3.4 yrs; height: 176.3 ± 5.8 cm; body mass: 79.0 ± 10.3 kg) participated in the study. All subjects completed three exercise sessions: 1. familiarization and 1RM test; 2. self-selected exercise intensity, & 3. imposed exercise intensity. All exercises (chest press, leg extension, lat pulldown, & leg curl) were performed using machines. Each experimental exercise session consisted of 3 sets of 10 repetitions for each of the 4 exercises with 1 min of rest between sets and 2 min of rest between exercises. In the self-selected exercise session, participants were instructed to choose a load in which they could perform three sets. The participants were able to adjust the load at the end of each set. In the second exercise session, the same load was used, but without the individuals' knowledge. Subjects were informed that the investigators selected the load. Affect (Feeling Scale) and Ratings of Perceived Exertion (RPE) - OMNI-RES were assessed after each exercise. **RESULTS:** RPE was similar in 3 of the 4 exercises, but Affect was lower ($p < 0.05$) in all of the exercises in the imposed intensity exercise

sessions. **CONCLUSION:** Self-selected intensity results in a more favorable affective response to resistance exercise than imposed intensity in college men with at least 6 months of resistance training experience.

2937 June 2 1:15 PM - 1:30 PM

Influence Of Physical Activity And Sedentary Behavior On Anticipation-related Pain Sensitivity In Gulf War Veterans With Chronic Muscle Pain

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Exercise can alter pain sensitivity among Gulf War Veterans with chronic muscle pain (CMP). Anticipation of a painful experience can influence perceptual and neural responses to non-painful thermal stimuli among Fibromyalgia patients and this may extend to other patient groups with CMP. However, the association between physical activity or sedentary behavior and anticipation-related pain sensitivity has not been adequately studied. **PURPOSE:** To determine if (i) anticipation of pain influenced perceptual and neural responses to thermal stimuli among Veterans with CMP and (ii) anticipation-related pain sensitivity was associated with physical activity or sedentary behavior. **METHODS:** Gulf War Veterans with ($n=29$; 46 ± 6.5 years) and without ($n=29$; 45 ± 6.7 years) CMP were randomly assigned to conditions in which they were told that they would receive a painful or non-painful heat stimulus. Following one week of physical activity monitoring (ActiGraph GT3X), functional MRI responses to a 20-second warm stimulus (40C) applied to the left palm were measured on a 3T MRI scanner (GE MR750). Participants were then asked to provide ratings of pain intensity and unpleasantness following thermal stimulus administration. **RESULTS:** Factorial ANOVA with group and condition as between-subjects factors revealed significantly higher pain intensity ($p=.003$; $d=.85$) and unpleasantness ($p=.006$; $d=0.76$) ratings in the pain anticipation condition. A main effect for group and condition by group interaction was not found. Analyses of fMRI responses showed significantly different lateral postcentral gyrus activation in the pain anticipation condition. Linear regression analyses on Veterans in the pain anticipation condition showed that physical activity (e.g., moderate-vigorous physical activity) and sedentary behavior (e.g., average sedentary bouts of 30 or 60 minutes) did not significantly predict perception of pain intensity or unpleasantness. **CONCLUSION:** Pain anticipation influences perceptual and neural responses to non-painful stimuli among Gulf War Veterans with or without CMP; however, physical activity or sedentary behavior may not be related to anticipation-related pain sensitivity in this population. Supported by Dept. of Veterans Affairs grant: 561-00436

2938 June 2 1:30 PM - 1:45 PM

Playing With A Friend Or Parent, Versus Playing Alone, Moderates Associations Between Hr And Rpe.

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Previously, our group have shown that interacting with peers and/or parents, relative to playing alone, increases physical activity behavior in children without altering perceived exertion. It is possible that the enriching nature of interacting with peers and parents distracts children from how intense their physical activity is thus disrupting their ability to accurately perceive exertion. **PURPOSE:** To determine if, relative to a condition where a child plays alone, playing with a friend or parent moderates the association between an objective, physiologic measure of intensity (i.e., heart rate) and ratings of perceived exertion (RPE) in children. We hypothesized that the association between heart rate and RPE will weaken from the alone condition to both the parent and friend conditions. **METHODS:** Twenty children (8.3 ± 1.3 years old, $n = 10$ girls) participated in three simulated recess conditions (alone, friend, parent) on separate days. During each of the conditions, children had 30 minutes of free access to an outdoor playground (e.g., slides, crawl tubes, etc.) and a chair with a table of sedentary activity options (e.g., books, toys, coloring sheets, etc.) situated within the playground property. Only a single participant and their friend or parent (during the friend and parent conditions) were present during each condition. Average heart rate was recorded during each condition via a telemetry monitor and self-reported RPE was obtained via the children's OMNI walk/run scale. **RESULTS:** Pearson's correlation analyses revealed that the association between heart rate and RPE was strongest when children were playing alone ($r = 0.34$). This association was 10% and 62% greater than when children were playing with their friend ($r = 0.31$) and parent ($r = 0.21$), respectively. **CONCLUSION:** Playing with a parent and, to a lesser extent, with a friend present moderates the association between heart rate and RPE relative to a condition when

children were playing alone. It is possible that when children played with a parent or friend it was more difficult to perceive effort because they were distracted by their exercise partner. That distraction may come in the form of greater enjoyment of or motivation for participating in physical activity.

2939 June 2 1:45 PM - 2:00 PM

Altered Breathing Pattern Responses to Exercise in Veterans with Fatiguing Illness

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Gulf War Veterans with fatiguing illness often perceive exercise as more effortful in comparison to controls despite similar exercise capacity. Breathing pattern responses may contribute to this perception, but have not been thoroughly examined in this group of Veterans. **PURPOSE:** To evaluate breathing patterns during a maximal cardiopulmonary exercise test (CPX) between deployed Veterans with fatiguing illness and controls. **METHODS:** CPX was performed on a cycle ergometer in 17 deployed Veterans (mean \pm SD; 49.6 ± 6.2 years) with clinical fatigue (Fatigue Severity Scale [FSS]: 54.7 ± 6.1) and 14 non-fatigued controls (53.5 ± 5.8 years; FSS: 18.2 ± 7.9). Ventilatory parameters were obtained breath-by-breath throughout exercise and compared at relative intensities (20, 40, 60, 80 and 100% of peak oxygen consumption [$\dot{V}O_{2j}$]). Primary variables of interest included both tidal volume (VT) and respiratory frequency (RF) at increasing exercise intensities and were compared between- and within-groups using repeated measures ANOVA. **RESULTS:** Demographics (Veterans vs. controls: 30.3 ± 4.4 kg/m² vs. 30.7 ± 4.7 kg/m²), baseline physical activity levels (108.3 ± 45.9 vs. 154 ± 52.6 min-wk⁻¹), and peak $\dot{V}O_2$ (22.5 ± 4.7 vs. 20.9 ± 5.9 ml/kg/min) were similar between groups. A significant main effect for exercise intensity was observed for both VT and RF ($p < 0.05$), but only VT demonstrated a significant group-by-time interaction ($p < 0.05$). Veterans with fatiguing illness had significantly higher VT at each exercise intensity level ($p < 0.01$) in comparison to controls, but RF was similar across all intensities. Bivariate associations were observed between VT at each exercise intensity with FSS ($r = 0.39$, $p < 0.01$) and a measure of physical health-related functioning (physical composite score; $r = -0.35$ to -0.45 , $p < 0.01$), but not for RF ($p > 0.05$). **CONCLUSIONS:** Despite similar peak exercise capacity, Veterans with fatiguing illness adopt a unique breathing pattern characterized by high tidal volumes throughout exercise. Higher exercise tidal volumes may encroach on vital capacity and contribute to perceptions of fatigue and effort. Additional studies are needed to confirm a neurophysiological basis of exercise discomfort in this group of Veterans, but evaluating breathing patterns during exercise may afford unique insight.

2940 June 2 2:00 PM - 2:15 PM

The Influence Of A Sit-stand Desk On Sleepiness, Physical Discomfort, Physical Fatigue And Mental Fatigue

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Sleepiness, pain and fatigue significantly impact the productivity of office workers, and prolonged sitting may negatively impact these feelings during deskwork. Using a sit-stand desk could benefit these measures, but it is not clear. **PURPOSE:** To examine whether using a sit-stand desk to alternate posture could improve ratings of sleepiness, mental fatigue, physical fatigue and physical discomfort. **METHODS:** 25 inactive adults (age: 42 ± 12 yr; BMI: 31.9 ± 5.0 kg/m²) participated in a randomized cross-over study of two simulated 8-hr workdays (with a lunchbreak) while performing continuous sitting (SIT) or alternating sit-stand postures every 30 min (SIT-STAND). Ratings of sleepiness were measured by the 9-pt Karolinska Sleepiness Scale each hr while at the desk. A validated questionnaire measured the overall presence of physical discomfort, degree of physical discomfort (averaged across 10 body locations) and degree of physical and mental fatigue every 2 hr by 100-pt visual analog scales. Outcomes were checked for skewness and log transformed. Generalized linear mixed models, controlling for baseline values, evaluated differences across condition and time. **RESULTS:** Sleepiness increased across the day ($p < 0.001$) and was lower in SIT-STAND vs. SIT ($p = 0.036$). Mental fatigue was similar across time ($p = 0.095$) and conditions ($p = 0.068$). Comparing SIT-STAND to SIT, the presence of any physical discomfort was less frequently reported ($p = 0.006$) and degree of physical discomfort was lower ($p < 0.001$). The presence or degree of physical discomfort did not differ over time ($p = 0.378$ and $p = 0.089$, respectively). Physical fatigue was similar across the day ($p = 0.050$) and conditions ($p = 0.712$). (See table 1)

CONCLUSION: Using a sit-stand desk during daily work activity resulted in better ratings of sleepiness and physical discomfort compared to sitting all workday. These measures are important for presenteeism of office workers and should be explored over a longer duration.

2941 June 2 2:15 PM - 2:30 PM

Perceptions At Moderate Work Intensity In Temperate And Hot Conditions In Trained And Untrained Individuals

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Ratings of perceived exertion (RPE) and thermal comfort (TC) scales are used to assess exercise intensity, subjects' exertion and heat perception. For the safety of workers in the heat, it has been proposed that increased fitness levels may have a protective effect and could be associated with benefits to work in the heat, but it remains unclear if trained individuals perceive exertion and heat differently than untrained individuals at moderate work intensities. **PURPOSE:** This study compares RPE and TC in trained (TR) versus untrained (UT) individuals at a cycling intensity of 75% $\text{VO}_{2\text{max}}$ in the heat.

METHODS: Twelve young healthy males were categorized into two groups, TR (n=6, age=26.3±5.9 years, BMI=23.6±2.0kg/m², aerobic exercise minutes=265±114.5minutes/week) and UT (n=6, age=23.0±2.7 years, BMI=25.6±1.1kg/m², aerobic exercise minutes=55±72.0 minutes/week) based on their self-reported exercise behaviors. Each individual completed a graded exercise test on a cycle ergometer to maximal exertion in a neutral (NORM; 25°C, 50% relative humidity) or hot (HYPER; 40°C, 50% relative humidity) environment. During the HYPER condition, participants also wore a heating garment with 45°C circulating water until their rectal temperature (Tre) increased by 0.5°C from baseline.

RESULTS: At the start of exercise or at 75% $\text{VO}_{2\text{max}}$, neither HR nor Tre showed significant differences between TR and UT in either condition. RPE and TC did not differ between TR and UT in either condition at 75% $\text{VO}_{2\text{max}}$ - NORM: TR: RPE: 14.1±1.8, UT: 15.0±2.2, p=0.458; TC: 0.8±0.7, UT: 1.6±1.1, p=0.141; HYPER: TR: RPE: 13.6±0.5, UT: 12.6±2.3, p=0.369; TC: 1.8±0.4, UT: 1.6±0.5, p=0.649. RPE did not show differences between NORM and HYPER at 75% $\text{VO}_{2\text{max}}$ in TR (p=0.557) nor UT (p=0.152).

CONCLUSIONS: Trained individuals perceive exertion and heat similarly to untrained individuals at 75% $\text{VO}_{2\text{max}}$ in normal or hot conditions. This conclusion has implications for workers safety and the risk for heat injuries in hyperthermia across individuals of varying fitness levels.

2942 June 2 2:30 PM - 2:45 PM

Comparison of Mood Response Through Five Weeks of a High Intensity Functional Training Competition

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(No relationships reported)

Mood is known to be affected by exercise, as well as the predictability of an event. By design, high-intensity functional training (HIFT) incorporates a wide variety of exercise modalities. Further, competitive HIFT events generally incorporate a unique and unpredictable combination of fitness challenges that may elicit varying mood responses. **Purpose:** Examine mood prior to and following 5 unique, competitive HIFT events during a worldwide fitness competition. **Methods:** Physically active adults (N=11; 34.9 ± 5.1 years, 77.9 ± 15.1 kg, 166.1 ± 10.6 cm) with HIFT experience (≥6 months) completed a baseline (BL) Profile of Mood States (POMS) questionnaire the week prior to the HIFT competition. During each week of the 5-wk competition, the competitors completed a unique HIFT fitness challenge. For each challenge, the POMS was completed prior to (PRE), immediately post (IP), 30-min post- (30P), and 60-min post-exercise (60P). The POMS yields measures of tension, depression, anger, confusion, fatigue (FAT), and vigor (VIG). Additionally, Total Mood Disturbance (TMD; sum of other 5 subscales minus VIG) and Energy Index (EI; VIG - FAT) were also calculated and analyzed. **Results:** Repeated measures analysis of variance revealed no differences between BL and PRE values across weeks. Week (1-5) x Time (PRE, IP, 30P, 60P) interactions were observed for EI (P=0.025) and FAT (P=0.002). Compared to Week 5, EI was higher (increased VIG and/or decreased FAT) in Week 3 at 30P (Wk3: 12.3 ± 3.6; Wk5: 4.0 ± 5.4, P=0.003), and higher than Wk1 (P=0.005) and Wk3 (P=0.005) at 60P (Wk1: 14.8 ± 8.7; Wk3: 11.6 ± 4.0; Wk5: 6.0 ± 5.4). Compared to Wk3, FAT was significantly greater at Wk1 (P=0.005), Wk4 (P=0.001), and Wk5 (P=0.008) at IP (Wk1: 10.3 ± 4.0; Wk3: 4.4 ± 5.2; Wk4: 9.1 ± 5.9; Wk5: 10.4 ± 7.3). No other significant interactions were observed between weeks. **Conclusion:**

The unique design of the HIFT competition did not seem to impact pre-exercise mood, but the different workouts resulted in differing mood responses, particularly for vigor and fatigue.

2943 June 2 2:45 PM - 3:00 PM

Establishing Thresholds for Visual Discrimination of Intrinsic and Novel Coordination Patterns

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(No relationships reported)

Human movements are characterized with different coordination patterns. The ability to visually discriminate the coordination pattern is important for people to recognize the other's movement and plan for the response. Two coordination patterns are known to be intrinsic for humans: in-phase (0°) and anti-phase (180°). They can be perceived and produced easily without practice. Any coordination pattern between 0° and 180° has to be learned through significant amount of practice. Neurological diseases or traumatic brain injury may result in decreased ability to perceive and produce the intrinsic coordination patterns, as well as to learn novel coordination patterns.

PURPOSE: To establish threshold for healthy controls to visually discriminate the intrinsic and novel coordination patterns. **METHODS:** A total of 15 healthy adults aged from 20-40s were recruited (23.47 ± 3.87). They were tested on the ability to visually discriminate three coordination patterns: 0°, 90°, and 180°. A computer display of a target pattern was shown, followed by displays of a pair of patterns, in which one was the target pattern and the other was the distracting pattern. Participants had to press a key to indicate whether the first or second of the pair was the target pattern. Logistic curve fitting was performed to calculate the individual threshold for discriminating each target coordination pattern. **RESULTS:** A one-way repeated measure ANOVA was performed to examine the difference of mean thresholds among three coordination patterns. A significant difference was shown ($F_{2,28} = 54.88$, p<.001). The threshold for discriminating 90° was the greatest with the largest variability (25.64° ± 12.39°). Although thresholds for discriminating the two intrinsic coordination patterns were smaller, discriminating 180° (4.97° ± 3.79°) was more challenged and variable than discriminating 0° (0.56° ± 1.00°). **CONCLUSION:** For health controls, visually discriminating intrinsic coordination patterns is easier and more consistent than discriminating novel coordination patterns. Establishing the normal thresholds for visual discrimination of intrinsic and novel coordination patterns helped to develop visual-motor coordination tests to screen the neurological diseases or traumatic brain injury.

F-16 Free Communication/Slide - Prospective Studies of Physical Activity and Health

Friday, June 2, 2017, 1:00 PM - 3:00 PM

Room: 507

2944 **Chair:** Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.*

(No relationships reported)

2945 June 2 1:00 PM - 1:15 PM

The Level Of Physical Activity Post-myocardial Infarction Predicts Future Mortality

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Reported Relationships: M. Börjesson: Consulting Fee; NovoNordisk, AstraZeneca.

There is little knowledge of the association between physical activity (PA) level and the mortality risk post myocardial infarction (MI). Smaller studies have indicated, that individuals who remain active or increase their level of PA after MI have a lower risk of death. However, in order to confirm this and adjust for confounders larger studies are needed. **PURPOSE:** Explore any association between PA level after MI and all-cause mortality during follow-up in a large MI-cohort.

METHODS: A national cohort study including all patients <75 years of age, with a diagnosis of MI between 1991-2014 (Swedish MI register SWEDEHEART). From the register self-reported PA, 6-10 weeks post MI, (i.e. number of sessions during the past seven days with moderate and/or vigorous PA lasting ≥30 minutes) was obtained. The answers were grouped into 0-1 sessions (inactive), 2-4 sessions (moderately active) and 5-7 sessions (highly active). Associations were first assessed unadjusted, stratified by potential confounders (sex, age, smoking status, ejection fraction, ST-

elevation and quality of life). Thereafter, a multiple logistic regression was performed to control for possible confounders. **RESULTS:** Complete data was obtained from 37 655 individuals (median 63 years, 74 % men). A total of 2512 deaths occurred during a mean of 4.1 years of follow-up. The mortality rate was 17.0 cases/1000 person-years. Moderate activity (n= 10 601) and high activity (n=18 545), was associated with a lower risk of all-cause mortality at follow-up (OR 0.356 95 % CI 0.320-0.396 and OR 0.334, 95 % CI 0.305-0.366), compared to being physically inactive (n=8519). The OR's remained largely unchanged when stratifying for age, sex, non-ST elevation MI/ST-elevation MI and ejection fraction. However, active smokers had a lower OR, for subsequent death, as had patients with a low EQ5D. The associations persisted in the multiple logistic regression, after adjustment for the possible confounders above. **CONCLUSIONS:** A higher level of physical activity 6 -10 weeks after myocardial infarction, is associated with a lower risk of all-cause mortality at follow-up. These results suggest that physical activity assessment is important post-MI, not least as an important predictor of subsequent mortality.

2946 June 2 1:15 PM - 1:30 PM

Effect Of Cardiorespiratory Fitness On Blood Glucose Trajectory With Aging: A Cohort Study Of Japanese Men

Haruki Momma¹, Susumu S. Sawada, FACSM², Kazunori Shimada³, Yuko Gando², Motohiko Miyachi², Chihiro Kinugawa⁴, Takashi Okamoto⁴, Koji Tsukamoto⁴, Cong Huang¹, Ryoichi Nagatomi¹. ¹Tohoku University, Sendai, Japan. ²National Institutes of Biomedical Innovation, health and Nutrition, Tokyo, Japan. ³Juntendo University Graduate School of Medicine, Tokyo, Japan. ⁴Tokyo Gas Health Promotion Center, Tokyo, Japan.
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(No relationships reported)

There has only been one study examining the effect of cardiorespiratory fitness (CRF) on blood glucose with aging among Americans. Whether CRF also has a similar effect on aging-associated change in blood glucose among Japanese with lower prevalence of obesity as compared with Americans. **PURPOSE:** To investigate whether the aging-related increase of glucose in Japanese men with higher CRF is smaller than that of those with lower CRF. **METHODS:** We studied 6,153 Japanese men (age: 20-60 y) free of diabetes, cardiovascular disease and stroke in 1986. The participants completed annual health examinations including fasting blood glucose until 2009. CRF was measured by a submaximal exercise test between 1979 and 1986. Participants were divided into quartiles (Q1, Q2, Q3, and Q4) for CRF based on the cumulative mean of CRF during the period. Time-invariant covariates included BMI, smoking status, drinking habit, desk work, family history of diabetes, and frequency of measurements of blood glucose, and time-variant covariates included systolic blood pressure and fasting blood triglyceride. The trajectories of glucose with aging were analyzed using linear mixed models. **RESULTS:** Fasting glucose increased at a linear rate with aging. Glucose increased at a yearly rate of 0.49 mg/dL (95% confidence interval: 0.48-0.50). After adjustment for covariates, the aging-related glucose increase in men with Q4 of CRF (0.42 [0.40-0.44] mg/dL per year) was smaller than that in men with Q1 (0.55 mg/dL [0.50-0.60] per year), Q2 (0.51 mg/dL [0.46-0.56] per year), Q3 (0.48 mg/dL [0.42-0.53] per year), respectively. **CONCLUSIONS:** Higher levels of CRF is inversely associated with the increase in blood glucose with aging among Japanese healthy men.

2947 June 2 1:30 PM - 1:45 PM

Associations Of Sarcopenia And Low Muscular Strength With All-cause Mortality Among Us Older Adults

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Sarcopenia is defined as aging-related loss of muscle mass and knee extension strength serves as a marker of lower extremity muscular strength in populations. Sarcopenia and low muscular strength (LMS) may be important but understudied risk factors for aging-related morbidity and mortality in the older and elderly populations. **PURPOSE:** We aimed to prospectively examine individual or joint associations of sarcopenia and LMS with all-cause mortality in a nationally representative sample of US older adults in the National Health and Nutrition Examination Survey (NHANES). **METHODS:** Data sources included the NHANES 1999-2002 with public-use 2011 linked mortality files, which comprised 4,449 participants aged 50 years and older with complete data on body composition by dual-energy x-ray absorptiometry and isokinetic knee extensor strength measurement. Sarcopenia was defined by two definitions proposed by the National Institutes of Health Sarcopenia Project according to appendicular lean mass

(ALM) and ALM divided by BMI (ALM/BMI). LMS was defined as the lowest 25% of measurements of knee extensor strength. Weighted multivariable logistic regression models were adjusted for age, sex, race, BMI, smoking, alcohol use, education, leisure time physical activity, sedentary time, and comorbidities. **RESULTS:** The weighted prevalence of sarcopenia was 23.1% defined by ALM and 17.0% defined by ALM/BMI; the weighted prevalence of low muscular strength was 19.4%. In the multivariate-adjusted models, sarcopenia was significantly associated with increased risk of all-cause mortality for ALM/BMI definition (OR: 1.44; 95% confidence interval [CI], 1.06-1.97) but not for ALM definition (OR: 1.37; 95% CI, 0.90-2.09) while LMS was strongly associated with all-cause mortality (OR: 2.32; 95% CI, 1.70-3.18). In the joint analyses, a significantly increased all-cause mortality was observed only among participants with LMS and non-sarcopenia (OR range: 2.03-2.50) and those with LMS and sarcopenia (OR range: 2.15-2.56) while those without sarcopenia and LMS were the reference group. **CONCLUSIONS:** Low knee extensor strength indicative of low muscular strength was independently and significantly associated with an increased risk of all-cause mortality among US older adults regardless of the presence or absence of sarcopenia.

2948 June 2 1:45 PM - 2:00 PM

Muscle Weakness Increases the Risk of Incident Diabetes in Older Mexican Americans

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(No relationships reported)

A natural decline of muscle strength occurs during the aging process; however, preserving muscle strength may reduce the risk of many preventable diseases such as diabetes, especially in higher risk populations. **PURPOSE:** The purpose of this study was to examine the sex-specific association between muscle weakness and incident diabetes in older Mexican Americans. **METHODS:** A subsample of 1,903 Mexican Americans aged at least 65 years at baseline was followed for 13 years. Muscle strength was assessed with a hand-held dynamometer and was normalized to body weight (normalized grip strength (NGS)). Male and female participants were categorized as weak if their NGS was ≤ 0.46 and ≤ 0.30 , respectively. Diabetes status and age of diabetes diagnosis was self-reported by participants. Sex-stratified Cox proportional hazard regression models were used to determine the association between muscle weakness and incident diabetes when using age as an entry variable and after adjusting for marital status, employment status, and education. A sensitivity analysis was performed to account for influential outliers in the outcome variable (time to incident diabetes) and the model was re-run. If a >10% change in the hazard ratios was identified, the results of the model that underwent the sensitivity analysis would be presented. **RESULTS:** The hazard ratio for incident diabetes was 1.16 (95% confidence intervals (CI): 1.12-1.20; $p < 0.001$) in weak vs. strong males and 1.24 (CI: 1.21-1.27; $p < 0.001$) in weak vs. strong females, after adjusting for marital status, employment status and education. **CONCLUSIONS:** Muscle weakness was robustly associated with an increased risk of incident diabetes in older Mexican American males and females. Health professionals should encourage physical activities and healthy behaviors that preserve or improve muscle strength, thereby reducing the risk of incident diabetes in older Mexican Americans. NGS may also be used to assess and monitor muscle weakness in older populations, especially because it is inexpensive and non-invasive.

2949 June 2 2:00 PM - 2:15 PM

Examining The "Weekend Warrior" And Mortality Using Accelerometer-assessed Physical Activity In NHANES

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PURPOSE: It remains unclear if those who participate in physical activity on only a few days a week, "weekend warriors", have similar health benefits to those who perform activity more often over the week. Accelerometers provide a real time, objective measure of physical activity that may allow for further exploration of activity and health through pattern analysis, such as examining activity frequency. The aim of this study is to use accelerometer-assessed physical activity to compare the mortality risk among "weekend warriors" to more regularly active adults, in a large population-based study. **METHODS:** Study participants were from the National Health and Nutrition Examination Survey (NHANES), a population-based study with mortality follow-up through 2011. Participants were required to be at least 20 years

old and have worn the accelerometer for 6 or 7 days ($n = 4206$). Weekly moderate-to-vigorous physical activity (MVPA) was categorized based on the US Federal Physical Activity Guidelines: 1) <75 minutes; 2) 75-150 minutes; 3) ≥ 150 minutes per week (recommended). Of those in the ≥ 150 minutes group, participants who performed $\geq 50\%$ of their weekly activity on only 1 or 2 days were classified as "weekend warriors", and the rest as "regularly active". To compare mortality rates based on physical activity category, we calculated hazard ratios (95% confidence intervals) using Cox survival analysis and adjusting for relevant covariates. **RESULTS:** Over an average of 79.4 (SD = 18.6) months of follow-up, there were 419 deaths. Participants with some activity, but insufficient to meet the guidelines (75-150 minutes per week MVPA), had a 61% reduction (HR = 0.39 (95% CI: 0.26, 0.58)) in mortality risk compared to those with <75 minutes per week. Participants meeting the guidelines had a similar mortality risk reduction, $\sim 50\%$, compared to those with the least activity, whether "weekend warriors" (HR = 0.50 (0.32, 0.81)) or regularly active participants (HR = 0.48 (0.28, 0.81)). **CONCLUSIONS:** Active participants and those with some activity, but insufficient to meet the guidelines, both had reduced mortality risk during follow-up compared to the least active participants. "Weekend warriors" were observed to have comparable magnitude of risk reduction as regularly active participants.

2950 June 2 2:15 PM - 2:30 PM

The Epidemiology of Health and Morbidity Amongst Former Rugby Union Players

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Despite over 7 million participants in rugby union ('rugby') globally, the effect of rugby on health, in terms of increasing or decreasing the prevalence of long-term morbidity amongst players, has not yet been established. Where sport may be associated with decreased morbidity, participation can be recommended as improving specific health outcomes. Where former players are seen to demonstrate health deficits, potential targets for population interventions may become evident. **PURPOSE:** To determine the prevalence of self-reported physician-diagnosed morbidity amongst former elite rugby players, and compare this with an age and gender-standardised representative national population comparison. **METHODS:** A cross-sectional questionnaire study was used. The English Longitudinal Study of Ageing (ELSA), a nationally representative study of English adults, was used as a control population. Age and gender matched standardised morbidity ratios (SMR) were calculated against the ELSA reference population. A post-hoc sensitivity analysis examined morbidity differences between the complete cohort of former players and ELSA participants. **RESULTS:** Amongst gender-matched rugby ($n=259$) and ELSA ($n=5186$) participants aged 50 and over, diabetes was significantly lower amongst former players (SMR 0.28, CI 0.11 to 0.66), whereas osteoporosis (SMR 2.69, CI 1.35 to 5.38) and osteoarthritis (SMR 4.00) were significantly increased amongst former players. In unadjusted, complete cohort sensitivity analyses, hypertension and heart problems were also decreased compared with ELSA. **CONCLUSIONS:** Morbidity differs amongst former elite rugby players and the general population. The magnitude of musculoskeletal morbidity in this population may warrant proactive osteoarthritis education and management in this at-risk population.

2951 June 2 2:30 PM - 2:45 PM

Longitudinal Associations Of Adiposity And Grip Strength With Physical Activity Assessed With Wrist-worn Accelerometers In 84,779 Adults: The Uk Biobank Study

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(No relationships reported)

PURPOSE: To determine the longitudinal associations of body mass index (BMI), waist circumference (WC) and grip strength (GS) with objectively measured physical activity (PA) in adults. **METHODS:** This study utilized data from the UK Biobank study, an ongoing prospective cohort of over half a million UK adults aged 40-69yrs at recruitment (2006 to 2010). Each participant underwent baseline measurements of BMI (kg/m²), WC (cm) and GS (kg). GS was measured using a hand dynamometer. Values from the two hands were averaged. Between 2013 and 2015, a sub-sample of over 100,000 participants each wore a tri-axial accelerometer on the dominant wrist for 7 days. Measurements taken at baseline were not repeated during the follow-up accelerometer protocol. Mean acceleration levels were calculated, and moderate-to-vigorous PA

(MVPA) was estimated as time when acceleration was above 125mg. BMI, WC and GS were standardized, and PA outcomes were log-transformed. **RESULTS:** A total of 84,812 participants (46,947 women) with ≥ 72 hours of wear and no missing covariates were included in the analysis. The median follow-up was 5.7 years (interquartile range: 4.9-6.5). Using multiple linear regression adjusted for GS and various potential confounders (demographic, lifestyle, disease status, seasonality), every 1 standard deviation increase in BMI and WC was associated with 0.071 (95% confidence interval [CI]: -0.073, -0.069) and 0.070 (95% CI: -0.073, -0.068) lower log of mean acceleration at follow-up, respectively, in women: in men, BMI (b: -0.066; CI: -0.069, -0.063) and WC (b: -0.076; CI: -0.079, -0.073). Positive associations were found between baseline GS and follow-up acceleration levels after adjusting for confounders and BMI, in women (b: 0.013; CI: 0.010, 0.01) and men (b: 0.004; CI: 0.001, 0.007). Marginal means (adjusted for confounders) of follow-up acceleration were lower in individuals with higher adiposity levels and/or lower GS at baseline. Similar results were observed with MVPA as an outcome.

CONCLUSIONS: BMI, WC and GS at baseline predicted objectively measured PA at follow-up. Findings of our study provide compelling justification for interventions and policies to focus on improving body composition and muscle strength to increase or prevent decline in PA at the population level.

2952 June 2 2:45 PM - 3:00 PM

Energy Expenditure From Light And Moderate-Vigorous Intensity Physical Activity And All-cause Mortality

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PURPOSE: It has been suggested that light intensity activity may have health benefits however, it is still uncertain whether 1 MET-hr of light intensity activity confers similar benefit as 1 MET-hr of moderate-to-vigorous (MV) activity. This study examined the mortality benefits of light and MV intensity activity, while accounting for the volume of activity. **METHODS:** Accelerometer (ActiGraph 7164) records were extracted from the NHANES 2003-2006 adult database ($n=6355$). Participants were followed prospectively for mortality through 2011 via the National Death Index. Volume of light and MV activity was determined by classifying monitored time into light (100-759 cts/m) and MV (760+ cts/m) intensity activity and by estimating energy expenditure (MET-hrs/d) within each intensity category. Cox proportional hazard models were used to estimate hazard ratios and 95% confidence intervals (HR [95% CI]) for mortality associated with 1 MET-hr/d increase in light or MV activity adjusted for age, sex, ethnicity, education, smoking, alcohol, health status (diabetes, cancer, heart disease, stroke, mobility), BMI, with and without mutual adjustment for light and MV activity. To account for non-linear mortality associations we examined both exposures among low- ($n=2588$) and highly-active adults ($n=2251$). **RESULTS:** There was complete data on 4839 adults (≥ 40 yrs) followed over a period of 6.5 yrs. There were 572 deaths registered among the low-active group and 128 deaths in the highly-active group. Initial models in the low-active group without mutual adjustment revealed significant associations for light (HR=0.85 [0.80, 0.90]) and MV activity (HR=0.70 [0.64, 0.77]). After mutual adjustment for each activity intensity, among low-active adults, a 1 MET-hr/d increase in light activity was associated with 9% lower mortality (HR=0.91 [0.86, 0.97]; $p = 0.002$), while a 1 MET-hr/d increase in MV activity was associated with 26% lower mortality (HR=0.74 [0.67, 0.81]; $p < 0.001$). There were no significant reductions in mortality risk among the high-active group ($p > 0.05$). **CONCLUSIONS:** The findings support the idea that greater amounts of light activity are associated with lower mortality among less active individuals after considering MV energy expenditure. However, for a given MET-hr of activity, MV may provide more benefit.

F-30 Thematic Poster - Altitude/Hypoxia/Supplementation

Friday, June 2, 2017, 3:15 PM - 5:15 PM
Room: 404

2996 **Chair:** Roy Salgado. *US Army Research Institute of Environmental Medicine, Natick, MA.*

(No relationships reported)

2997 **Board #1** June 2 3:15 PM - 5:15 PM
Co-ingestion Of Glucose And Fructose During Exercise On Acute Exposure To Altitude

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(No relationships reported)

The reduction in partial pressure of oxygen (O_2) leading to reduced O_2 delivery to tissues at altitude has the potential to alter substrate utilization during exercise. Experiments at sea level suggest performance benefits from consuming multiple transportable carbohydrates, the impact of this at altitude is not known. **PURPOSE:** To investigate how carbohydrate (CHO) (glucose and fructose) ingestion effects fuel utilization during exercise at 2500m and the impact of this on performance. **METHODS:** Ingestion of 1.2 g·min⁻¹ glucose plus 0.8 g·min⁻¹ fructose was compared to 1.2 g·min⁻¹ glucose and a placebo during 120 minutes running at 70% $\dot{V}O_{2max}$ performed by eight males in a normobaric hypoxic chamber set at 2500m altitude. Exogenous and endogenous oxidation was quantified using ¹³C stable mass isotope tracing techniques. Performance was measured in a 5 km TT. **RESULTS:** CHO ingestion shifted fuel use to predominantly CHO (79.51 ± 7.11, 79.45 ± 1.88 and 56.66 ± 20.18% in glucose plus fructose, glucose alone and placebo, respectively) compared with placebo where fat (20.49 ± 7.11, 20.55 ± 11.88 and 43.34 ± 20.18% in glucose plus fructose, glucose alone and placebo, respectively) was the dominant fuel. Co-ingestion of glucose and fructose led to significantly ($p < 0.001$; ES= 3.82) greater peak exogenous CHO oxidation rates compared to glucose alone (1.51 ± 0.14 g·min⁻¹ and 0.96 ± 0.07 g·min⁻¹, respectively) and this resulted in a significantly ($p = 0.007$; ES= 1.01) lower contribution from endogenous CHO oxidation (49.15 ± 8.85% and 59.65 ± 1.80%, respectively). Co-ingestion of glucose and fructose did not improve performance in the 5 km TT (25:37 ± 03:01 minutes) compared to glucose alone (25:13 ± 02:53 minutes). However, time to complete the 5 km TT was significantly ($p = 0.002$; ES= 0.47) faster in the glucose only trial compared to placebo (26:33 ± 2:59 minutes). **CONCLUSION:** CHO ingestion reduced the reliance on fat oxidation compared to placebo and the co-ingestion of glucose and fructose increased exogenous and spared endogenous CHO oxidation over glucose alone. However, the co-ingestion of glucose and fructose did not provide an ergogenic benefit at 2500m.

2998 **Board #2** June 2 3:15 PM - 5:15 PM
No Impact of Carbohydrate Supplementation and Altitude Acclimatization on Aerobic Exercise Performance

Robert W. Kenefick, FACSM, Adam J. Luippold, Karleigh E. Bradbury, Andrew J. Young, FACSM, Allyson N. Derosier, Marques A. Wilson, Claire E. Berryman, Stefan M. Pasiakos, FACSM. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*

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(No relationships reported)

Ergogenic benefits of carbohydrate (CHO) supplementation during exercise at high altitude (HA) appear to vary depending on acclimatization status. However, longitudinal evaluation of potential performance benefits of CHO in the same volunteers, prior to- and following acclimatization to HA have not been reported. **PURPOSE:** To determine the impact of a CHO beverage consumed during steady-state exercise, on subsequent time trial (TT) performance (2 mi. run), of lowlanders immediately after they arrived at high altitude (A-HA) and after 22 days (C-HA) of acclimatization at 4,300 m. **METHODS:** Seventeen unacclimatized men (mean ± SD; age, 23.4 ± 5.6 y; body mass, 81.9 ± 13.9 kg; SL $\dot{V}O_{2peak}$ 4.2 ± 0.7 L/min, HA $\dot{V}O_{2peak}$ 2.8 ± 0.5 L/min) performed 80-min of treadmill walking (~55% of HA $\dot{V}O_{2peak}$) at sea level (SL), A-HA and C-HA. Before, and every 20 min during exercise they consumed either a CHO beverage (n = 9; 45 g fructose/L + 55 g glucose/L, 1.8 g CHO/min) or a flavor-matched placebo (PLA, n = 8). Immediately following walking/supplementation, a 2 mi., self-paced TT was performed. **RESULTS:** There were no differences ($P > 0.05$) in TT duration between CHO and PLA at SL (17.1 ± 2.8 vs. 18.8 ± 4.2 min), A-HA (27.9 ± 5.0 vs. 27.3 ± 7.0 min) or C-HA (23.9 ± 4.0 vs. 24.2 ± 4.7 min), respectively. Acute and chronic HA exposure did significantly alter TT

performance such that A-HA duration > SL and C-HA, and C-HA duration was > SL ($P < 0.05$). There were also no differences ($P > 0.05$) at SL, A-HA and C-HA between CHO and PLA in exercise intensity (% SL $\dot{V}O_{2peak}$) and pacing at 0.5 mi. increments during the TTs. **CONCLUSIONS:** CHO supplementation did not provide any benefit to TT performance when volunteers were unacclimatized or acclimatized to HA. Chronic HA exposure/acclimatization did improve performance compared to that after acute HA exposure, but performance remained worse than at SL. Authors' views not official U.S. Army or DoD policy.

2999 **Board #3** June 2 3:15 PM - 5:15 PM

Effect Of Sodium Bicarbonate Ingestion During 6-, 8-, 12-hour Hypobaric Hypoxic Acclimatization on Cycling Performance

Nazareth Khodiguiian¹, Jens Johansson², Andrew Cornwell¹, Svenja Wassmann¹, Jacob D. Jelmini¹, Eddie Leon¹. ¹California State University, Los Angeles, Los Angeles, CA. ²Mercy Medical Center, Roseburg, OR.

(No relationships reported)

Numerous studies investigate the ergogenic effects of normobaric and hypobaric hypoxic acclimatization on endurance performance in normobaria. Likewise, numerous studies assessed the ergogenic effect of sodium bicarbonate ingestion on performance. Diuresis of bicarbonate ions induced by altitude exposure may reduce the extracellular buffering of H^+ , compromising the performance at high altitude. Purpose of this study was to investigate the effect of Sodium Bicarbonate ingestion during hypobaric hypoxic acclimatization on cycling performance in hypobaria. Eight, eight, and twelve subjects were exposed to hypobaric hypoxia (525mmHg) for 6, 8, and 12 hours, respectively. Sodium bicarbonate supplementation took place at 4.5 and 1.5 hours (200 mg·kg⁻¹ and 250 mg·kg⁻¹ of body mass, respectively) before performance test (525 mmHg). Subjects were tested in 4 conditions: Normobaric placebo (NBPbo); Normobaric Bicarbonate (NBBC); Hypobaric Placebo (HBPbo); and Hypobaric Bicarbonate (HBBC). Time trials consisted of performing 360 revolutions of pedals as fast as possible against a resistance equal to 5% of body weight. Blood samples were collected from a venous catheter before the exposure, 15 min before the exercise, and 3-5 minutes after the exercise. Urinary bicarbonate excretion was measured during the exposure. There were no differences in performance time, serum bicarbonate and lactate concentrations, as well as total urinary bicarbonate excretion between the 6-, 8-, and 12-hour acclimatization. Therefore the data were pooled and analyzed together. Serum bicarbonate concentration was significantly lower (26.4±2.8 vs 24.1±2.5 P=.000) and urinary bicarbonate excretion was significantly higher (613±460.1 vs 322±264.9, p=.003) in HBPbo than in NBPbo at the end of acclimatization. Bicarbonate supplementation significantly improved cycling performance (2.0±4.21%) in hypobaric hypoxia, while the improvement was not significant in normobaria. It was concluded that sodium bicarbonate supplementation during short-duration acclimatization improves high intensity cycling performance.

3000 **Board #4** June 2 3:15 PM - 5:15 PM

Effect Of Dietary Nitrate Supplementation On Step Test Performance At Sea Level And Altitude

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Nitrate-rich beetroot juice improves exercise performance in untrained and moderately trained individuals at sea level through increased production of nitric oxide (NO). Beetroot supplementation may be more effective during exercise in a hypoxic environment, where NO production is reduced, due to low O_2 tensions and muscle pH. However, results from studies that have examined the effects of nitrate supplementation on exercise performance at altitude have been equivocal. **PURPOSE:** To examine the effect of beetroot-juice ingestion on step test performance at sea level and altitude. **METHODS:** Undergraduate students enrolled in a 10-day study abroad to Peru that included a two-day hike on the Inca trail. Prior to traveling, all students performed a Queens College step test at sea level. Students stepped at a predetermined cadence for 3 minutes, after which recovery heart rate was recorded and entered into a standardized regression equation to estimate $\dot{V}O_{2max}$. The test was repeated at sea level, 90 minutes after ingesting a 70 mL shot of beetroot juice (6.45 mmol nitrate concentration). The step test was completed twice more at an altitude of 3500 meters; both with and without beetroot juice ingestion. All tests were separated by at least 24 hours. **RESULTS:** Twelve students (age 21 ± 1.7 years; M:6, F:6) completed all aspects of the study. The estimated $\dot{V}O_{2max}$ at sea level without and following nitrate supplementation was 45.2 ± 9.3 ml/kg/min and 46.8 ± 9.1 ml/kg/min, respectively. The estimated $\dot{V}O_{2max}$ at 3500 meters increased from 45.2 ± 9.8 ml/kg/min to 47.7 ± 12.3 ml/kg/min following nitrate ingestion. However, one-way repeated measures ANOVA revealed no differences in mean estimated $\dot{V}O_{2max}$ across conditions, $F(3,33) = 1.31, p = 0.29$. **CONCLUSION:** We found no apparent effect of altitude or nitrate

supplementation on step test performance in a group of college students. The duration of the exercise bout, as well as the dosage and timing of nitrate supplementation may explain our inability to observe an ergogenic effect.

3001 Board #5 June 2 3:15 PM - 5:15 PM
"Beet On Alps": Effect of Dietary Nitrate Supplementation on Skeletal Muscle Oxidative Capacity during Prolonged Exposure to Hypobaric Hypoxia
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 (No relationships reported)

PURPOSE: Skeletal muscle oxidative function is influenced by inspired O₂ fraction. Previous studies in acute hypoxia have shown that dietary nitrate supplementation is able to attenuate or prevent the hypoxia-induced decrement of performance. No data have been provided during prolonged exposure to hypobaric hypoxia, a condition that affects both skeletal muscle oxidative metabolism and nitric oxide bioavailability. Aim of this study was to investigate the effects of a dietary nitrate supplementation on *gastrocnemius* muscle oxidative capacity during a prolonged exposure to high altitude. **METHODS:** At altitude (3,269m a.s.l., Casati Refuge, Italy), fourteen healthy young (29±4 yr) subjects were supplemented for three days with beetroot juice (2x70mL/day, 8.4 mmol nitrate/day [BEET-IT]) or nitrate-depleted juice (PLA) following a double-blind randomized cross-over design. As an index of *gastrocnemius* muscle oxidative capacity, the recovery rate of muscle oxygen consumption (mV̇O₂) was measured by near-infrared spectroscopy using repeated, transient arterial occlusions following a brief bout of plantar-flexion exercise. Experiments were carried out after 7-14 days of hypoxic exposure, at the end of both supplementation periods, and in normoxia. **RESULTS:** In normoxia, the time constant of mV̇O₂ (13.2±4.9 s) was comparable to that observed in healthy active subjects. At altitude, the time constant of mV̇O₂ was significantly (p=0.01) faster in BEET-IT (9.3±3.4) vs. PLA (16.7±5.8). Plasma [nitrate] and [nitrite] were significantly higher in BEET-IT than in PLA. **CONCLUSIONS:** During prolonged exposure to hypobaric hypoxia, a three-day dietary nitrate supplementation accelerated the recovery kinetics of mV̇O₂, suggesting an improvement of muscle oxidative capacity. Future studies will have to investigate if these results are related to an increased mitochondrial efficiency and/or to a better microvascular perfusion after nitrate supplementation in hypoxia.

3002 Board #6 June 2 3:15 PM - 5:15 PM
Limb Muscle and Frontal Lobe Oxygenation Saturation during Exercise at Altitude Following Acute Nitrate Loading
 David M. Fothergill, Haley Dodson, Allison R. Loiselle. *Naval Submarine Medical Research Laboratory, Groton, CT.*
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 (No relationships reported)

BACKGROUND: It has been theorized that the ergogenic efficacy of nitrate (NO₃⁻) supplementation on aerobic performance may be best observed during exercise performed at altitude where the O₂ independent NO₃⁻-nitrite (NO₂⁻)-nitric oxide (NO) pathway may become an increasingly important source of NO bioavailability that could potentially favorably influence tissue blood flow and tissue oxygen saturation levels.

PURPOSE: To determine if acute NO₃⁻ supplementation impacts limb muscle oxygen saturation (SmO₂) and brain frontal lobe oxygen saturation (SbO₂) during exercise under hypobaric hypoxia.

METHODS: Recreationally active individuals (11 males, 1 female; mean ± SD age = 38.1 ± 12.6 yr., sea level maximal oxygen uptake (VO₂max) = 41.7 ± 5.7 ml/kg/min) conducted 2 exercise trials (nitrate loading (N), and placebo (P)) while exposed to a simulated altitude of 3,048 m in a hypobaric chamber. Each trial consisted of 15 min of steady state cycle exercise at 45% of their maximum sea level workload, followed by an incremental exercise test to exhaustion. 110 minutes before starting the steady state exercise in the N and P trials, subjects drank 500 ml of water containing either 20.4 mg/kg of NaNO₃ or the equivalent molar concentration of NaCl respectively, in a double-blind randomized, placebo-controlled cross-over fashion. Oxygen saturation of the vastus lateralis and frontal lobe of the brain were measured using near-infrared spectroscopy and were expressed as changes from their respective sea level rest conditions prior to analysis.

RESULTS: SmO₂ decreased linearly with increasing workload (p<0.00001) but did not differ between the N and P trials during the steady state submaximal exercise or at any workload during the VO₂ max exercise. SbO₂ also did not differ between the N and P trials during exercise at altitude. There was however a significant two-way interaction between workload and supplement condition for oxyhemoglobin concentration (ΔHbO₂) of the frontal lobe during the VO₂max test (F_{4,40} = 4.37, p<0.01) that was due to a lower frontal lobe ΔHbO₂ in the N trial compared to the P trial that occurred only at the maximal workload (p<0.05).

CONCLUSIONS: Acute NaNO₃ supplementation does not alter SmO₂ or SbO₂ during steady state or maximal exercise at altitude, but may lower frontal lobe ΔHbO₂ only at maximal exercise.

F-31 Thematic Poster - Nutritional Status of Athletes II

Friday, June 2, 2017, 3:15 PM - 5:15 PM
 Room: 101

3003 **Chair:** Kelly L. Pritchett. *Central Washington University, Ellensburg, WA.*
 (No relationships reported)

3004 Board #1 June 2 3:15 PM - 5:15 PM Comparison Of High And Low 25(OH)-Vitamin D Concentrations On Recovery From Resistance Exercise In Men

Leonardo P. Oliveira¹, Sandro Bartolomei¹, Eliahu Sadres¹, David Church¹, Elliott Arroyo¹, Joseph A. Gordon, III¹, Alyssa N. Varanoske¹, Ran Wang¹, Kyle S. Beyer¹, Jeffrey R. Stout, FACSM¹, John A. Rathmacher², Jay R. Hoffman, FACSM¹. ¹University of Central Florida, Orlando, FL. ²Metabolic Technologies, Inc., Aimes, IA. (Sponsor: Jay Hoffman, FACSM)
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 (No relationships reported)

BACKGROUND: Vitamin D status (VITD) has been related to impaired skeletal muscle function, and may be associated with recovery after muscle injury. Limited data exists on the relationship between VITD concentrations, muscle damage and inflammatory markers from an acute bout of exercise.

PURPOSE: Examine the effect of VITD concentrations on acute physiological responses and recovery indices from resistance exercise. **METHODS:** 15 resistance trained men (24±4 y) with at least 2 years of resistance training experience volunteered to participate in this study. Participants were grouped into a low 25(OH)-VITD (LVD; 26.7±1.7 ng·ml⁻¹; n=7) or high 25(OH)-VITD (HVD; 37.2±7.2 ng·ml⁻¹; n=8) group based upon baseline (BL) 25(OH)-VITD concentrations. Participants performed 8 sets of 10-12 repetitions at 70% of the maximal strength of the squat exercise, with 75 s of rest between sets. Performance [counter movement jump (CMJP), endocrine (testosterone [T] and cortisol [C]), inflammatory (IL-6 and C-reactive protein [CRP]), and muscle damage (creatinine kinase [CK] and myoglobin [MB]) assessments were performed at BL, 30-min, 24-h, 48-h and 72-h post-exercise. Data was analyzed using a repeated measures ANOVA. To complement this procedure, magnitude based inferences were used to provide additional interpretation of the differences that VITD concentrations may have had on the recovery response. **RESULTS:** No significant interactions were noted between LVD and HVD in CMJP (p=0.26), C (p=0.97), T (p=0.21), CRP (p=0.30), IL-6 (p=0.58) or CK (p=0.16) responses to the exercise protocol. However, a significant interaction was observed in MB (p=0.05) responses. Although post-hoc analyses failed to see any significant differences between the groups at any time point, inferential analysis indicated that MB concentrations was "likely" higher at 30-min for LVD (87.2±57.4 ng·ml⁻¹) than HVD (51.3±21.9 ng·ml⁻¹). CRP levels were "likely" lower at 24-h (549±373 mg·L⁻¹ vs. 1344±1654 mg·L⁻¹) and 48-h (565±386 mg·L⁻¹ vs. 1079±1077 mg·L⁻¹) for HVD. Inferences for all other comparisons were unclear. **CONCLUSIONS:** Results indicated that HVD provides a degree of resiliency towards acute muscle damage and enhances recovery of high velocity resistance exercise compared to LVD. Further research using greater sample size appears warranted.

3005 Board #2 June 2 3:15 PM - 5:15 PM Exploring the Relationship between Soluble Fiber Intake and Bone Mineral Density in Athletes

Anneliese M. Kuemmerle¹, Jody L. Herman¹, Emily N. Werner, FACSM¹, Jacqui Van Grouw¹, Rachel C. Kelley², Francesco Alessio¹, Michael L. Bruneau, 19102¹, Stella L. Volpe, 19102, FACSM¹. ¹Drexel University, Philadelphia, PA. ²University of Florida, Gainesville, FL. (Sponsor: Stella Lucia Volpe, FACSM)
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Short chain fatty acids (SCFAs) produced by bacterial fermentation of soluble fiber in the gut enhance mineral absorption. SCFAs reduce luminal pH, affect signal pathways, alter epigenetic regulation, and foster the proliferation of immune-modulating gut bacteria, suggesting a positive correlation between soluble fiber intake and bone mineral density (BMD). **PURPOSE:** To evaluate the relationship between soluble fiber intake and total body BMD in athletes 18 years of age and older. **METHODS:**

Thirty-one participants (16 females, 15 males) who volunteered for a cross-sectional study underwent dual energy X-ray absorptiometry (DXA) scans and completed self-administered Block Food Frequency Questionnaires (FFQ). **RESULTS:** Participants' mean age was 35.7±10.9 years, and mean body mass index (BMI) was 25.32±3.77 kg/m². Participants consumed an average of 1960.3±644.2 kilocalories/day. Mean daily soluble fiber intake was 7.1±2.3 grams/day. Average total body BMD was 1.28±0.12 g/cm². There was no significant correlation between soluble fiber intake and BMD ($r=-0.188$, $p=0.312$). No significant correlation was found between soluble fiber intake and BMD for women ($r=0.057$, $p=0.835$) or men ($r=-0.477$, $p=0.073$). A multiple linear regression was calculated to predict BMD based on soluble fiber intake controlling for intakes of calcium, vitamin D, and protein. No significant regression equations were found for the total sample ($p=0.357$), women ($p=0.617$), or men ($p=0.177$). **CONCLUSIONS:** Soluble fiber intake was not correlated with BMD in this sample of athletes. Directions for future research include recruiting a larger sample and exploring the possibility of a synergistic relationship between soluble fiber and intake of minerals. These represent data from an unfunded research project

3006 Board #3 June 2 3:15 PM - 5:15 PM
Validation Of A Two-item Food Security Screening Tool For Male, Collegiate Athletes

David H. Holben, Kacie Poll, Melinda Valliant, Hyun-Woo (David) Joung, *University of Mississippi, University, MS.*
 (Sponsor: Mark Loftin, FACSM)
 (No relationships reported)

Food insecurity (FI), lacking access to food for an active healthy life, is associated with poor nutrition and health outcomes. Collegiate athletes may have experienced FI during childhood (CH) or high school (HS) and may also experience it at college (COL), which may negatively impact food acquisition and habits. A brief CH food security status (FSS) screening tool was previously validated by Hager et al. (2010) in low-income families with children.

PURPOSE: To develop a brief FSS screening tool and to examine its sensitivity (SENS) and specificity (SPEC) in a sample of NCAA Division 1 male, collegiate athletes ≥18 years of age (y). **METHODS:** A cross-sectional survey of NCAA athletes from a Southeastern Conference (SEC) university was approved by the Institutional Review Board and conducted during August-September, 2016. The questionnaire included the USDA food security survey module and a 2-item measure to assess CH, HS, and COL FSS. USDA and Hager et al. methods were used to calculate FSS and SENS/SPEC, respectively. **RESULTS:** Participating athletes (n=93) were 19.7±1.4 y and primarily white, football players [race: white (n=45, 48.4%); black (n=38, 40.9%); other (n=10, 10.9%)] [sport: football (n=65, 69.9%); baseball (n=20, 21.4%); cross country/track (n=5, 5.4%); golf (n=3, 3.2%)]. The CH 2-item measure was highly SENS (92.9%) and SPEC (91.1%) for HS FSS, as was the HS 2-item method (SENS 92.9%, SPEC 94.9%). The COL 2-item measure was highly SENS (100%) and SPEC (88.9%) for COL FSS. **CONCLUSION:** A 2-item FSS can be used to screen for FI in male collegiate athletes. Further research to validate its use in a larger sample that includes females is warranted, as is research to assess the relation of FI to eating behaviors in athletes.

3007 Board #4 June 2 3:15 PM - 5:15 PM
The Relationship Between In-Race Nutrition and Finish Time for Ironman Triathletes

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PURPOSE: The purpose of the present investigation was to determine the predictive power of triathletes' in-race nutrition plans during an Ironman triathlon on overall finish time. Aspects of the in-race nutrition plans considered were calories consumed per hour while biking, total caffeine consumed while biking, and total fluids consumed on the bike portion of the Ironman race. **METHODS:** Ironman triathletes (N= 152) were surveyed to determine their in-race nutrition plan at Ironman Wisconsin and the Ironman World Championships. A regression analysis was utilized to determine the predictive power of calories, fluid and caffeine consumed on the bike on overall Ironman finish time. **RESULTS:** Average Ironman finish time (N= 152) was 12:41:12 (+/-2:04:43), average calories consumed per hour on the bike was 268.83 (+/- 131.71). Average fluid consumed during the biking portion of the race was 3559.52 mLs (+/- 1802.52). Average caffeine consumed during the biking portion of the race was 89.16 mg (+/- 143.84). The amount of calories consumed per hour on the bike and in-race caffeine consumption was significantly ($p < .05$) correlated with Ironman finish time ($r = -.355$, $r = -.191$, respectively), while fluid intake was not significantly ($p > .05$) correlated with Ironman performance ($r = -.054$). Calories and caffeine consumption while biking were used to create a multiple regression equation. The overall regression model was statistically significant $F(2, 137) = 12.845$, $p < .05$. The regression equation revealed that 15.8% of the variance in Ironman race time can be significantly ($p < .05$) attributed to calories and caffeine consumption during the bike portion of the

race. **CONCLUSIONS:** Total fluid consumed on the bike portion of the Ironman was not correlated to overall finish time; however, calories per hour and total caffeine consumed on the bike both were negatively correlated with overall finish time. This suggests that greater calorie and caffeine consumption on the bike can contribute to decreased overall finish time, and hence an improvement in performance.

3008 Board #5 June 2 3:15 PM - 5:15 PM
Weight Cutting And Professional Mixed-martial Artists: How Do They Cut Weight And Who Is Advising Them?

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PURPOSE: Although mixed martial arts (MMA) has been around for decades, current peer-reviewed literature is limited to individual sports (such as boxing, judo, and wrestling) that compose mixed martial arts (MMA). Within other combat sports, weight cutting practices have included methods of extreme dehydration or food restriction; however data is lacking in professional MMA athletes. Thus, the purpose of this study was to survey professional MMA athletes about their current and past weight cutting methods as well as to investigate who is advising them nutrition and strength and conditioning.

METHODS: N=55 male professional mixed martial artists (18-40 yrs) were recruited from every weight class in the states of California and New Mexico. Participants were administered a questionnaire that had been reviewed by a registered dietitian, a certified strength and conditioning specialist, and an exercise physiologist. Data presented as percentage of frequency of responses calculated using IBM Analytics, SPSS v24.

RESULTS: The top 3 methods MMA fighters use in cutting weight were food restriction (87.3%), increased training (70.9%) and the Sauna (69.1%). Most MMA fighters do not utilize a professional nutritionist/dietitian for advice during either the weight cut (74.5%) or off-season (75.4%). In fact, only 7.3% reported they regularly used a professional nutritionist/dietitian when cutting weight. Fighters are receiving nutrition advice primarily from teammates (78.2%), while only 23.6% are getting any advice, on or off-season from a professional nutritionist.

CONCLUSIONS: Professional mixed martial artists report cutting weight for a fight using methods that can be considered dangerous and impair performance. Many reported receiving no professional advice on or off-season from a licensed nutritionist or dietitian.

3009 Board #6 June 2 3:15 PM - 5:15 PM
Nutrition Goals Prioritized By Elite Endurance Runners Undergoing A Nutrition Education Intervention

Michelle Barrack¹, Michael Fredericson, FACSM², Tenforde S. Adam³, Emily Kraus², Brian Kim⁴, Sonal Singh⁴, Andrea Kussman⁴, Kristen Gravani², Yasi Ansari⁴, Beth Miller⁴, Aurelia Nattiv, FACSM⁴. ¹California State University, Long Beach, Long Beach, CA. ²Stanford University, Palo Alto, CA. ³Spaulding Rehabilitation Hospital, Cambridge, MA. ⁴University of California Los Angeles, Los Angeles, CA. (Sponsor: Aurelia Nattiv, FACSM)
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Few studies have evaluated goals selected by endurance runners and their sports dietitian to address nutritional deficits.

PURPOSE: To outline nutrition goal(s) chosen during a nutrition education session among a sample of NCAA Division I male and female endurance runners enrolled in a nutrition education intervention focused on optimizing intake of energy, bone building nutrients, and reducing the risk of bone stress injury.

METHODS: Fifty-nine collegiate distance runners from two institutions met with a sports dietitian for a 15-30 minute counseling session to address current food intake, exercise training, anthropometric measures and nutrition goals. Runners, with guidance from the sports dietitian, chose 1-3 goals from seven preselected goal options including adding ≥1 snacks/day; adding a meal/day; increasing intake of energy dense foods; increasing intake of carbohydrate rich foods; adding or modify a pre/post workout snack; increasing intake of calcium, vitamin D; eating more frequently. Chi-square analyses evaluated group differences.

RESULTS: The most common goals included 1) adding ≥1 snacks/day (45.8% of runners) and 2) adding or modifying a pre/post workout snack (40.7% of runners). Runners' least common goal was to eat more frequently (8.5% of runners). Female compared to male runners were more likely to choose the goal of adding a meal/day (18.5% vs. 3.1%, $p=0.05$), whereas more runners with low BMI (< 18.5 kg/m²) compared to ≥18.5 kg/m² chose goal of increasing intake of energy dense foods (50.0% vs. 12.7%, $p=0.05$). Runners characterized with "moderate" vs. "low" or "high" risk for the Female Athlete Triad (or comparable Male Triad) were more likely

to choose the goal of increasing intake of carbohydrate-rich foods (30.8% vs. 3.7% and 0%, respectively, $p=0.02$). A larger proportion of runners with “high” vs. “moderate” or “low” risk selected the goal of adding a meal/day (40.0% vs. 11.5% vs. 3.7%, $p=0.05$).

CONCLUSIONS: While the most common goal runners selected focused on adding ≥ 1 snacks/day, those classified with “high” risk for the Triad or low BMI prioritized adding a meal/day or increasing the energy density of foods consumed. These findings may aid runners and their sport dietitian in selecting goals for optimizing nutrient intake, which may benefit health and performance.

3010 Board #7 June 2 3:15 PM - 5:15 PM
Influence of a Nutrition Recovery Station Following Exercise on Acute Dietary Intake.
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Reported Relationships: B. Desbrow: Royalty; Human Kinetics - Caffeine for Sports Performance Book.

PURPOSE: Immediate post-exercise access to fluid/food via a recovery station is a common feature of mass participation sporting events. Yet little evidence exists examining their impact on improving recovery or influencing subsequent dietary intake. This study aimed to determine if access to food/fluid during a post-exercise recovery period significantly alters dietary and fluid intakes over a 24hr period.
METHODS: 127 (79 males) healthy participants (mean±SD, age=22.5±3.5y, body mass (BM)=73±13kg) completed two self-paced morning 10km runs separated by 1 week. Immediately following the first run, participants were randomly assigned to enter a “recovery station” (*ad libitum* water, sports drink and fruit) for 30min or leave without access to the recovery area. All participants completed the alternate recovery option the following week. Participants recorded nude BM before and after exercise and measured Urine Specific Gravity (U_{SG}) before running and the following morning. Additionally, participants recorded all food and fluid consumed for both run days via a food diary and photographs which were analysed by a qualified dietitian. Paired-samples *t*-tests assessed differences in hydration and dietary outcome variables (Recovery vs No Recovery).
RESULTS: No difference in pre-exercise U_{SG} or BM change during exercise were observed between intervention groups ($p>0.05$). Attending the recovery zone resulted in a greater total daily fluid intake (Recovery=3.37±1.46L, No Recovery=3.16±1.32L, $p=0.009$) but had no influence on daily total energy (Recovery=10.15±4.2MJ, No Recovery=10.15±3.9MJ), carbohydrate (Recovery=276±131g, No Recovery=264±128g) or protein (Recovery=118±61g, No Recovery=122±54g) ($p>0.05$) intakes. Next day morning U_{SG} values were not different between groups (Recovery=1.018±0.007, No Recovery=1.019±0.009, $p>0.05$).
CONCLUSIONS: Attending a recovery station immediately following a 10km run has little impact on 24h exercise day dietary intake or rehydration in recreational runners.

F-32 Thematic Poster - Physical Activity and Mental Health
 Friday, June 2, 2017, 3:15 PM - 5:15 PM
 Room: 304

3011 **Chair:** Matthew P. Herring. University of Limerick, Limerick, Ireland.
 (No relationships reported)

3012 Board #1 June 2 3:15 PM - 5:15 PM
Promoting Mental Among Urban Adolescents Through Physical Activity: Open-trial of Leaders@Play 2.0
 Eduardo E. Bustamante¹, Tara G. Mehta¹, Angela L. Walden¹, Hannah Munson¹, Aneisha Dunmore¹, Grace Cua¹, Stacy L. Frazier². ¹University of Illinois at Chicago, Chicago, IL. ²Florida International University, Miami, FL.
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PURPOSE: Early adolescence is characterized by decreasing parental monitoring and increasing peer pressure to engage in risky behaviors that may initiate a trajectory toward poor school outcomes, association with deviant peers and stressful life events. High-quality physical activity programs can promote mental and physical health of urban youth by providing refuge from neighborhood violence and opportunities for social skills development and positive peer relations. **METHODS:** Middle school

youth across 5 Chicago Park District parks participated in an open trial of Leaders @ Play 2.0, a 1-2 hour biweekly component of a 6-week Summer Camp. Leaders @ Play was developed via university-community partnership, co-facilitated by park staff and mental health staff, and designed to teach and reinforce life skills (i.e., effective communication, emotion regulation, and problem solving) through physically active games and relaxation activities. The Strengths and Difficulties Questionnaire (SDQ) was completed by parents at baseline and post-test. The SDQ reports a prosocial scale, total problems scale, and 4 subscales (emotional problems, conduct problems, peer problems, and hyperactivity / inattention). Descriptive statistics were analyzed for all participants at baseline and paired *t*-tests and within-group effect sizes (Cohen’s *d*) were calculated for participants providing both baseline and post-test data. **RESULTS:** Youth (N=38) were 31% Hispanic; 26% African American; 55% low-income, 57% male, and M=13.2 years-old. Effect sizes demonstrated a moderate effect on prosocial behavior ($t[1,14]=2.02, p=.063; d=0.70$) and a small effect on total problems ($t[1,14]=2.00, p=.066; d=-0.43$). Among subscales, emotional problems improved significantly ($t[1,14]=2.66, p<.05; d=-.70$), a small non-significant effect size was evident for conduct problems ($t[1,14]=1.19, p=.253; d=-.31$), while peer problems ($t[1,14]=-0.37, p=.719; d=0.07$) and hyperactivity / inattention ($t[1,14]=7.91, p=.442; d=-0.16$) were unaffected. **CONCLUSIONS:** Findings provide preliminary support for the potential of physical activity programs that systematically challenge and reinforce social skills to improve prosocial behaviors and decrease emotional problems amongst adolescents in urban settings.

3013 Board #2 June 2 3:15 PM - 5:15 PM
Is There A Shift In The Ideal Body In The Adolescents?
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PURPOSE: A healthy body image is important for adolescents. It serves as a predictor of good quality of life and should be given focus when working to improve health in adolescents. Unfortunately, previous studies have reported that a high prevalence of male and female adolescents are dissatisfied with their bodies, and especially females have high drive for thinness. However, a muscular and lean body is presented as the new ideal body in the social media. Therefore, it is expected that this might affect the ideal body in the adolescents. The purpose is therefore to investigate how male and female adolescents report that a muscular and lean body is important, if there are differences between what male and females report, and whether this drive for muscularity and leanness is more prevalent than drive for thinness among male and female high-school students.
METHODS: We used baseline data from an ongoing RCT aiming to enhance positive body image among high-school students in Oslo and Akershus County. A total of 1703 students aged 16-17 years (n=630 males, BMI=21.7 kg/m² (2,8), and n=1073 females, BMI=21.4 kg/m² (2,9)) were included. The Drive for Leanness Scale (DLS) and the Internalization; Thin/Low Body Fat subscale (of SATAQ-4) were used to assess prevalence of students with high scores on the Drive for leanness and Thin/Low Body Fat subscale. Pearson Chi-Square analyses were used to examine group differences. A *p*-value <0.05 was considered significant.
RESULTS: A significantly higher prevalence of female students (39%) compared to males (18%) had high scores on the Drive for leanness scale ($p<0.001$). A significantly higher prevalence of females (17%) compared to male students (13%) had high score on the Thin/Low Body Fat subscale ($p<0.05$). When comparing physically active male and females with non-active male and females, no significant difference was observed between groups on the Thin/Low Body Fat subscale.
CONCLUSIONS: Our results show that a drive toward a muscular and lean body is more common among both male and female students as compared to the drive for thinness. This might indicate a shift in the ideal body especially for the female adolescents.

3014 Board #3 June 2 3:15 PM - 5:15 PM
Subjective and Physiological Predictors of Anxiety at Rest and During a Working Memory Task
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 (No relationships reported)

Purpose: Prior research has suggested that an acute bout of moderate exercise is associated with reduced state anxiety in healthy adults and patients with anxiety disorders. However, it is unclear if low-intensity exercise would have the same or

reduced impact on state anxiety as compared to moderate. Our aim was to combine subjective ratings of exertion and physiological measures to ascertain if low and moderate acute exercise influences anxiety at rest and during a working memory (WM) task.

Methods: In an ongoing study, 21 healthy adults (9 female, age: 26.5±1.25 yrs, VO2Max: 35.3±10.8 mL/kg/min.) performed three exercise sessions on a cycle ergometer: one maximal exercise test and two subsequent randomized 30-minute exercise sessions at moderate and low (60-70% and 10-20% heart rate reserve, respectively) intensities separated by approximately 1 week. Ratings of perceived exertion (RPE) were obtained every 5 minutes during each submaximal exercise session. 30 minutes after exercise, subjects performed a WM task (n-back) under standardized threat of electric shock and safe conditions. Anxiety was assessed subjectively by ratings on a scale from 1-10 before the task and after each of four runs of the n-back (3 difficulty loads: 0-back, 1-back, 3-back). Paired Ttests were used to test the difference in state anxiety following submaximal exercise and linear mixed effects tests were used to assess the influence of RPE these findings.

Results: Anxiety scores post-exercise were lower following moderate exercise during the 3-back while under threat of shock only after the first run (5.5±2.3 vs. 4.1±2.4, p=0.03). TTests did not show anxiety scores to differ at any other time points nor conditions (p's>0.05). RPE scores during moderate and low intensity exercises were negatively associated with anxiety 30-min post-exercise (before the n-back, B= -0.38±0.17, p=0.04), during the 3-back while under threat of shock (B= -0.51±0.17, p<0.01), and during the 3-back safe condition (B= -0.32±0.12, p=0.02).

Conclusion: Moderate exercise led to lower state anxiety than low intensity exercise during the highest difficulty WM task, yet these effects were short lasting. Higher RPE during exercise, up to 60-70% HRR, predicted lower anxiety at rest and during a cognitively challenging WM task under both anxiogenic and normal conditions.

3015 Board #4 June 2 3:15 PM - 5:15 PM

Longitudinal Influence Of Prolonged And Short Bouts Of Sedentary Time On Mental Wellbeing

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(No relationships reported)

Excessive sedentary time is related to poor mental wellbeing. However, the differential influence of sedentary time accumulated in prolonged versus short bouts on factors related to mental wellbeing is unknown. **PURPOSE:** To examine the longitudinal influence of sedentary bout length on mood, stress, and sleep over one year.

METHODS: Two hundred and seventy healthy adults (48% women; age 27.8 ± 3.7) completed the Profile of Mood States (POMS) and the Perceived Stress Scale (PSS), and wore a Sensewear Armband to objectively measure sedentary time, physical activity, and sleep duration and efficiency at baseline and one year later. Prolonged and short bouts of sedentary time were operationalized to those greater and less than 30 minutes in duration. Fixed effects regression analyses were performed with baseline minutes and changes in prolonged and short bouts of sedentary time and minutes of moderate and vigorous physical activity (MVPA) as predictors of changes in mood disturbance, stress, and sleep duration and efficiency over one year as outcomes.

RESULTS: For mood, the overall model was significant (p=0.04) with changes in prolonged (p=0.004) and short bouts (p=0.006) of sedentary time positively predicting changes in mood disturbance. For stress, the overall model trended towards significance (p=0.06) with only changes in prolonged bouts of sedentary time as a positive predictor (p=0.003). For sleep duration, the overall model was significant (p<0.0001) with changes in prolonged and short bouts of sedentary time as inverse predictors and change in MVPA as a positive predictor (all p<0.0001).

For sleep efficiency, the overall model was significant (p<0.03) with changes in both prolonged (p=0.017) and short bouts of sedentary time (p=0.008) as inverse predictors.

CONCLUSIONS: Changes in both prolonged and shorter bouts of sedentary time are predictive of future mood, stress, and sleep in healthy young adults adding to the evidence that sedentary time has negative, long-term consequences for wellbeing, regardless of how it is accumulated. Interestingly, in this sample of healthy adults, baseline levels of sedentary time and MVPA were not predictive of changes in mental wellbeing-related outcomes. Interventions targeting sedentary time may not need to target specific bout lengths to realize benefits.

3016 Board #5 June 2 3:15 PM - 5:15 PM
Acute Moderate Exercise Improves Working Memory Efficiency In Humans

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(No relationships reported)

Background: Despite evidence indicating that a single bout of exercise can reduce state anxiety and improve cognitive function, (for review Chang et al. 2015, Ensari et al. 2015) few studies have examined the impact of acute exercise on the relationship between anxiety and cognition. The current study explores the modulatory effects of exercise on anxiety and working memory (WM) performance. Moderate exercise, compared to light exercise, was expected to improve WM performance, while decreasing self-reported anxiety and physiological measures (anxiety-potentiated startle) of anxiety.

Methods: Healthy adults (N = 21) of varied physical fitness levels underwent three exercise sessions on a cycle ergometer: one maximal exercise test to assess maximal heart rate (HR) and two subsequent randomized 30-minute exercise sessions at moderate (60-70% HR reserve (HRR)) and low (10-20% HRR) intensities. After exercise, subjects performed a WM task (n-back) under threat of unpredictable electric shock and safe conditions. Anxiety was probed using the acoustic startle reflex and retrospective subjective measures. WM performance (accuracy and reaction time), subjective anxiety, and startle variables were analyzed using 3-way ANOVAs, with Condition (threat, safety), Load (0-back, 1-back, 3-back), and Exercise (light, moderate) as within-subject factors.

Results: Participants reported higher subjective feelings of anxiety and had a greater startle response in the threat compared to the safe condition. Moderate intensity exercise resulted in a faster reaction time at a trend level time (F(1,19) = 3.34, p = 0.08) without compromising accuracy. This was most notable during the 3-back WM level (F(2,18) = 3.69, p = 0.05) during both safe and threat contexts. There was no effect of exercise level on subjective anxiety or anxiety-potentiated startle.

Conclusion: Acute moderate exercise improves cognitive efficiency (shorter reaction times) without compromising accuracy but does not reduce elevated state anxiety. This might be due to an increase in arousal that affects reaction time but not the distribution of working memory resources between cognitive function and anxiety. If this pattern strengthens with the full sample (N=36), we will (1) move to a patient population, and (2) apply this protocol to a neuroimaging study.

3017 Board #6 June 2 3:15 PM - 5:15 PM
Use of a Sit-Stand Desk Reduces Wake Time During the Subsequent Night's Sleep

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Reported Relationships: C.E. Kline: Contracted Research - Including Principle Investigator; HumanScale.

Acute bouts of leisure-time physical activity commonly improve sleep on the subsequent night. However, the impact of sedentary behavior on sleep is unclear. Further, whether breaking up sedentary time during the workday improves the following night's sleep is unknown. **Purpose:** To examine whether breaking up prolonged sedentary time by standing during the workday leads to better sleep the following night in comparison to a sedentary workday. **Methods:** 25 inactive adults with untreated pre- or stage 1 hypertension (16 males, 42±12 yr, body mass index: 31.9±5.0 kg/m²) participated in a randomized crossover trial consisting of two simulated 8-h workdays: one with continuous sitting (SIT) and one with alternating periods of sitting and standing every 30 min (SIT-STAND). Sleep was assessed on the night following each simulated workday. Participants completed a diary to indicate sleep onset latency (SOL), number of awakenings, wakefulness after sleep onset (WASO), and depth and quality of sleep. Participants also wore an accelerometer on the non-dominant wrist (Philips Actiwatch Spectrum) to objectively assess sleep (bedtime, out-of-bed time, total sleep time, SOL, WASO). Paired t-tests and effect size calculations were used to evaluate differences in sleep following the two conditions.

Results: Diary-based WASO was significantly lower following SIT-STAND compared to SIT (13.9±30.1 min vs. 23.2±38.6 min; P=.03, d=0.47). Self-reported SOL, awakenings, sleep depth, and sleep quality were not significantly between conditions, though SIT-STAND led to small-sized reduction in SOL and awakenings (d=0.33 and d=0.29, respectively). There was a small-sized reduction in actigraphic WASO following SIT-STAND compared to SIT (30.2±12.7 min vs. 37.7±25.0 min; d=0.39), though this difference was not statistically significant (P=.09). Actigraphic estimates of bedtime, out-of-bed time, total sleep time, and SOL did not differ between conditions (P>.61, d<0.11). **Conclusion:** Alternating sitting and standing during the workday leads to small improvements in sleep on the night following the simulated workday, particularly in reduced wake time. Whether this effect on sleep remains or is enhanced with long-term reduction in workplace sedentary behavior deserves further exploration.

3018 Board #7 June 2 3:15 PM - 5:15 PM
Physical Activity As A Mediator Of Intervention Effects On Depression And Perceived Stress Among Latinas
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 (No relationships reported)

Physical activity (PA) may reduce depression and stress. While Latinas have unique risk factors and buffers for depression and stress, there is limited research regarding the effects of PA on these outcomes within this population.

PURPOSE: The aim of this study is to investigate the potential mediating role of PA in the effects of a culturally and linguistically tailored PA intervention for Latinas on depression scores and perceived stress.

METHODS: Data are from a sample of 266 Latina women who participated in the Seamos Saludables intervention. Two product of coefficient mediation models were used to assess whether increases in Moderate to Vigorous PA (MVPA, as measured by the 7-day Physical Activity Recall) mediated the effect of the intervention on depression scores and perceived stress (measured by the Center for Epidemiologic Studies Short Depression Scale and the Perceived Stress Scale, respectively).

RESULTS: The Seamos Saludables PA intervention, which was successful in helping participants increase their PA, had no direct effect on change in depression scores, nor on change in perceived stress. Nevertheless, among completers, a significant indirect effect on depression scores ($ab=-0.44$; $CI=-0.87, -0.02$) and perceived stress ($ab=-0.98$; $CI=-1.75, -0.22$) was observed through PA. The intervention significantly increased MVPA at 12 months ($B=57.96$, $p<0.001$), and MVPA significantly reduced depression scores ($B=-0.008$, $p=0.018$) and perceived stress ($B=-0.02$, $p<0.001$), controlling for baseline depression and stress, respectively, and baseline MVPA.

CONCLUSION:

Even though there was no direct effect of the PA intervention on depression scores and perceived stress, higher levels of MVPA among participants were associated with reduced depression scores and perceived stress. Given that depression and stress are associated with negative mental and physical health outcomes, these findings represent a promising approach to improving health among Latinas.

3019 Board #8 June 2 3:15 PM - 5:15 PM
Psychological Antecedents and Consequences of Maximal Fitness Testing Among Firefighters
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 (No relationships reported)

Little is known about psychological correlates of maximal aerobic and strength performance or psychological responses to maximal fitness testing among firefighters, a high-stress occupational group frequently exposed to psychological and physical stressors.

PURPOSE: To examine the psychological correlates of and acute responses to maximal fitness testing among firefighters. **METHODS:** Twenty-seven male firefighters, aged 31-53 years (42.3 ± 6.8), currently working in Ireland completed measures of positive and negative affect (PANAS), mood (POMS), and state anxiety (STAI-Y1) before and 10-min after maximal fitness testing, including an isometric mid-thigh pull test followed by a maximal treadmill test. Multiple regression adjusted for age quantified associations between psychological variables and maximal aerobic capacity and full body force. Paired t-tests and standardized mean differences (SMD) quantified change in psychological outcomes in response to maximal aerobic and strength tests. **RESULTS:** Mean VO_{2max} was 42.6 ± 7.3 mL·min⁻¹·kg⁻¹. Mean full body force was 2782.3 ± 507.6 N. A significant inverse association was found between age and VO_{2max} ($r=-0.42$, $p\leq 0.03$). No outcomes were significantly associated with VO_{2max} (β : -0.14 to 0.25 ; all $p>0.17$) or maximal full body force (β : -0.24 to 0.35 ; all $p>0.07$). Though statistically nonsignificant, the direction of correlations with both VO_{2max} and maximal strength was consistent (i.e., positive or negative for both) for positive affect, feelings of energy, and state anxiety. Feelings of tension ($p\leq 0.01$) and anger ($p\leq 0.04$) were significantly improved, and feelings of confusion ($p\leq 0.07$) and energy ($p\leq 0.09$) were nominally improved. Exercise effects ranged from small-to-moderate for positive (SMD=0.15) and negative affect (SMD=0.27), feelings of depression (SMD=0.25), energy (SMD=0.31), confusion (SMD=0.36), anger (SMD=0.43), and tension (SMD=0.55), total mood disturbance (SMD=0.24), and state anxiety (SMD=0.27).

CONCLUSIONS: Mood, affect, and state anxiety did not significantly predict maximal aerobic capacity or strength among firefighters. Differential associations with aerobic capacity and strength were suggested. Acute maximal aerobic and strength testing resulted in small-to-moderate improvements in psychological outcomes.

F-33 Thematic Poster - Special Populations

Friday, June 2, 2017, 3:15 PM - 5:15 PM
 Room: 403

3020 **Chair:** Geoffrey E. Moore, FACSM. *Healthy Living & Exercise Medicine Associates, Ithaca, NY.*
 (No relationships reported)

3021 Board #1 June 2 3:15 PM - 5:15 PM
Assessment Of Cardiovascular Fitness In Wheelchair Rugby Athletes: Validation Of The 8-loop Field Test
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 (No relationships reported)

In wheelchair Rugby (WCR), the existence of large differences in disability level complicates utilizing traditional uniform test procedures among different WCR athletes. To date, no field tests measuring VO_{2peak} directly exist for the sport of wheelchair rugby. Thus, a strong need exist to establish valid and standardized, yet individually adjustable testing procedures to evaluate cardiovascular function and physiological mobility capacity in WCR.

PURPOSE: The present study aimed to develop an incremental field test ('8-loop') for WCR athletes, regardless of classification and disability, that involved continuous recording of progressive and maximum cardiovascular data, using an on-court standardized wheelchair exercise protocol. **METHODS:** Ten National Team male WCR athletes (31.2 years) were tested, comprising 7 athletes with tetraplegia, 1 with cerebral palsy, 1 with Charcot-Marie-Tooth Type 2 disease and 1 with lower limb amputations. All WCR classes were represented. An incremental 8-loop field test was performed to voluntary exhaustion to determine VO_{2peak} . The indoor test track consisted of a standardized 8-form (total length 226.2 m). During the test, progressive increases in lap velocity were indicated by sound signals to the athletes until failure to complete a lap within the intended lap time. Test validity was evaluated by direct measurements (Oxycon Mobile) of VO_2 and RER during all laps performed. Furthermore, heart-rate (HR) progression was recorded throughout the test, and blood lactate concentration ([La], earlobe) was measured 2 minutes after test completion. **RESULTS:** During the 8-loop test, a VO_{2peak} of 2014.4 ml/min \pm 987.9 (mean \pm SD), RER 1.11 ± 0.15 , HR_{peak} 143.8 BPM \pm 26.4 and [La] of 4.1 mmol/L \pm 1.7 were measured. VO_{2peak} ($r^2=0.83$, $p<0.01$) and HR_{peak} ($r^2=0.78$, $p<0.01$) were strongly correlated to the number of stages (Laps) completed in the 8-loop test. **CONCLUSION:** Strong linear relationships were observed between the 8-loop test outcome (number of stages/laps completed) and the physiological variables obtained (VO_{2peak} , HR), which suggest that a high validity exist for this field test, when applied in elite wheelchair rugby athletes. Test-retest reliability of the 8-loop test should be evaluated in future studies.

3022 Board #2 June 2 3:15 PM - 5:15 PM
Physical Fitness And Cardiovascular Risk In People With Intellectual Disabilities
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 (No relationships reported)

PURPOSE: To determine the relationship between physical condition and indirect indicators of cardiovascular risk students with intellectual disability Gustavo Restrepo College. **METHODS:** This is an observational study - analytical cross section. The study makes an assessment of the anthropometric profile and physical qualities, using battery Brockport Physical Fitness for children under 18; for over 18 years, the same tests were used but with rates for their age. A sample of 175 students were evaluated, of whom 96 were men and 79 women. For statistical analysis SPSS was used, using normality tests Kolmogorov-Smirnov and Pearson correlation. **RESULTS:** The results in body composition showed higher for the population over 18 years compared with under 18 values; variables related to physical abilities had higher results in over 18 years. For variables that obtained normality in the population under 18 years, the Pearson correlation was applied, with confidence levels of 95%, where it was observed that the anthropometric variables saved a correlation positive correlation between them, which you are setting a higher cardiovascular risk ($R = 0.85$, $p 0.01$). As for the correlation between anthropometric variables and variables of physical fitness as VO_{2max} , and force variables, this correlation is negative ($R = -0.365$ $p 0.01$), showing that students evaluated with anthropometric overweight and obesity has values less physical condition. In the population over 18 years is a negative correlation between

muscle strength and body composition variables and cardiovascular risk ($R = -0.60$, $p = 0.01$) was observed, and aerobic power equally between these variables ($R = -0.428$, $p = 0.01$). **CONCLUSION:** Although anthropometric measurements in children under 18 are generally below the limits of risk for cardiovascular disease, these results are close to those limits, which leads to argue that they need a specific prevention program. In itself a relationship between risk variables and qualities as strength and aerobic capacity is observed, so it is necessary to create programs that encourage the practice of physical activity in this population.

3023 Board #3 June 2 3:15 PM - 5:15 PM

Relationship between Muscular Strength and Functional Balance in People Post-Stroke

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(No relationships reported)

Impaired balance and weak muscle strength are common deficits associated with stroke. These deficits increase the risk of fall among people post-stroke. The relationship between muscular strength and balance was previously reported to be weak. However, the conclusion was made based on clinical balance assessments instead of biomechanical data. Limited research examined the relationship between balance and strength in people post-stroke. **PURPOSE:** To investigate the relationship between muscular strength and functional balance in people post-stroke. **METHODS:** A total of 20 people post-stroke completed balance and strength assessments over two separate visits. A computerized dynamic posturography system (NeuroCom International, Clackamas, OR, 2010) was used to perform four balance tests including limits of stability test (LOS), sit to stand test (STS), walk across test (WA), and step up and over test (SUO). In addition, participants completed isometric muscle strength tests of the trunk, hip, knee, and ankle. Peak torque was measured with a computerized dynamometer (Biodex Medical Systems Inc, Shirley, NY, 2012). Pearson's correlation test was used for statistical analysis. **RESULTS:** There was a strong correlation between max excursion (LOS test) and muscle strengths of knee flexor/extensor on the affected side (r values ranged between 0.721 and 0.793, $p < 0.04$). A strong correlation was also found between step width (WA test) and muscular strengths of trunk extensor, knee flexor, ankle plantar-flexor, hip flexor and extensor on the unaffected side (r values ranged between 0.797 and 0.902, $p < 0.01$). STS and SUO did not show any significant correlation with muscle strength. **CONCLUSIONS:** Our findings suggest that strengthening of the knee flexor/extensor may help people post-stroke to shift the weight to maximum range without losing balance. Also, our results indicate that the strength of the core and lower extremities muscles is strongly associated with gait stability.

3024 Board #4 June 2 3:15 PM - 5:15 PM

Feasibility And Effectiveness Of High Intensity Exercise Training For High-Functioning Children With Autism Spectrum Disorder

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PURPOSE: This study assessed the feasibility and effectiveness of a high intensity exercise program for high-functioning children with autism spectrum disorder (HFASD). **METHODS:** Thirty children with HFASD (M age: 10.1 ± 1.6 yrs) engaged in a 1-hour exercise session, 4 d/wk for 5 weeks. Each session included an instruction period, warm-up, workout, related game, and cool-down. Child satisfaction surveys (7-point Likert scale) assessed perceived enjoyment of the session/program, difficulty of the activity(ies), level of staff support, physical benefits, etc. Staff satisfaction surveys assessed staff's enjoyment of running the session(s), clarity of the lessons, and utility of the manual and training. Fidelity of implementation (accuracy) was assessed in 67% of all sessions by staff not involved in exercise delivery. Biometric (i.e., height, weight, waist circumference, BMI) and physical performance data (i.e., strength, flexibility, cardiovascular fitness, power) were also collected. The intensity of physical activity during the sessions was assessed using accelerometers during the first and final week on parallel activities. Paired t -tests were used to assess pre to post program differences. **RESULTS:** Child satisfaction ratings indicated that when compared to other fitness/sport programs that they had participated in, this experience was very satisfying (M : 6.3), and that the overall feeling about the program was very positive (M : 6.4). The staff ($N=7$) also rated the program very positively (M : 7.0). Results indicated that the program was implemented with a high level of accuracy (93.7%). Pre-posttest comparisons yielded statistically significant improvements in sit-ups in 60 seconds ($M \Delta = 3.0$, $p = 0.017$), air squats in 60 seconds ($M \Delta = 6.9$, $p = 0.001$), and standing long jump ($M \Delta = 4.7$, $p < 0.001$). Additionally, the rounds completed on parallel workouts

improved significantly ($M \Delta = 1.4$, $p = 0.011$), as did the time spent in moderate-to-vigorous intensity activities ($M \Delta = 4.9$, $p = 0.033$). There were no significant changes in biometric measures.

CONCLUSION: The high intensity exercise program was feasible (high levels of fidelity and child and staff satisfaction) and resulted in a number of significant improvements in the physical performance of children with HFASD.

3025 Board #5 June 2 3:15 PM - 5:15 PM

Assessment of Arm Crank and Wheelchair Treadmill Ergometry in Wheelchair Basketball Players

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Assessing training program in competitive wheelchair basketball players is essential for successful competition and performance. **PURPOSE:** The aim of this study was to compare arm to treadmill wheelchair ergometry and to determine various metabolic and respiratory thresholds to provide athletes with optimal training prescription and training program. **METHODS:** Five male and 3 female wheelchair basketball players (age: 29.3 ± 2.9 yrs; BW: 68.0 ± 14.3 kg; Ht: 164.5 ± 20.6 cm) of the first German division participated in this study. Participants were tested twice, once via arm ergometry and again via wheelchair treadmill in randomized order. Measured threshold variables were: blood lactate concentration (LA mmol.l⁻¹), heart rate in beats per minute (HR bpm), power output in Watts (PO), energy expenditure (EE, Kcals), oxygen uptake ($\dot{V}O_2$ ml.kg⁻¹.min⁻¹) and maximal performance expressed in percent (%). The data were calculated for differences via non-parametric statistical analysis, correlation and statistical significance (r ; $P < 0.05$). The data was assessed according to two different concepts previously reported by Dickhuth and by Mader. **RESULTS:** When considering Dickhuth concept, our results yielded significant differences for LA ($P < 0.025$), EE ($P < 0.012$), $\dot{V}O_2$ ($P < 0.012$) and maximal performance ($P < 0.036$). According to Mader concept, we found significant differences for HR ($P < 0.012$), EE ($P < 0.012$), $\dot{V}O_2$ ($P < 0.012$) and maximal performance ($P < 0.02$). When utilizing Dickhuth concept, results yielded significant correlation for EE ($r = 0.81$; $P < 0.015$) only; while Mader concept revealed significant correlation for HR ($r = 0.76$; $P < 0.031$), EE ($r = 0.81$; $P < 0.015$) and maximal performance ($r = 0.81$; $P < 0.015$). **CONCLUSION:** Our results revealed that measures generated from arm ergometry vs. wheelchair treadmill are not useful to monitor training prescription. The large and expected significant differences in $\dot{V}O_2$ uptake alone between arm and treadmill tests lacked usefulness of the tests. We therefore recommend using treadmill test for wheelchair basketball players as it better mirrors demands of wheelchair basketball competition.

3026 Board #6 June 2 3:15 PM - 5:15 PM

Is the Metabolic Cost of Running Different for Athletes with Unilateral Versus Bilateral Transtibial Amputations?

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Running-specific prostheses (RSPs) enable athletes with transtibial amputations to run. Yet, it is unknown if distance running performance is different between athletes with unilateral vs. bilateral amputations. **PURPOSE:** Metabolic cost affects distance running performance. Thus, we sought to compare the metabolic cost of running for athletes with unilateral and bilateral transtibial amputations using RSPs. **METHODS:** 10 athletes with unilateral and 5 athletes with bilateral transtibial amputations each completed 15, 5-minute trials on a treadmill (≤ 6 trials per day) at 2.5 or 3.0 m/s, with at least 5 minutes rest preceding each trial. Participants used a different RSP configuration for each trial. RSP configurations consisted of a randomly assigned: prosthetic model (A, B, C) stiffness category (recommended ± 1), and height (recommended ± 2 cm). We instructed participants to fast for at least 3 hours prior to testing. We measured and averaged the rates of oxygen consumption ($\dot{V}O_2$) using open-circuit expired gas analysis during the final 2 minutes of each trial. We normalized $\dot{V}O_2$ by participant mass, which included running gear, for each RSP condition. We then divided $\dot{V}O_2$ by velocity to calculate the metabolic cost of transport (CoT) in ml O₂/kg/km. We independently compared the lowest (best) and highest (worst) CoTs from athletes with unilateral and bilateral amputations using two-tailed t -tests. Significance was set at $\alpha = 0.05$. **RESULTS:** The lowest and highest CoTs for athletes with unilateral amputations were 200.1 ± 14.0 and 238.4 ± 16.5 ml O₂/kg/km (mean \pm SD), respectively. The lowest and highest CoTs for athletes with bilateral amputations were 186.2 ± 12.3 and 226.9 ± 22.7 ml O₂/kg/km (mean \pm SD), respectively. The lowest ($p = 0.085$) and highest ($p = 0.282$) CoTs were similar for both cohorts. For context, Olympic qualifying, sub-elite, and recreational non-amputee runners elicit CoTs of

181.9 ± 9.1, 187.5 ± 9.7, and 190.5 ± 13.6 ml O₂/kg/km (mean ± SD), respectively.
CONCLUSION The metabolic cost of running is similar for athletes with unilateral and bilateral transfemoral amputations, indicating that distance running performance may be the same for both groups.
 This project was supported by the BADER Consortium, a DoD CDMRP cooperative agreement (W81XWH-11-2-0222).

3027 Board #7 June 2 3:15 PM - 5:15 PM

Physiological Responses To A Simulated Half-marathon Road-race In Elite Wheelchair Racing Athletes

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Technology has traditionally limited research on wheelchair racing (WCR) to simulated training studies based on heart rate and speed. Practical technology is now available to examine actual physiological responses in real-time. **PURPOSE:** The purpose of this study was to characterize physiological responses across a 25-km time trial in WCR athletes with paraplegic spinal cord injury. **METHODS:** Eight internationally-elite WCR athletes (27.5±4.0 yrs, 162.5±18.6 cm, 53.5±10.9 kg, 21.5±6.7 yrs post injury) completed a maximal exercise test and 25-km time trial separated by three to five days. Energy expenditure and related variables were measured continuously during the time trial with a portable metabolic unit (COSMED K4b2, Chicago, Illinois) with field conditions of 21°C, 39.6% humidity, and wind at 22.4 km*hr⁻¹. Blood samples were collected before and immediately after the cessation of the trial to determine blood glucose and lactate concentrations. Core temperature was measured using an ingestible sensor thermistor. **RESULTS:** Six participants completed the 25-km race course (50:42±5:10 minutes) and provided usable data (Table 1). Mean VO₂ and HR were 73% and 92% of peak values, respectively. There was a significant increase in blood lactate concentration from 0.8±0.2 at baseline to 3.9±1.8 mmol/L after the race (P=0.001). Blood glucose concentrations did not differ from pre- (83.2±1.8 mg/dL) to post-race (91.0±6.6 mg/dL)(P=0.30). Core temperature increased from 37.2±0.3 to 38.7±1.2°C immediately after exercise (P=0.007). **DISCUSSION:** We demonstrate the physiologic response to competitive conditions in elite WCR athletes. Similar to elite able-bodied endurance athletes, WCR athletes sustained a high exercise intensity predominantly through carbohydrate metabolism. Our findings enable more accurate estimates of energy expenditure and have implications for the design of effective training strategies.

Table 1. Acute Physiological Responses (M±SD)

Variable	Rest	25-km Time Trial	Trial Range
VO ₂ (ml*kg ⁻¹ *min ⁻¹)	5.0±1.2	32.8±4.6	31–37
HR (bpm)	72.2±11.3	172.7±11.4	161–184
VE (L*min ⁻¹)	9.3±1.4	86.9±20.1	65–124
Calorie Expenditure (kcal*min ⁻¹)	1.2±0.2	8.4±2.1	6–9
RER	0.80±0.04	0.98±0.03	.93–1.02
CHO Utilization (%)	30.1±18.7	84.9±8.3	73–92
FAT Utilization (%)	58.9±12.0	13.6±7.0	6–24

3028 Board #8 June 2 3:15 PM - 5:15 PM

Reliability & Validity Of Aquatic Deep Water Peak VO2 Testing For Individuals With Spinal Cord Injury

William H. Scott¹, Anna Ogonowska-Slodownik², Peter H. Gorman¹, Robert Slodownik², Paula R. Geigle¹. ¹University of Maryland School of Medicine, Baltimore, MD. ²Franz Josef Pisudski University of Physical Education, Warsaw, Poland.
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 (No relationships reported)

PURPOSE: To understand the reliability of peak VO₂ testing for individuals with spinal cord injury (SCI) in deep water and on land arm cycle ergometer; and to determine the relationship between these two testing conditions. **METHODS:** Nineteen participants (15 men, 4 women) with SCI enrolled in a pilot study to assess peak VO₂ using a Cosmed metabolic cart and tubing connection unit (Aquatrain): (1) in supported vigorous deep water exercise (aquatic), and (2) on land arm cycle ergometer. Participants randomized into either aquatic or arm cycle ergometer

measurements, separated by 48 hours both conditions. Seventeen individuals (13 men and 4 women) completed both testing conditions and two others completed only arm ergometer sessions.

RESULTS: Peak oxygen consumption correlated clinically and statistically significantly for both conditions, aquatic (n=17, r=0.93, p<0.001) and arm cycle ergometry (n=19, r=0.95, p<0.001); and a Pearson correlation between aquatic and arm cycle peak VO₂ existed (n=17, r=0.70, p<0.002). We hypothesized a priori lower extremity motor score (LEMS), age, gender, and weight could potentially impact peak VO₂ outcomes. For these participants only LEMS influenced supported deep water peak VO₂, n=14, B=0.66, p<0.008, and arm cycle ergometer peak VO₂, n=16, B=0.54, p<0.025.

CONCLUSIONS: Determining peak VO₂ for individuals with SCI is highly reproducible for arm cycle ergometry and in supported deep water with the metabolic cart Aquatrainer connection. Additionally, supported deep water peak VO₂ testing is reliable (R=0.93) and valid (r=0.70) compared to arm cycle ergometry (gold standard). Clinically it is important to assess peak VO₂ after an aquatic intervention using the same conditions as the treatment conditions, and both supported deep water and arm cycle ergometer provide reliable and valid peak VO₂ outcomes.

F-34 Thematic Poster - Sports Injuries: Friend or Foe?

Friday, June 2, 2017, 3:15 PM - 5:15 PM
 Room: 505

3029 **Chair:** Steven P. Broglio, FACSM. University of Michigan, Ann Arbor, MI.

(No relationships reported)

3030 Board #1 June 2 3:15 PM - 5:15 PM
Epidemiology Of Sudden Death In American Youth Sports

Brad D. Endres, Rebecca L. Stearns, Robert A. Huggins, Douglas J. Casa, FACSM. Korey Stringer Institute, Storrs, CT.
 (No relationships reported)

Little epidemiological data on the incidence of injury and sudden death in American youth sport exists. **Purpose:** Describe the epidemiology of sudden death (SD) in organized American youth sport. **Methods:** SD surveillance was conducted from 8/1/2011 to 10/27/2016 via LexisNexis and other publicly available news or media reports. A certified athletic trainer reviewed each case to confirm the official cause of SD and/or offer a speculated cause of SD if official cause was unknown. Cases of SD that occurred in youth athletes 17 years of age and younger in organized sports were included. Cases of athletes at the high school level or higher were excluded. Details of the athlete (age, gender, level of play), event (sport, event type, activity), and death (date of incident, date of death, location of death, official and speculated cause of death) were examined. **Results:** From 2007-2015, 45 SDs (average = 5 deaths/yr) were reported in American youth sports. The age range of SD was from 8-17 years old. The mean age of SD was 13 ± 2 years old. The overall incidence rate was 0.23 deaths/100,000 participants. The deadliest year was 2015 with 11 cases. When broken down into three-year segments, 6 SDs occurred from 2007-2009, 16 from 2010-2012, and 23 from 2013-2015. From 2007-2015, males experienced a greater number of SD compared to females (n=36, 80% of all deaths). Basketball had the highest number of SDs from 2007-2015, with a total of 16 occurrences. The most frequent cause of SD was cardiac-related (n=34, 76% of all deaths). Furthermore, 15 of the 16 basketball deaths (94%) were cardiac related. **Conclusions:** From 2007-2015 45 youth athletes died while playing organized sport, with an increasing number of SDs in more recent years. Males experienced a greater number of SDs than females. The sport and condition with the greatest SDs were basketball and cardiac-related SDs, respectively. With an overall incidence of 0.23 SDs/100,000 participants, these rates are on par with reported high school SD rates from 2007-2014 school years as reported by the National Center for Catastrophic Sport Injury Research (average=0.24/100,000). This study sets a precedent for further examination into youth sport SD and supports the need for mandated health and safety guidelines in this population.

FRIDAY, JUNE 2, 2017

3031 Board #2 June 2 3:15 PM - 5:15 PM

Epidemiology Of Sports-related Concussion In Japanese High School AthletesFumiko TSUKUDA, Female¹, Kousuke TAKEUCHI², Shinobu TANAKA², Takeshi KOMATSU², Masao KANAMORI¹.¹Ritsumeikan University, Kusatsu, SHIGA, Japan. ²Biwako Seikei Sport College, Otsu, SHIGA, Japan.

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(No relationships reported)

As a result of epidemiological articles on sports-related concussion (SRC) in Japan, few articles were published. Incidence rate of sports-related concussion among high school student athletes in Japan has not been researched. **PURPOSE:** To describe epidemiology of SRC in Japanese high school Athletes. **METHODS:** SRC data from the medical check among 18-19 years old students in total 368 athletes were analyzed. Data are collected from history of concussion, neurological symptoms (SCAT2), Balance Error Scoring System (BESS) by the assessment of concussion held in Zurich (McCrory P et al. 2012). Incidence are obtained to estimate the experience rate of three person-years among the subjects. Cases of concussion are ascertained by certificated Japanese athletic trainer and sports doctors. Symptoms comparisons were made using two-way ANOVA with repeated measures. **RESULTS:** Experience rate of concussion during high school three years were 2.72 percent of ascertain cases, and 4.08 percent of total cases (ascertain and uncertain). Incident rates of ascertained cases were estimated to be 0.013 person-year, rates of total cases be 0.020. Injury rate per 1000 Athletic-Exposures were 0.42 with Men's basketball, 0.22 with Men's soccer. The rates of concussion in basketball were higher than Americans (Daneshvar DH, 2011 and Giza CC, 2013). The rates in soccer were lower. Headache, Pressure in head, Dizziness were statistically increased the number from the result of SCAT2. Higher Incidence among sports are observed in Men's basketball and Men's Soccer. There were not significant different from annual practice time between concussion (CC) and non-concussion (NCC) cases, basketball CC: 1364.0 hours/year. NCC: 1155.8 hours/year. Balance Error Scoring System at baseline were CC: 27.34, NCC: 27.38. Limitations: We could not evaluate the rate of Rugby, American-football and Judo because of a few players.

CONCLUSIONS: Incident rates of concussion of Japanese high school students were estimated to be 0.013 person-year at least. Injury rate per 1000 Athletic-Exposures were 0.42 with Men's basketball, 0.22 with Men's soccer.

3032 Board #3 June 2 3:15 PM - 5:15 PM

Developmental Stage And Age At Time Of First Concussion Influences Subsequent Concussion RiskJulianne D. Schmidt¹, Katherine Rizzone², Nicole L. Hoffman¹, Michelle L. Weber¹, Jeffrey Bazarian². ¹University of Georgia, Athens, GA. ²University of Rochester, Rochester, NY.

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(No relationships reported)

Sustaining a single concussion increases the risk of sustaining a subsequent concussion. Individuals that sustain their first concussion during childhood may be at greater risk for sustaining multiple concussions throughout their lifetime, due to a longer window of vulnerability. **PURPOSE:** To determine whether developmental stage and age at first concussion influence risk of subsequent concussion. **METHODS:** A total of 23,582 collegiate athletes from 26 universities and military cadets from 3 military academies completed a concussion history questionnaire (15,232 males, 8,335 females, 15 missing; age: 19.9±1.4 years, mass: 77.4±17.2 kg, height: 177.3±10.4 cm). Participants were asked to self-report the number of concussions and age at time of each injury. Participants with concussion histories (n=3,819) were categorized as having sustained their first concussion during childhood (<10 yo) or adolescence (≥10 yo & ≤18 yo) based on World Health Organization criteria. We then determined the number of subsequent concussions sustained prior to age 18. We used a Poisson regression to model developmental stage predicting risk of subsequent concussion. A second model was developed to determine whether age at first concussion predicted subsequent concussion risk ($\alpha = 0.05$). **RESULTS:** Of the 3,819 participants with a previous concussion, 251 (6.6%) sustained their first concussion during childhood and 3,568 (93.4%) during adolescence. Participants that sustained their first concussion during childhood had 81% higher risk of sustaining subsequent concussions (RR=1.81, 95% CI: 1.49, 2.21) compared to those that sustained their first concussion during adolescence. Subsequent concussion risk decreased by 10% for each additional year of age at the time of first concussion (RR=0.90, 95% CI: 0.88, 0.92). **CONCLUSION:** Sustaining a concussion at a young age seems to lengthen the window of vulnerability to sustaining subsequent concussions, resulting in higher risk of sustaining multiple concussions in a lifetime. Sustaining multiple concussions may cause prolonged recovery, early medical disqualification from sport, and late life cognitive impairments. Concussion prevention strategies are of particular need at the youth level to prevent children from sustaining their first concussion at a young age.

3033 Board #4 June 2 3:15 PM - 5:15 PM

Sex Differences In Head Injuries Among Collegiate Soccer Players: NCAA ISS, 2004-2009Avinash Chandran, Mary Barron, Beverly Westerman, Loretta DiPietro, FACSM. *The Milken Institute School of Public Health, Washington, DC.* (Sponsor: Loretta DiPietro, FACSM)

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(No relationships reported)

Some of the highest rates of head injuries and concussion among all contact/collision sports are observed in soccer; yet, the multifactorial determinants of head injuries among players remain relatively undefined. **PURPOSE:** To examine sex-differences in the rate and the severity (lost days of participation, resultant concussions) of head injuries among collegiate soccer players between 2004 and 2009, while controlling for several covariables previously linked to injury occurrence. **METHODS:** Data from the National Collegiate Athletic Association Injury Surveillance System (NCAA-ISS) were used to calculate injury incidence density (ID) per 1000 athletic exposures (AE). The rate ratio (RR), along with the 95% Wald confidence interval (CI), compared ID among female, relative to male soccer players. Multivariable logistic regression and multivariable negative binomial regression modeling then tested the relation between sex and head injury incidence and severity while controlling for contact, setting, and competition level. **RESULTS:** Between 2004 and 2009, the sex-specific rate of soccer-related head injuries was 0.87 per 1000 AEs in women and 0.71 per 1000 AEs in men (RR = 1.23, 95% CI = [1.08, 1.41]). The rate of head injuries due to player-to-player contact was comparable between women and men (RR=0.95, 95% CI=[0.81, 1.11]); however, the rate of injury due to contact with apparatus was nearly 2 ½ -fold higher (RR=2.46, 95% CI = [1.76, 3.44]) and the rate due to contact with a playing surface was over two-fold higher (RR=2.29, 95% CI = [1.34, 3.91]) in women than in men. We also observed a significant joint effect between sex and contact in our regression models, with a particularly notable antagonistic interaction observed while modeling head injuries. **CONCLUSION:** Among female players, head contact with a ball, a goal post, or the playing surface may be especially deleterious compared with head contact with another player.

3034 Board #5 June 2 3:15 PM - 5:15 PM

National Hockey League Players' Concussion And Lower-Body Injury Risk Across the 2012-2015 SeasonsKathryn L. O'Connor, Tanu Bhargava, Andrew L. Lapointe, Steven P. Broglio, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Steven P. Broglio, FACSM)

Email: kloconn@umich.edu

(No relationships reported)

Recent literature has indicated that concussion increases musculoskeletal injury risk. Various studies have demonstrated post-concussion changes in gait and posture, but few studies focus on orthopedic trauma. **PURPOSE:** Investigate the association between concussion and lower-body injury risk in the NHL players during 2012-2015 seasons. **METHODS:** Season statistics and injuries were compiled from hockey-reference.com. All head injuries were reviewed, using public news reports, to determine evidence for concussive injury. Over the four seasons 3505 athlete seasons (2012: n = 839, 2013: n = 886, 2014: n = 882, 2015: n = 898) were compiled with 2048 unique NHL players. Each injury was classified as illness, lower-body, upper-body, concussion, undisclosed, or other. Primary analyses examined the first and second injuries. Odds ratios and 95% CI were calculated for the likelihood of concussion after a lower-body injury and the likelihood of lower-body injury after concussion. Upper-body injuries were not examined as they could be concussive injuries per the NHL reporting guidelines. **RESULTS:** Players had an average age: 26.8 years (SD=4.6), height: 185.7 cm (SD=5.3), weight: 91.7 kg (SD=6.8), and games played: 45.3 (SD = 27.7). The majority of the players were forwards 65% (n = 2286). Across four seasons, 48% (n = 1673) of all athletes had at least one injury or illness with an average of 9.4 (SD = 12.8) games lost per season. There were 141 recorded concussions (4.1%) and 900 lower body injuries (26%) from 2012-2015. Players whose first injury was to the lower-body had 3 times (95% CI: 1.48-6.24) the odds of subsequent concussion within the same season compared to those without lower-body injury. Furthermore, players whose first injury was a concussion had 2.25 (95% CI: 1.28-3.96) times the odds of a lower body injury within the same season.

CONCLUSIONS: Athletes with concussion have greater subsequent lower-body risk when compared to athletes with no injury or illness. However, it may be that certain athletes are generally more injury prone than others given the bidirectional association between concussion and lower-body injury. Future studies should investigate individual characteristics to determine specific injury risk and identify at-risk athletes.

3035 Board #6 June 2 3:15 PM - 5:15 PM
Prediction of Injury among Elite Dancers: Three Years of Prospective Surveillance
 Marijeanne Liederbach¹, Evangelos Pappas², Leigh Schanfein¹, Beth Glace³. ¹*NYU Langone Medical Center Hospital for Joint Diseases, New York, NY.* ²*University of Sydney, Sydney, Australia.* ³*Lenox Hill Hospital Northwell Health, New York, NY.* (Sponsor: Mal McHugh, FACSM)
 (No relationships reported)

Injuries in dance are commonplace and distressing in terms of human and financial impact. It is the hope of dance medicine healthcare professionals and educators to detect risk for injury prospectively, often through screening efforts. It is known that screening has been very useful for rapport building, improving health literacy and facilitating entryways to local healthcare systems. However screening, as we have been conducting it, has still not proven to be predictive of injury despite implementation of preventative interventions such as pre-season conditioning programs. **PURPOSE:** To test the predictive validity of four patient reported outcome measures (PRO) in addition to an array of motor control designed clinical performance-based outcome measures (CPBO) collected during preseason screening in predicting subsequent season time loss injury. **METHODS:** 241 elite classical dancers (21.5±5.0 years; 69 men, 172 women) who received regular onsite care consented to participate in PRO and CPBO-based preseason screenings and ongoing, healthcare practitioner documented injury surveillance. The PRO's utilized in this study were the Discomfort Rating Scale (DRS); the World Health Organization Functional Scale (WHO); the Profile of Mood States total score (POMS) and the Eating Attitudes Test-26 (EAT). Data were analyzed with a multivariate logistic regression model for the outcome variables "injured in subsequent season" and "number of therapy visits in subsequent season". **RESULTS:** All PRO variables were associated with the primary outcome variables (p=0.003, R²=0.492, R²=0.242, adjusted R²=0.205). **CONCLUSION:** Injury prevention screening for dancers should include PRO scores to predict those at greatest risk for time loss injury.

3036 Board #7 June 2 3:15 PM - 5:15 PM
Injury in D III Volleyball Players is Associated with Preseason Jump and Hop Measures
 Jason Brumitt¹, Alma Mattocks², Phil Lentz³, Jeremy Loew⁴. ¹*George Fox University, Newberg, OR.* ²*Spalding University, Louisville, KY.* ³*Pacific University, Forest Grove, OR.* ⁴*Lewis and Clark College, Portland, OR.* (Sponsor: Mitchell J Rauh, FACSM)
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 (No relationships reported)

Purpose: Collegiate volleyball (VB) players are at risk for sports injuries. Reported time-loss injury rates for female Division III (D III) collegiate VB players range from 4.0 to 5.4 injuries per 1000 athletic exposures (AEs). Identifying risk factors in this population may help coaches to reduce injury rates via targeted training programs. The purpose of this prospective cohort study was to determine the ability of 2 functional performance tests (FPTs) [the standing long jump (SLJ) and/or the single-leg hop (SLH) for distance] to identify female D III VB players who may be at an increased risk for a non-contact time-loss lower quadrant (LQ = low back and lower extremities) injury. **Methods:** 68 female VB players (18.9 ± 1.0 years old) from 5 D III teams performed 3 trials of each FPT in the preseason. Off-season training habits were also collected. Mean SLJ and SLH distances (normalized to height) were used for study analysis. Injury rates were calculated per 1000 AEs for initial and subsequent injuries. Crude and adjusted odds ratios (OR) were calculated to identify the risk association between preseason FPT measures and LQ injury. **Results:** The mean SLJ distance was 0.82 ± .09 and the mean SLH distances were 0.68 ± 0.09 (R) and 0.68 ± 0.11 (L). Fourteen initial time-loss injuries [thigh/knee region = 5; foot/ankle region = 9] and 2 subsequent time-loss injuries (foot/ankle = 2) occurred during the study. The initial time-loss injury rate was 3.0 (95% CI: 1.7-5.0) per 1000 AEs and the subsequent injury rate was 5.6 (95% CI: 0.9-18.4) per 1000 AEs. Individual test performance did not discriminate risk; however, a limb symmetry index (LSI) > 10% was associated with an increased risk of LQ injury (OR = 3.8; 95% CI: 1.0, 13.5). Suboptimal FPT scores and an LSI > 10% was associated with an increased risk of LQ injury (OR = 21.2; 95% CI: 2.1, 210) and foot/ankle (FA) injury (OR = 14.3; 95% CI: 2.0, 102.9). Adjusted OR were calculated for the aforementioned categories adjusting for off-season weightlifting reports: 1) LSI > 10% (AOR 5.5; 95% CI: 1.3, 22.3); 2) suboptimal FPT scores and LQ injury (AOR 25.7; 95% CI: 2.2, 299); 3) suboptimal FPT scores and FA injury (AOR 16.3; 95% CI: 1.9, 139). **Conclusions:** Suboptimal performance on a battery of FPTs may be useful as a screening tool to identify female D III VB players at risk for a non-contact time-loss LQ injury.

3037 Board #8 June 2 3:15 PM - 5:15 PM
The Injury and Illness Profile of 23055 Participants in a 94.7km Cycle Race - Cross-Sectional Study
 Dina C. Janse van Rensburg, FACSM, Mia Breed, Lizelle Fletcher, Catharina C. Grant, Audrey Jansen van Rensburg, Martin P. Schweltnus, FACSM. *University of Pretoria, Pretoria, South Africa.*
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 (No relationships reported)

INTRODUCTION: The Momentum 94.7 Cycle Challenge is an annual recreational long distance cycling event in South Africa. Medical support at such an event is imperative, with little known regarding the risk of acute traumatic injuries and acute medical illness. **PURPOSE:** To describe the incidence and patterns of acute injury and medical illness and difference between sexes during a mass community cycling race. **METHODS:** A descriptive study of the 2014 Momentum 94.7 Cycle Challenge, documenting the incidence of acute traumatic injuries and acute non-traumatic medical illness in 23055 race starters (males=17520, females=5236, not specified=299) during the 94.7km distance. **RESULTS:** An incidence (per 1000 starters) of 38.69 (females=38.39, males=36.52) for all medical illness; with an incidence of 11.88 (females=16.42, males=10.73) for adverse medical events and of 1.3 (females=2.67, males=0.86) for serious adverse events, were reported. The incidence of non-traumatic medical complaints was 32.48 (females=31.32, males=33.39) and of traumatic injuries was 3.99 (females=7.07, males=3.14). Females had a higher risk of sustaining traumatic injuries (p<0.001), central nervous system (p=0.0062) and eye complaints (p=0.0107). The musculoskeletal system had the most complaints, 80.7%. Males 10-16yrs (p=0.0013) and females 23-39yrs (p=0.0336) and >50yrs (p=0.0002), had a higher risk for traumatic injuries. **CONCLUSIONS:** A reported ratio of 1:26 (females=1:26, males=1:28) of all starters developed medical complaints; with 1:84 cyclists (females=1:61, males=1:93) that developed adverse events and did not finish the race; and 1:769 participants (females=1:374, males=1:1163) developing serious adverse events that required hospitalisation. The majority of admissions for traumatic injuries were followed by cardiovascular complaints. A wide spectrum of medical complaints can be expected during mass recreational sport events, with a higher risk for females to sustain traumatic injuries, and encounter central nervous system and eye complaints. The majority of disorders involved the musculoskeletal system. Information regarding the pattern and type of medical encounters can prove useful during planning and management of similar future events.

F-35 Free Communication/Slide - Physical Activity Intervention Trials
 Friday, June 2, 2017, 3:15 PM - 5:00 PM
 Room: 402

3038 **Chair:** Melissa Napolitano. *The George Washington University, Washington, DC.*
 (No relationships reported)

3040 June 2 3:15 PM - 3:30 PM
Effects Of Three-stages Training Program On Balance And Functional Fitness For Community-dwelling Old-old Japanese
 Hiroshi Kohno¹, Hidenori Asai². ¹*TOYO University, Asaka-shi, Saitama, Japan.* ²*Ehime University, Matsuyama, Ehime, Japan.*
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 (No relationships reported)

PURPOSE: To examine effectiveness of three-stages physical training program on balance ability and ADL-related functional fitness for community-dwelling Japanese old-old females. **METHODS:** After giving written informed consent, the subjects, unable to stand on one leg more than 20 seconds with eyes open, were divided into the 3 times/week group (HFG; 13 females, 80.0±2.3 yrs, BMI 23.0±1.8) and the 1time/week group (LFG; 10 females, 81.3±3.6 yrs, BMI 21.4±1.3). The program was composed of three stages for 16 weeks. First, they learned about managing skill for their physical soreness and were asked to standing on one-leg with eyes open for one minutes, 3 times a day both each leg at class and at home. Second, they learned to strengthen their core and lower legs muscle using an elastic band. The last stage was to learn three minutes arm and legs combined exercise program with music. ADL-related functional fitness(sitting & standing time, zigzag walking time), one-leg standing time with eyes open, knee extension strength, fear of falling score were obtained. Balance ability was measured

by the area covering and total length of the center of gravity sway (COP). Each measurement items were assessed before and after the intervention period. Student's T-test and two-way repeated measures ANOVA were used to test the effectiveness. **RESULTS:** The class participation were 83±5% and 71±8% respectively. Sitting & standing time (HFG: 18.4±5.6 to 16.2±5.4 sec., LFG: 17.4±3.9 to 17.4±3.6sec., F=3.205, P=0.088), zigzag walking time (HFG: 19.6±3.0 to 17.0±3.3sec., LFG: 17.1±4.2 to 16.8±2.9sec., F=12.18, P=0.002), one-leg standing time with eyes open (HFG: 6.1±3.1 to 13.3±4.4 sec., LFG: 5.9±2.3 to 6.1±1.8sec., F=26.44, P=0.000), knee extension strength (HFG: 181.5±39.6 to 208.5±41.5 N, LFG: 192.0±15.5 to 196.5±14.5 N, F=4.775, P=0.040), and balance ability (area covering of COP; HFG: 15.3±5.8 to 10.6±7.1 cm², LFG: 14.6±4.1 to 17.2±8.9 cm², F=7.064, P=0.015, total length of COP; HFG: 148.3±31.9 to 100.7±27.4 cm., LFG: 141.0±30.2 to 135.7±37.2 cm, F=12.183, P=0.002) also improved significantly in HFG. Fear of falling score was not change in both groups. **CONCLUSIONS:** Three-stage physical training program was effective on balance ability and functional fitness for Japanese old-old females.

3041 June 2 3:30 PM - 3:45 PM

Both MBSR and Aerobic Exercise Training can Affect Physical Activity Behavior in Sedentary Individuals

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Mindfulness-Based Stress Reduction (MBSR) and aerobic exercise training (AET) have emerged as robust programs to improve health and wellbeing. Physical activity may be enhanced to a similar degree by MBSR and AET, although their relative effects on physical activity have not been objectively assessed.

PURPOSE: To compare the effects of 8-weeks of MBSR and AET on objectively measured physical activity.

METHODS: Participants underwent 7-days of physical activity monitoring (Actigraph GT3X) at baseline prior to randomization, and again following completion of 8-weeks of training in MBSR or AET, or neither (no-treatment control group). Actigraph-based average daily minutes of sedentary, light, moderate, vigorous and moderate-to-vigorous (MVPA) activities were calculated. Weekly time spent in MVPA lasting longer than 10 minutes (MVPA Bouts) was calculated to assess physical activity engagement sufficient to meet national recommendations. Groups were compared via pairwise comparisons of changes in MVPA and MVPA Bouts from pre-randomization (August) to post-intervention (November).

RESULTS: Sufficient data for analysis (≥ 3 week and ≥ 1 weekend day, >10 hours/day) were obtained from 49 participants (18 MBSR, 14 AET, 17 control) out of 66 who enrolled. Reflecting a seasonal decline (Aug to Nov), daily MVPA decreased in all groups: control by 17.9 ± 25.7 min/day, MBSR by 5.7 ± 7.5 min/day, and AET by 7.4 ± 14.3 min/day, without statistically significant differences among the groups (all $p > 0.05$). MVPA Bouts decreased 77.3 ± 106.6 min/week in the control and 15.5 ± 37.0 min/week in the MBSR group, with a nonsignificant difference favoring MBSR ($p = 0.080$); AET increased MVPA Bouts by 5.7 ± 64.1 min/week, significantly different from control ($p = 0.029$) but not MBSR ($p = 0.564$).

CONCLUSIONS: This pilot study showed that while exercise training leads to more minutes of MVPA sufficient to meet physical activity guidelines compared to a no-treatment control, MBSR training may mitigate seasonal decline with similar effects to exercise training on daily MVPA and MVPA in 10+ min bouts. As these findings indicate that MBSR training has beneficial effects on MVPA, future research is needed to determine if MBSR improves wellbeing through changes in physical activity.

3042 June 2 3:45 PM - 4:00 PM

Effects of High-intensity Interval Training and Moderate-intensity Continuous Training on Sleep in Sedentary Obese Adults

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(No relationships reported)

Regular moderate-intensity physical activity has been shown to improve sleep duration and quality in individuals with mild to moderate sleep complaints. It is not known whether more vigorous exercise may have similar, more pronounced, or even detrimental effects on sleep. **PURPOSE:** To examine the effects of high-intensity interval training vs. moderate-intensity continuous training on objectively- and subjectively-measured sleep parameters. **METHODS:** Fifteen volunteers (35.1 ± 8.1 y; BMI = 36.0 ± 5.0 kg/m²) completed 8 weeks (3 d/wk) of either high-intensity interval training (HIIT (n=8): 10, 1-min intervals at 90-95% of heart rate max (HR_{max}))

or moderate-intensity continuous training (MICT (n=7): 30 min at 70-75% of HR_{max}) on cycle ergometers. Subjects wore accelerometers (Actigraph GT3x+) on the non-dominant wrist during sleep periods for seven consecutive days at baseline, week 5, and week 8. Measures of total sleep time (TST, min), sleep onset latency (SOL, min), and sleep efficiency (SE, %) were derived. Participants also completed the Pittsburgh Sleep Quality Index (PSQI) at baseline and after training. **RESULTS:** For Actigraph-measured sleep, SOL was marginally improved in HIIT (-1.92 ± 3.9 min) compared to MICT (+4.92 ± 8.15 min, $p = 0.08$, $d = 0.61$). SE was also marginally improved in HIIT (+2.5 ± 5.2%) compared to MICT (-3.8 ± 4.6, $p = 0.06$, $d = 0.65$). No changes were observed for TST. For PSQI-measured sleep, MICT showed favorable improvements compared to HIIT for sleep latency ($p=0.09$, $d = 0.51$), sleep duration ($p=0.06$, $d = 0.57$), sleep efficiency ($p=0.07$, $d = 0.55$), and the global score ($p=0.03$, $d = 0.67$), but no differences were observed for sleep quality, disturbances, medication use, or daytime dysfunction. **CONCLUSION:** This study is the first to compare HIIT vs. MICT on sleep using both actigraphy and subjective measures. Our results suggest that in comparison to moderate-intensity continuous training, high-intensity interval training may lead to the perception of poorer sleep quality. Conversely, objectively measured sleep quality may respond more favorably to HIIT than MICT.

3043 June 2 4:00 PM - 4:15 PM

Six Months of Aerobic Fitness Training on Daily Affect in High-Stressed Family Caregivers

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(No relationships reported)

PURPOSE: Positive (PoA) and negative affect (NeA) independently contribute to psychological and physical health. Observational studies have shown that active adults have greater daily PoA than less active individuals, whereas there is inconsistent evidence for NeA. We report results of a randomized controlled trial on the effects of 24 weeks of aerobic training on daily PoA and NeA.

METHODS: Sixty-three high stress family caregivers of persons with dementia were randomized into a waitlist control group (n = 33) or a 24-week aerobic training intervention group (n = 30). Treatment group participants gradually increased weekly moderate-to-vigorous activity to 150 minutes per week by the 8th week in the study. Prior to randomization and again in the 24th week, participants completed 6 online ecological momentary assessments per day for 7 days. A visual analog scale of 0 to 100 was used to assess PoA and NeA. Based on the circumplex theory of emotion, we further divided PoA and NeA along their dimensions, valence and activation, leading to four types: Positive Deactivated (PDA), Positive Activated (PAA), Negative Deactivated (NDA), Negative Activated (NAA).

RESULTS: Mixed models revealed that change over time (Δ) between exercise and control group caregivers was significantly different for PoA, NeA, and the four subcomponents (all p 's < .001). Exercisers significantly increased daily PoA ($\beta_{\Delta} = 6.18$, SE = 0.64, CI = 4.93, 7.42) and decreased NeA ($\beta_{\Delta} = -4.74$, SE = 0.62, CI = -5.96, -3.54, $p < .001$) compared to baseline, whereas the control group increased in both PoA and NeA (PoA: $\beta_{\Delta} = 1.74$, SE = 0.56, CI = 0.63, 2.84, $p = .002$; NeA: $\beta_{\Delta} = 2.35$, SE = 0.55, CI = 1.28, 3.42, $p < .001$). These effects were consistent for PDA, PAA, NDA, NAA, with one exception: PAA did not increase significantly in waitlist control participants ($p = .31$).

CONCLUSIONS: All caregivers increased in daily PoA after 6 months, however, those who exercised increased significantly more. On the other hand, there was a significant distinction in the pattern for daily NeA: exercisers decreased and control participants increased. These findings have implications for understanding the role of fitness training on daily affective states, especially in family caregivers of persons with a progressive disorder.

3044 June 2 4:15 PM - 4:30 PM

Health In Pregnancy and Postpartum (HIPP): Targeting Gestational Weight Gain and Postpartum Weight Loss

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(No relationships reported)

Interventions to prevent excessive weight gain and promote postpartum weight loss have modest results, particularly in overweight and obese women.

PURPOSE: To describe the rationale and design of the HIPP trial; discuss recruitment strategies, challenges, and yield to date; and present baseline demographic and physical activity (PA) data.

METHODS: HIPP is a randomized controlled trial enrolling women from SC who are <16 wks gestation, overweight or obese, white or African American, 18 to 44 yrs old, without exercise contraindications. Participants are randomized to a behavioral lifestyle intervention or usual care (target N=400) and assessed at baseline, 32 wks gestation, and 6- and 12-mos postpartum. Outcomes include gestational weight gain (primary) and PA (secondary) measured with the Sensewear Armband. The behavioral lifestyle intervention, grounded in Social Cognitive Theory, consists of two individual counseling sessions (early pregnancy and postpartum), weekly or biweekly pregnancy counseling calls, biweekly postpartum counseling calls, 10 pregnancy and 16 postpartum podcasts, and an optional private Facebook group (to 6-mos postpartum). The usual care group receives monthly mailings and a matched number of podcasts on non-weight related topics.

RESULTS: To date, 95 participants have enrolled, representing 16% of women who completed a screening form and were initially eligible. Eight (16%) have withdrawn, two due to medical ineligibility. Barriers to enrollment include failure to reach women for telephone screening, ineligibility, and no shows to baseline visits. These challenges led to increasing recruitment sites and replacing group intervention sessions with individual telephone counseling. At baseline, participants were 10.0 ± 2.1 wks gestation, 30.2 ± 5.6 yrs old, 44% nulliparous, 34% African American, 60% college graduates, and 48% obese. Baseline armband average wear-time was 23.5 ± 0.3 hrs/d. Participants accumulated 36 ± 22 total mins/d of MVPA and 5399 ± 2303 steps/d. 32-wk data show trends favoring the intervention group (40 vs. 26 mins/d MVPA, 5078 vs. 4620 steps/d).

CONCLUSION: HIPP is an innovative study that addresses gaps in the literature. Recruitment posed challenges necessitating study modifications. Primary outcome results are expected in 2019.

Funded by NIH/NICHHD.

3045 June 2 4:30 PM - 4:45 PM

Effects of a Long-Term Physical Activity Program on Activity Patterns in Mobility Impaired Older Adults

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(No relationships reported)

Purpose: To examine the effect of a long-term structured physical activity intervention on accelerometer-derived metrics of activity composition changes in older adults at high risk for mobility disability.

Methods: Participants were randomized to either a physical activity (PA) or health education (HE) program. The PA intervention included a walking regimen with strength, flexibility, and balance training. The HE program featured health-related discussions and a brief upper body stretching routine. Participants (n = 1,341) wore a hip-worn accelerometer for ≥ 10 h/day for ≥ 3 days at baseline and again at 6, 12 and 24 months post-randomization. Total physical activity (TPA)—defined as movements registering 100+ counts/min—was segmented into the following intensities: low light (LLPA; 100-759 counts/min), high light (HLLPA; 760-1,040 counts/min), low moderate (LMPA; 1,041-2,019 counts/min), and high moderate and greater (HMPA; 2,020+ counts/min) physical activity. Patterns of activity were characterized as bouts (defined as the consecutive minutes within an intensity).

Results: Both groups decreased TPA (-10.5 ± 1.0 minutes/day annually), but the PA intervention attenuated this effect (PA vs HE: $+6.4 \pm 2.1$ minutes/day, $p < 0.001$). This attenuation shifted TPA composition by increasing daily time in HLLPA (1+ bouts: 0.8 ± 0.3 ; 5+ bouts: 0.2 ± 0.04 ; 10+ bouts: 0.1 ± 0.02 minutes), LMPA (1+ bouts: 2.7 ± 0.4 ; 2+ bouts: 2.4 ± 0.3 ; 5+ bouts: 2.0 ± 0.2 ; 10+ bouts: 1.1 ± 0.1 minutes), and HMPA (1+ bouts: 2.8 ± 0.4 ; 2+ bouts: 2.5 ± 0.3 ; 5+ bouts: 2.1 ± 0.3 ; 10+ bouts: 1.7 ± 0.2 minutes). All findings were statistically significant at $p < 0.01$.

Discussion: The PA intervention increased physical activity by shifting the composition of activity toward higher intensity activity in longer duration bouts. However, a long-term structured physical activity intervention did not completely eliminate overall declines in total daily activity experienced by mobility impaired older adults.

3046 June 2 4:45 PM - 5:00 PM

Effects of Supervised and Unsupervised Physical Activity Programs for Weight Loss

Seth A. Creasy¹, Renee J. Rogers², Kelliann K. Davis, FACSM², Bethany Barone Gibbs², Erin E. Kershaw², Sara J. Kovacs², Meghan R. Maher², Robert J. Kowalsky², Matthew O'Dell², Katherine A. Collins², Shawn D. Raybuck², Marissa L. Marcin², Patrick T. Donahue², John M. Jakicic, FACSM². ¹University of Colorado Anschutz Medical Campus, Aurora, CO. ²University of Pittsburgh, Pittsburgh, PA. (Sponsor: John M. Jakicic, FACSM)
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(No relationships reported)

Both supervised and unsupervised physical activity programs have been included within a standard behavioral weight loss intervention (SBWI). However, few studies have directly compared supervised and unsupervised physical activity within the context of a SBWI.

PURPOSE: This study examined changes in moderate-to-vigorous physical activity (MVPA), fitness, and weight in response to a supervised physical activity program prescribed in minutes per week (SUP-PA), an unsupervised physical activity program prescribed in minutes per week (UNSUP-PA), and an unsupervised physical activity program prescribed in steps per day (STEP) during a SBWI.

METHODS: Adults (N=52, age: 43.5 ± 10.1 years, BMI: 31.5 ± 3.5 kg·m⁻²) participated in a SBWI and were randomized to STEP (n=18), UNSUP-PA (n=17), and SUP-PA (n=17). Subjects were prescribed a calorie-restricted diet (1200-1800 kcal·day⁻¹) and to progressively increase physical activity (SUP-PA and UNSUP-PA: 150 min·week⁻¹; STEP: 10,000 total steps·day⁻¹ with 2,500 brisk steps·day⁻¹). All three groups attended weekly in-person group intervention sessions for 12 weeks. SUP-PA also attended supervised activity sessions, whereas UNSUP-PA and STEP engaged in unsupervised physical activity.

RESULTS: MVPA in bouts of ≥ 10 minutes significantly increased over the 12-week intervention by 11.5 ± 31.2 min·day⁻¹ in STEP, 16.1 ± 25.8 min·day⁻¹ in UNSUP-PA, and 21.6 ± 24.9 min·day⁻¹ in SUP-PA ($p < 0.001$) with no differences between groups ($p = 0.94$) or group by time interaction ($p = 0.81$). Weight significantly decreased ($p < 0.001$) with no significant difference between groups (STEP: -5.3 ± 3.6 kg, UNSUP-PA: -5.1 ± 3.3 kg, SUP-PA: -3.8 ± 3.0 kg) ($p = 0.81$). Fitness increased significantly greater in both SUP-PA (3.8 ± 1.6 ml·kg⁻¹·min⁻¹; 0.22 ± 0.23 L·min⁻¹) and UNSUP-PA (3.8 ± 3.2 ml·kg⁻¹·min⁻¹; 0.17 ± 0.24 L·min⁻¹) compared to STEP (1.3 ± 2.4 ml·kg⁻¹·min⁻¹; -0.04 ± 0.19 L·min⁻¹) ($p < 0.05$).

CONCLUSIONS: Unsupervised physical activity prescribed in min·week⁻¹ or steps·day⁻¹ may elicit a similar increase in MVPA and reduction in weight compared to supervised physical activity within a SBWI. However, physical activity prescribed in steps·day⁻¹ may elicit less favorable changes in fitness. Whether results are consistent across a longer intervention period warrants further investigation.

F-36 Free Communication/Slide - Weight Management

Friday, June 2, 2017, 3:15 PM - 4:45 PM
Room: 103

3047 **Chair:** Kathleen Woolf, FACSM. *New York University, New York, NY.*

(No relationships reported)

3048 June 2 3:15 PM - 3:30 PM

Iso-caloric Two-intensity Intermittent Exercise Blunts Detection, Leptin Response, And Dietary Compensation In Obese Women

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(No relationships reported)

PURPOSE: Whether obesity can influence appetite, hormonal responses to, and compensation for exercise energy expenditure (EEE) is uncertain. We tested the hypotheses that: (1) EEE suppresses appetite but increases post-exercise food intake independently of obesity, and (2) the effect may be mediated by energy-sensing hormones leptin and insulin.

METHODS: The 57-y old lean (BMI 23.4 kg/m²) and obese (BMI 33.6 kg/m²) women remained sedentary (SED) or did iso-caloric high- or a low-intensity, intermittent exercise (HIE 80%, LIIE 40% of VO₂max, respectively) one h after the morning (0700 h) and mid-day (1300 h) weight-maintenance meals. After the evening 1900 h

meal, an ad-libitum snack (2100 h) assessed compensation for EEE. A visual analog scale evaluated the appetite. Plasma glucose, FFAs, insulin and leptin were measured at 30 to 60-min intervals.

RESULTS: Meal intake (1350 vs 1473 Kcal) and mean EEE at two intensities during morning and mid-day postprandial periods (PPs) (1821 and 2202 Kcal) were similar in lean and obese women, respectively, as was EE during SED day (758 and 818 Kcal). This resulted in 529 and 380 Kcal positive energy balance on SED days and a 471 and 729 Kcal negative energy balance on exercise days in lean and obese women, respectively. Lean women ate an additional 256, and obese women 261 Kcal, of ad-libitum snack in SED trials. On LIIE and HIIE days, lean women increased snack intake by 24.6 and 37.9 %, respectively, but failed to compensate for 32 and 25% of exercise energy deficit. Corresponding increases of snack intake by obese women to LIIE and HIIE was 6 and 15%, and the compensation for EEE failed by 62 and 58%, respectively. Hunger was similarly suppressed during mid-day, but not morning, LIIE and HIIE in lean, but not the obese subjects, while obesity did not affect PP fullness. In LIIE and HIIE trials at mid-day, but not morning, exercise, a rise in FFAs was greater in lean than in the obese. In lean, but not the obese women, exercise suppressed PP insulin responses and led to a 5%, 12-h-sustained decline in plasma leptin.

CONCLUSIONS: EEE at intensities differing by a factor of two, suppresses hunger after the mid-day meal, PP insulin after morning and mid-day meals and leptin over a 12-h period in lean, but not the obese women. Obesity blunts detection, hormonal responses, and dietary compensation to EEE.

3049 June 2 3:30 PM - 3:45 PM

Effects Of Steady-state And High-intensity Exercise On Compensatory Eating Behavior

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(No relationships reported)

Obesity is a worldwide epidemic despite volumes of information while overwhelming evidence exists suggesting exercise and calorie restriction helps manage weight. Studies have shown significant differences in weight loss between high-intensity interval training and moderate continuous training potentially due to compensatory eating behaviors. **PURPOSE:** The aim of this study is to observe the differences in eating behaviors following high intensity intervals (HI) and continuous steady state (SS) running. **METHODS:** Nine lean (BMI=23.90±2.15 kg/m²) exercise trained college-aged (23.56±3.78 years) males (n=3) and females (n=6) participated in this study. Preliminary assessment included informed consent, medical history, body composition, and VO_{2max} (ParvoMedics, Sandy, UT). Subjects were randomized to one of three trials: control, HI, or SS. Subjects arrived fasted to the lab between 6:00-8:00 am. Subjects were given a 20oz sports drink and rested for 30 minutes prior to exercise. During the HI exercise, subjects exercised on a treadmill at 1:1 work:recovery ratio alternating one minute at 90% VO_{2max} and one minute at 50% VO_{2max}. Subjects completed 16 intervals during the SS exercise, subjects ran on a treadmill at 70% VO_{2max} for 33 minutes. Subjects sat quietly for 32 minutes during the control trial. Food logs were collect 24 hours before and after exercise bouts. Data was analyzed using a two-way repeated measures ANOVA (IBM SPSS, Armonk, NY). Significance was set at p=0.05. All data are presented as mean±SE. **RESULTS:** Caloric expenditure was higher during exercise than control (CON: 77.42±3.48kcal, HI: 321.06±24.16kcal, SS: 345.04±24.28kcal, p<0.001) but not different between HI and SS (p=0.49). Caloric intake was not different between trials (CON: 1557.11±172.48kcal, HI: 1849.78±149.80kcal, SS: 1683.11±142.73kcal, p=0.23). Carbohydrate intake was not different between trials (CON: 186.22±25.03g, HI: 224.89±24.28g, SS: 201.44±22.98g, p=0.41). Fat intake was not different between trials (CON: 55.44±8.31g, HI: 72.50±9.05g, SS: 63.44±4.66g, p=0.16). Protein intake was not different between trials (CON: 78.33±28.36g, HI: 69.33±10.18g, SS: 70.00±13.96g, p=0.64). **CONCLUSION:** Subjects diet did not differ in total energy or macronutrient intake after HI and SS exercise.

3050 June 2 3:45 PM - 4:00 PM

Aerobic Exercise Training Increases Dietary Restraint and Reduces Hunger and Energy Intake in Overweight/ Obese Adults

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(No relationships reported)

Exercise is associated with changes in energy intake, but findings are conflicting and mechanisms underpinning responses are unclear.

PURPOSE: To determine how aerobic exercise (AEx) training influences appetite, food-related behaviors, and energy intake.

METHODS: Previously sedentary, overweight/obese (OB/OW) adults (6F, 2M; 33±4 yr; BMI: 30.8±3 kg/m²) completed a 12-week supervised AEx program (5x/wk, energy expenditure ~400 kcal/session). At baseline (PRE) and post-intervention (POST), participants consumed a test breakfast meal (25% of daily energy requirements). Hunger and satiety were evaluated every 30 minutes for 3 hours using visual analog scales. Dietary restraint and disinhibition were assessed via Three-Factor Eating Inventory questionnaire. Subsequently, *ad libitum* energy intake was measured for 3-days under free-living conditions using participant selected meals provided by our metabolic kitchen. PRE-POST differences were assessed using paired sample t-tests. **RESULTS:** Body mass (91.9±19.8 vs. 90.4±20.5 kg, mean±SD) and composition (36±8 vs. 35±6 % fat mass) did not change (p=0.115 and p=0.515, respectively). Fasting hunger was significantly reduced (81±11 vs. 66±20, p=0.048). In response to the test meal, there was a trend for a reduction in hunger area under the curve (AUC) (7228±1459 vs. 6088±2244 pg/mL, p=0.066) but no change in Satiety AUC (7556±2808 vs. 8451±2617, p=0.452). Dietary restraint increased (9.9±2 v. 13.5±5, p=0.045), but disinhibition was unchanged (7.3±3 v. 6.9±3, p=0.476). 3-day *ad libitum* energy intake tended to decrease (2624±1222 vs. 2307±1161 kcal, p=0.089).

CONCLUSIONS: AEx training resulted in reduced *ad libitum* energy intake in OB/OW adults. This was due to decreased hunger cues and increased food-related cognitive restraint. However, because body mass did not change, it is possible that compensatory alterations in free-living energy expenditure and/or habitual energy intake occurred. Larger trials including measures of gut peptides and neuroimaging will be necessary to fully elucidate the bio-behavioral mechanisms responsible for predicting changes in appetite, energy-intake, and body weight regulation in response to AEx training.

FUNDING: ADA 1-14-TS-07 (PI: Corrier), NIH K01DK100445 (PI: Legget), NIH T32DK007446 (Halliday)

3051 June 2 4:00 PM - 4:15 PM

Effect Of Employment Status On Physical Activity And Sedentary Behavior Long-term Post-bariatric Surgery

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(No relationships reported)

Chronic sedentarism and weight re-gain are both serious concerns following bariatric surgery. Pre-surgery, employment rates are lower compared to the normal weight population. Participation in daily activity is affected by multiple factors such as age, sex, high socioeconomic status and white collar occupations, which are also inversely associated with obesity severity. **PURPOSE:** To explore the influence of employment status on the daytime sedentary and physical activity habits of bariatric patients long-term post-surgery. **METHODS:** 59 adults aged 51.19 ± 8.91 years, weighing 95.24 ± 25.0 kg with a BMI of 34.64 ± 10.11 kg/m² having undergone bariatric surgery 9.98 ± 3.09 years earlier participated in this study. Participants were asked to wear an ActivPal™ tri-axial accelerometer attached to their mid-thigh for seven consecutive days, 24 hours/day. All participants wore the device for ≥ 4 days and ≥ 22 hours/day. Self-reported nighttime sleeping facilitated distinguishing this from day sitting time. Patients were collapsed into two groups: employed (N = 21), or unemployed (N = 38). Sedentary time and steps were divided by total day time monitored and expressed as steps/hr and percent of day spent in sedentary behavior. ANCOVA was performed comparing the two groups on their steps/hr and percent sedentary time controlling for age, sex, BMI, and percent weight regained post-surgery. **RESULTS:** Employment status did not influence steps/hr for Week ($F(1, 54) = 2.78, p = .10$) or Weekend ($F(1, 54) = 2.97, p = .091$). Moreover, employment status did not influence percent sedentary time for Week ($F(1, 54) = .36, p = .550$) or Weekend days ($F(1, 54) = 1.29, p = .260$). **CONCLUSION:** Employment status does not appear to affect the percentage of the day spent in sedentary behaviors or physical activity among patients long-term post-bariatric surgery. Future research should focus on tailoring both exercise and lifestyle programs to meet the needs of employed and unemployed patients.

3052 June 2 4:15 PM - 4:30 PM

Diet plus Varying Doses of Physical Activity on Weight Loss: The Heart Health Study

Renee J. Rogers, Meghan R. McGuire, John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: John M. Jakicic, FACSM)
Email: r.j.rogers@pitt.edu

Reported Relationships: R.J. Rogers: Contracted Research - Including Principle Investigator; Weight Watchers International, Inc..

PURPOSE: This study examined whether adding physical activity recommended for public health (150 min/wk) or weight control (250 min/wk) to a diet enhanced weight loss or selective cardiometabolic risk factors in obesity across 12 months.

METHODS: Participants (N=383; Age=44.7±8.2 years, BMI=32.4±3.8 kg/m²) were randomized to a reduced calorie diet (DIET, N=127), diet plus a moderate dose of physical activity (MOD-EX, N=129), or diet plus a high dose of physical activity (HIGH-EX, N=127). All groups received weekly in-person intervention sessions for months 1-6, with combined in-person and telephonic sessions for months 7-12. Diet was prescribed at 1200-1800 kcal/day. MOD-EX was prescribed physical activity that progressed to 150 min/wk with HIGH-EX progressed to 250 min/wk. Physical activity, weight, waist circumference, and resting blood pressure were assessed at 0 and 12 months.

RESULTS: Retention at 12 months was 86.6% in DIET, 80.6% in MOD-EX, and 83.5% in HIGH-EX. Physical activity at 0 and 12 months was 65.4±73.8 and 88.2±104.3 min/wk in DIET; 68.7±93.8 and 179.1±125.3 min/wk in MOD-EX; and 71.5±84.4 and 228.8±148.3 min/wk in HIGH-EX (Group X Time p<0.001). Weight decreased at 12 months (DIET: -9.9±8.3 kg, MOD-EX: -10.8±8.2 kg, HIGH-EX: -9.5±7.3 kg) (p<0.001), with no difference between groups. There were also significant and similar changes across groups in waist circumference at 12 months (DIET: -8.8±8.1 cm, MOD-EX: -10.4±8.8 cm, HIGH-EX: -9.3±7.4 cm) (p<0.001). Resting systolic and diastolic blood pressure decreased significantly (p<0.001) by 4.3±10.1 mmHg and 2.6±6.6 mmHg, respectively; however, there was no difference between groups.

CONCLUSIONS: MOD-EX and HIGH-EX engaged in physical activity that was consistent with the prescribed doses of physical activity; however, this did not improve weight loss, waist circumference or resting blood pressure compared to DIET at 12 months. It is likely that compensation in energy balance occurred in response to physical activity that limited additional weight loss or changes in selective cardiometabolic risk factors. Additional research is warranted to understand the physiological and behavior compensation that may occur in response to these interventions in adults with obesity.

Supported by: NIH (R01 HL103646)

3054 June 2 4:30 PM - 4:45 PM

Metabolic Flexibility Among Women In Response To A Single High Fat Meal.

Alyssa Olenick, Regis Pearson, Nuha Shaker, Rachel Tinius, Maire Blankenship, Evie Oregon, Don Hoover, Jill Maples. *Western Kentucky University, Bowling Green, KY.* (Sponsor: Dr. James Green, FACSM)

(No relationships reported)

Metabolic flexibility is the ability to adjust substrate oxidation according to nutrient availability. For example, one that fails to increase fat metabolism in response to a high fat meal would be characterized as metabolically inflexible. This metabolic inflexibility may lead to weight gain and the development of metabolic disease. Previous studies have shown that obese women are metabolically inflexible in response to short-term high fat diets compared to lean women. However, the acute response to a single high fat meal has not been described. **PURPOSE:** To determine if obese women are metabolically inflexible in response to a single high-fat meal, compared to lean. **METHODS:** Baseline (T1), fasting glucose, resting energy expenditure (REE), lipid and carbohydrate oxidation (estimated using indirect calorimetry), were assessed for lean (n= 4; Age=26.5±4.43 yrs; BMI=23.6±1.7) and obese (n= 2; Age=35.5±2.1 yrs; BMI=34.7±7.6) Caucasian women. Participants then consumed a high fat shake (975 kcal, 62% fat). Additional REE, lipid and carbohydrate oxidation measurements were taken at 120 (T2) and 240 (T3) minutes post shake. **RESULTS:** There were no significant differences in age between groups. T1 REE was significantly higher (p<0.05) among obese (1930.2±179.3 kcal) women compared to lean (1607.7±120.0 kcal) women. There was a significant time effect on lipid and carbohydrate oxidation (p<0.05) and a significant BMI effect (p<0.05) on lipid oxidation. Lipid oxidation increased among both groups, but was significantly higher among obese (T1=0.12±0.01, T2=0.14±0.01, T3=0.13±0.01) women compared to lean (T1=0.08±0.01, T2=0.11±0.01, T3=0.10±0.01) at all three time points. Although not significant, there was a trend for the lean women to increase lipid oxidation to a greater extent from T1 to T2 (lean 38.3±13.8% increase vs. obese 16.7±0.0% increase; p=0.11). **CONCLUSIONS:** Current preliminary data suggest that lipid oxidation is higher among obese women compared to lean after consuming a single high fat meal. The obese women appear to respond similarly in terms of metabolic flexibility, compared to lean women. A single high fat meal may not be enough of a stimulus to elicit the metabolic inflexibility previously reported among obese women in response to a high fat diet. Supported for by WKU Graduate School Research Grant

F-37 Clinical Case Slide - Pulmonary

Friday, June 2, 2017, 3:15 PM - 5:15 PM

Room: 507

3055 **Chair:** Dennis Khalili-Borna, FACSM. *Kaiser Permanente, Fontana, CA.*

(No relationships reported)

3056 **Discussant:** Steven R. Boas, FACSM. *CARE Specialists, Inc., Glenview, IL.*

(No relationships reported)

3057 **Discussant:** Todd May. *Naval Hospital Camp Pendleton, Camp Pendleton, CA.*

(No relationships reported)

3058 June 2 3:15 PM - 3:35 PM

Episodes Of Near-syncope In A Runner

Darrika D. Van¹, Thomas G. Allison², Michael S. Emery³.
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(No relationships reported)

History: A 14-year-old female cross-country & track athlete presents with complaints of near syncope towards the end of exercise. Her symptoms do not occur during training only during competitive events in particular when attempting to catch an opponent near the end of a race. She is also a swimmer and has never experienced symptoms with competitive swimming. These episodes have been accompanied by lightheadedness and dizziness and she would "stumble" across the finish line. They have not resulted in bodily injury and she recovers quickly. She has no other past medical history or medications. The family history is noncontributory.

Physical Examination:

Height 5'3". Weight 98 pounds. BMI 17.4

Blood Pressure 101/56; heart rate 97 bpm

Well-developed young female who appears mildly anxious

Normal lung auscultation

Cardiovascular exam with regular rate and rhythm; no murmurs/gallops/rubs

Differential Diagnosis:

1. Primary cardiac arrhythmia
2. Cardiovascular structural abnormality
3. Vasovagal response
4. Postural orthostatic tachycardia syndrome
5. Anxiety

Tests and Results:

ECG: Normal ECG with sinus rhythm at 83bpm.

Echocardiogram: All chambers normal size and function with no valvular abnormalities.

Baseline Spirometry: Normal

Cardiopulmonary Stress Test with reproduction of symptoms on the treadmill:

Peak VO₂ 45.3 mL/Kg/min (100% predicted)

Peak O₂ pulse 9 mL/beat (97% predicted)

Max HR 212 bpm (103% predicted)

Stress ECG: sinus rhythm throughout without ischemic changes

Immediate recovery BP 124/60 (peak BP not obtained due to symptoms)

Peak respiratory rate 77 (53 at AT)

Tidal volume at peak 899 mL/breath (resting 612 mL/breath; AT 821 mL/breath)

Breathing reserve at peak 32%

VE/VCO₂ at AT 26

Vt/FVC at peak 29% (27% at AT)

Final Working Diagnosis: Dysfunctional breathing with patterned disorder breathing

Treatment/Outcomes:

1. Reassurance of no primary cardiovascular abnormality
2. Lifestyle modification including liberalizing salt and fluid intake
3. Encouragement to work on breathing mechanics with her coaches and/or referral to speech pathology

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Chronic Dyspnea - RunningJack Nickless, Anthony Romeo. *Midwest Orthopaedics at Rush, Chicago, IL.**(No relationships reported)*

HISTORY: 63 year-old male presented to clinic with complaint of continued severe shortness of breath status-post left total shoulder arthroplasty. Surgery was performed under general anesthesia with interscalene nerve block for regional anesthesia. Previously, patient had been running 3 miles per day and golfing regularly without issues. Immediately after the surgery, he began to notice a significant decrease in his functional status due to SOB. He now has difficulty walking up one flight of stairs, cutting the grass, or golfing more than 9 holes because of the SOB he experiences with activity. Denies fevers, chills, cough, hemoptysis, chest pain, palpitations, and calf pain. He is otherwise very happy with the improvements in pain, ROM, and overall functionality of his left shoulder s/p left TSA.

PHYSICAL EXAMINATION: VS: BP 132/76, P 66, Temp 36.7 C, Resp 18, SpO2 96%; Gen: Awake, alert, cooperative, NAD; Lungs: No increased work of breathing, good air exchange, CTAB, No rales or wheezing; CV: RRR, +S1S2, no S3 or S4, no murmurs noted; Neuro: AOX3, sensation to light touch intact throughout LUE, no focal deficits; Skin: Surgical incisions clean, dry, and intact

DIFFERENTIAL DIAGNOSIS: 1. Atelectasis 2. Pulmonary Embolism 3. Underlying pulmonary condition (COPD vs. pulmonary fibrosis vs. lung carcinoma) 4. Congestive heart failure 5. Diaphragmatic paralysis from phrenic nerve injury

TEST AND RESULTS: CTA Chest: significant pleural effusion, negative for PE; CXR: elevated left hemi-diaphragm

FINAL WORKING DIAGNOSIS: Left diaphragmatic paralysis secondary to phrenic nerve injury associated with interscalene block

TREATMENT AND OUTCOMES:

1. Patient initially on Aspirin and encouraged to ambulate for DVT prophylaxis 2. Provided with an incentive spirometer to prevent post-op atelectasis 3. Extensive outpatient Cardiology and Pulmonology evaluations without findings of underlying medical condition to explain symptoms 4. Suspected phrenic nerve injury associated with pre-operative interscalene block 5. Pulmonary rehabilitation performed with minimal improvement symptoms 6. We have discussed the possibility of further pulmonary rehabilitation vs. neurosurgical consultation for possibility of phrenic nerve decompression with possible nerve graft

3060 June 2 3:55 PM - 4:15 PM

Thirteen-year-old Female Football Player With Shortness Of BreathMark R. Johnson. *SIU SOM, Springfield, IL.**(No relationships reported)***HISTORY:**

Patient is a 13 yo otherwise healthy female who complains of Shortness of Breath (SOB) and chest discomfort. Patient is a football player (tackle) in a community football program. SOB is described as a chest tightness in the mid chest starting 10 minutes into running. She denies throat tightens and reports expiratory wheezing. She has an associated cough. Rest and relaxation relieve symptoms. Albuterol helps with symptoms. Patient has had trauma to her chest while playing football.

PMH: Had tonsillectomy adenoidectomy otherwise noncontributory

FMH/Social: No significant

PHYSICAL EXAMINATION:

Vitals Wt 89kg(99%), Ht 157cm(40%), BMI 36(99%)

117/73, 78, 16, 99%

General: Stocky well developed female with significant muscular development

HEENT: Unremarkable

Chest: Tender to palpation costosternal articulations, no bruising, no pectus

Lungs: Clear to auscultation, symmetric, no retractions

Heart: RRR no murmur, normal pulses, normal capillary refill

Abdomen: Soft NT ND no mass, no HSM

Neuro: Non-focal

DIFFERENTIAL DIAGNOSIS:

EIB, Extra-thoracic Airflow Obstruction, relative deconditioning, obesity-associated dyspnea, Pulmonary Hypertension, Chest Wall Injury, Costochondritis/Tietze

TEST AND RESULTS:

CXR/Bilateral Ribs: Unremarkable

RAST Environmental Panel: No significant reactions

CPET: VO2 3492(135%), VO2/kg 39.7, VeVO2 22AT 32Max, ETCO2 40/36, Flow Limitation at significant levels starting halfway through testing and approached nearly all the expiratory phase. In last 30 seconds developed stridor, strap muscle use that responded to coaching for on abdominal breathing and concentration on exhalation.

FINAL WORKING DIAGNOSIS:

Physiologic flow limitation resulting in extra-thoracic airflow obstruction

TREATMENT AND OUTCOMES:

1. Weight reduction with goal of BMI 30-32 (approximately 10-15kg)
2. If symptoms persist after weight reduction will consider speech therapy referral
3. Full activity as tolerated without limitation

3061 June 2 4:15 PM - 4:35 PM

Right Upper Quadrant Pain In a Soccer PlayerJason T. Losee. *Evergreen Sports Medicine Fellowship, Augusta, ME.* (Sponsor: James Dunlap M.D., FACSM)

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(No relationships reported)

Abdominal injuries are rare in sports. However, unrecognized, they can be serious and even life threatening. A 16-year-old F. soccer player presented with worsening RUQ abdominal pain after being struck in the abdomen by a soccer ball. Two days prior she had been kicked by a goalie in the abdomen, although she did not experience much pain with that incident. In the ED the patient denied chest pain or pressure, cough, congestion, shortness of breath, vomiting, diarrhea, constipation, black or bloody stools. PMH: allergic rhinitis. PSH: none. Allergies: NKDA. Meds: Flonase. **PHYSICAL EXAMINATION:** Temp 98.4 deg, HR 85, BP 116/60, SaO₂ 100% on room air. Well-developed and well-nourished. Alert and oriented to person, place and time. Head normocephalic and atraumatic. Pupils equal, round, reactive to light and accommodation. Sclera anicteric. No conjunctiva injection. Extraocular movements intact. Trachea midline. Lungs clear to auscultation with normal breath sounds bilaterally. Abdomen soft with tenderness in the RUQ and voluntary guarding. No rigidity, rebound, abrasions, Grey-Turner sign, or Cullen's sign. No masses or hepatosplenomegaly. No CVA tenderness. No focal or neurological deficits.

DIFFERENTIAL DIAGNOSIS:

1. Rib contusion/fracture
2. Liver contusion/laceration
3. Bowel perforation
4. Traumatic pancreatitis
5. Pancreatic laceration/pseudocyst
6. Retroperitoneal hematoma
7. Rectus sheath hematoma
8. Pulmonary contusion
9. Splenic contusion/laceration.
10. Kidney hematoma/laceration

TESTS AND RESULTS:

WBC count of 14.6, Hgb and hematocrit of 13.7 and 41. Urine preg. negative, BUN and Cr 21 and 1.03, alk phos 109, ALT 304, AST 346, Total Bilirubin 0.6, Lipase 76, CRP <0.29, lactic acid 0.9, monospot neg, UA positive for trace ketones.

CT abdomen and pelvis with contrast:

- Three hepatic contusions without laceration or hemoperitoneum

FINAL/WORKING DIAGNOSIS:

Liver contusions

TREATMENT AND OUTCOMES:

1. Liver enzymes and WBCs trended to normal.
2. Cleared for light stationary biking at one month.
3. Patient has not been cleared for full sport participation. She will avoid contact sports participation for three months from the time of injury. May consider a repeat CT scan at that time to verify resolution of the contusions.

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Splenic Injury - FootballJennifer Kim. *Kaiser Fontana, Fontana, CA.* (Sponsor: Robert Sallis, FACSM)

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(No relationships reported)

HISTORY: A 21-year-old football wide receiver sustained a hit to his left ribs by an opposing player's helmet during the last quarter of a mid-season game. After being tackled, the athlete was able to get up and walk off the field.

EXAMINATION: Athlete was assessed on the sidelines shortly after injury and found to have localized tenderness along the lower left ribs. He reported mild nausea but no dizziness or shortness of breath. Pain was made worse by twisting movements of the torso and deep inspiration. He was given a bag of ice to place on his ribs. At the end of the game his exam and symptoms had not changed. A few hours later he noticed the pain was worse with supine position. Pain did not improve with Tylenol. Late in the evening, the intensity of pain did not subside and began to radiate to his left shoulder.

DIFFERENTIAL DIAGNOSIS:

1. Rib contusion
2. Lower rib fracture(s)
3. Splenic injury

TEST AND RESULTS:

On the advice of his trainer, the athlete went to ED that night. X-rays of the ribs were negative for fracture. No further studies were done. He was diagnosed with rib contusion and discharged home with pain medication. The following morning, his pain had worsened and he developed emesis with attempts to eat. Again on the advice of his trainer he returned to Urgent Care. The examining physician noted abdominal bloating and left upper quadrant tenderness. He was then sent to the ED where a CBC drawn was notable for anemia. Ultrasound and CT abdomen confirmed diagnosis of splenic laceration.

FINAL/WORKING DIAGNOSIS:

Splenic laceration, grade IV

TREATMENT AND OUTCOMES:

1. After reviewing the CT scan, it was determined that immediate surgical intervention was not needed
2. Athlete was admitted to ICU where serial Hb/Hct was monitored for the next 48 hours. Hct stabilized and athlete remained hemodynamically stable
3. Athlete was discharged from hospital with restrictions on return to play until 3 months post injury. He is feeling well but unable to return to football before the end of this season.

3063 June 2 4:55 PM - 5:15 PM

Blunt Abdominal Trauma at Pre-season Scrimmage

Brian J. Schutzbach¹, Mark Lavallee, FACSM². ¹Greenville Health System, Greenville, SC. ²Wellspan Health, York, PA. (Sponsor: Mark Lavallee M.D., FACSM)
Email: brian.j.schutzbach@gmail.com

(No relationships reported)

History: 17 year old male wide receiver came to the sideline with severe 7/10 sharp, stabbing, mid abdominal pain at a high school scrimmage after he had caught a pass and was tackled. He was unaware if a body part or a helmet struck him in the abdomen. Another teammate came over and said he was sandwiched by two players. He denied any radiation of his pain. He noted associated difficulty breathing and numbness in his fingers bilaterally. He also pitches for baseball team with aspirations of playing college baseball. **Physical Examination:** Sideline examination of abdomen showed a soft, non-distended, thin abdomen with normal bowel sounds and maximal tenderness in the left upper quadrant. He also displayed guarding. Patient was mentating well but was tachypneic with normal lung sounds. His skin was cool in the distal extremities. After 5 mins of rehydration and monitoring, he was evaluated again with similar findings of 7/10 abdominal pain. The abdominal exam was repeated and no significant improvements were noted. The decision was made him to transfer him to the local emergency department by EMS for imaging of his abdomen and closer monitoring. **Differential Diagnosis:** 1. Diaphragmatic Spasm 2. Rectus Sheath Hematoma 3. Splenic Laceration 4. Rib Fracture 5. Kidney Laceration 6. Liver Contusion 7. Anxiety with Tachypnea causing Hypocarbica **Tests and Results:** CT Abdomen and Pelvis with IV Contrast shows an extensive irregular mid splenic fracture at the level of the hilum measuring from 3.5 to 5.5 cm. There is hypodense intraperitoneal fluid extending across the upper abdomen and down both flanks into the cul-de-sac. Left renal upper pole laceration with contained intracapsular hematoma. **Final/Working Diagnosis:** Grade IV Splenic Laceration **Treatment and Outcomes:** 1. Transferred to Level 1 trauma center for embolization of splenic artery 2. Monitored vitals, hemoglobins and pain control s/p embolization 3. Surgical team performed splenectomy due to persistent sever pain and presence of hemoperitonenum despite stable hemoglobins. 4. Discharged home without complications and did not return to play football again. 5. Patient was able to return to throwing activities for baseball at 8 weeks after initial injury.

F-38 Clinical Case Slide - Shoulder II

Friday, June 2, 2017, 3:15 PM - 5:15 PM
Room: 401

3064 **Chair:** Jason L. Zaremski, FACSM. *University of Florida, Gainesville, FL.*
(No relationships reported)

3065 **Discussant:** Ramsey Shehab. *Henry Ford, Detroit, MI.*
(No relationships reported)

3066 **Discussant:** Shawn F. Kane, FACSM. *U.S. Army, Carthage, NC.*
(No relationships reported)

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Weakness In Shoulder After A Football Collision

Timothy Gill, Kevin Duprey. *Crozer-Keystone Health System, Springfield, PA.* (Sponsor: Thomas Kaminski, FACSM)
(No relationships reported)

HISTORY: 16 year old male football player presented to the office with left shoulder weakness 5 days after he was clipped and landed on his left shoulder. At time of injury, he experienced a dull 6/10 ache in the lateral shoulder, but was able to continue playing for the last few minutes of the game. The following morning, he developed difficulty moving his arm, including reaching across his body and tying his shoes. His shoulder pain was gradually improved at the time of the visit, but weakness persisted.

PHYSICAL EXAMINATION: He has full painless active cervical ROM, Spurling's Negative. Left shoulder exam reveals a diminished painless ROM with forward flexion to 20 degrees and abduction to 20 degrees. He has external rotation to 70 degrees and internal rotation to T10 bilaterally. He has 4/5 strength with internal rotation, 5/5 with external rotation, 3/5 with abduction and forward flexion. He has mild tenderness to palpation over the anterior shoulder. He has no tenderness over the SC, AC, or the supraspinatus. He has a negative scarf test and resisted adduction. He has a drop arm with lowering from abduction.

DIFFERENTIAL DIAGNOSIS: Supraspinatus tear; Labral Tear; Axillary nerve palsy, shoulder dislocation, Cervical radiculopathy, Cervical disc herniation, Humerus fracture.

TEST AND RESULTS: X-ray of the shoulder revealed no evidence of fracture, dislocation or other abnormality. MRI of the shoulder revealed marrow contusion of the greater tuberosity, mild subchondral subdeltoid bursitis and no rotator cuff or labral tear appreciated.

FINAL WORKING DIAGNOSIS: Transient axillary nerve palsy with osseous contusion of humerus.

TREATMENT AND OUTCOMES: Over the following two weeks, he regained full strength and motion. Axillary nerve palsy, commonly associated with shoulder dislocations, is rare following a simple fall to the ground.

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A New Frontier for the Medial Clavicle

Sam Hwu¹, Garry W.K. Ho, FACSM¹, Keith W. Lawhorn². ¹*Sports Medicine Fellowship Program, Virginia Commonwealth University - Fairfax Family Practice, Fairfax, VA.* ²*OrthoVirginia, Fairfax, VA.*
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(No relationships reported)

History: A 63 year-old male presented with a 2-week history of left upper extremity pain after being hit by a car on his left side while riding his bicycle. He sustained fractured ribs, an extraarticular fracture-dislocation of the left medial clavicle, a minimally displaced oblique fractured left scapular body, and a displaced, comminuted fractured left distal radius for which he underwent ORIF. While hospitalized, he was informed there were no surgical options to treat his left clavicle fracture-dislocation. **Physical Examination:** Examination revealed a male with his left arm in a sling. He had a prominent anterior sternoclavicular joint and deformity of his medial clavicle. His range of motion was limited due to pain and guarding. He had 2+ radial pulses, intact sensation to light touch, and no obvious motor dysfunction of his upper extremities.

Differential Diagnosis: 1. Anterior sternoclavicular joint dislocation 2. Medial clavicular fracture-dislocation

Tests and Results: Left shoulder CT scan: 1. Comminuted, anteriorly angulated fracture of the medial aspect of the left clavicle with severe shortening and subluxation of sternoclavicular joint. 2. Minimally displaced oblique fracture through scapular body. Multiple anterior and posterior ribs. No pneumothorax.

Final Diagnosis: 1. Medial clavicular fracture with significant shortening and fracture-dislocation of sternoclavicular joint. 2. Minimally displaced scapular body fracture. 3. Anterior and posterior rib fractures.

Treatment and Outcomes: He underwent an ORIF of his medial clavicle fracture-dislocation using a 7-hole 15-mm hook plate. The plate was placed under the inferior border of the medial head of the clavicle and superior to the first rib to push the lateral clavicle fragment posteriorly to reduce the fracture. Screws were placed in the hook plate to stabilize the fracture and maintain the clavicle out to length as much as possible. The arm was ranged with mild motion of the hook plate under the sternum and the fracture stable. His scapular and rib fractures were treated nonoperatively. A hook plate is designed for fixation of a lateral clavicle fracture, but its use in medial clavicle fractures has not been well established. We offer this case as an example of a successful outcome using this novel operative approach.

3069 June 2 3:55 PM - 4:15 PM

Shoulder Injury - Ground Level Fall

Kevin M. Mullins, Brian A. Davis, FACSM. *University of California, Davis, Sacramento, CA.*
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*(No relationships reported)***HISTORY:**

A 60-year-old woman sustained a right shoulder injury after falling from a chair onto an outstretched arm 2 years ago. She immediately had severe right lateral shoulder pain, worse with abduction. Outside facility workup included normal x-rays, C Spine MRI with a small annular posterior disc bulge at C6-7, Shoulder MRI with mild increased T2 signals at insertional sites of supraspinatus and long head biceps tendons. NCS of median/ulnar nerves were normal and needle EMG of deltoid, infraspinatus, serratus anterior and rhomboid major also normal. She was treated with a subacromial corticosteroid injection and therapy with minimal improvement, and is now presenting with unresolved chronic symptoms impacting her ADLs.

PHYSICAL EXAMINATION:

On inspection decreased muscle bulk in right trapezius on shoulder shrug and scapular retraction. No tenderness to palpation. Passive range of motion full in all planes, and notable for right scapular hike with abduction greater than 60 degrees and loss of adduction control of scapula, as it rides into anterior/superior supraclavicular region. Active shoulder abduction limited to 54 degrees when standing due to weakness, but able to obtain full 170 degrees when supine. Strength of right trapezius is 4/5, remaining muscles 5/5 with scapula stabilized. Sensation intact to light touch and shoulder impingement maneuvers are negative.

TEST AND RESULTS:

Our repeat NCS done personally was significant for an abnormal right spinal accessory nerve CMAP to the trapezius with significantly decreased amplitude and onset latency comparable to the left side. Needle EMG was evident for normal right deltoid, infraspinatus, serratus anterior, rhomboid major but markedly abnormal right upper and middle trapezius findings with increased insertional activity, fibrillation potentials, positive sharp waves, polyphasic MUAPs and reduced recruitment.

FINAL WORKING DIAGNOSIS:

Right incomplete spinal accessory neuropathy - mostly affecting upper fibers.

TREATMENT AND OUTCOMES:

1. Collaboration with sports medicine orthotist for molding of a customized scapular stabilizer/restraining brace.
2. Physical Therapy Rx for shoulder girdle complex strengthening and range of motion exercises.
3. Patient with significant improvement in pain, range of motion, and general function with brace.

3070 June 2 4:15 PM - 4:35 PM

Shoulder Pain in a Professional Contemporary Ballet Dancer

Brennan Boettcher, Jonathan Finnoff, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Jonathan Finnoff, FACSM)
Email: boettcher.brennan@mayo.edu

*(No relationships reported)***History:**

A 22 year-old male professional ballet dancer presented with a 1 year history of non-radiating, posterior right shoulder pain. The pain severity was between a 0-8/10, and was aggravated when lifting other dancers. He denied any instability, clicking or catching, weakness, or numbness or tingling.

One year ago, while dancing, he fell on his right shoulder/neck. By report, a c-spine MRI revealed a cervical disc herniation (unknown level). He was treated successfully with physical therapy, but his pain gradually recurred.

Physical Examination:

Fit appearing 22 year-old male in no distress.

At rest, the right shoulder was elevated and protracted. There was subtle scapular dyskinesia with a delay in right scapular movement and prominent right medial scapular border.

He was tender over the supraspinatus and infraspinatus muscles.

Cervical and shoulder motion were full and symmetric.

Special tests revealed a (-) Spurling's, and mild peri-scapular pain with position one of O'Brien's, empty can and Hawkin's impingement tests.

Neurovascular exam was normal.

Differential Diagnosis:

Rotator cuff tendinopathy/tear

Labral tear

Scapular dyskinesia

Peri-scapular myofascial pain

Subacromial bursitis

Cervical radiculopathy

Glenohumeral instability

Tests and results:

Complete diagnostic shoulder ultrasound revealed supraspinatus, infraspinatus, and teres minor hyperechogenicity and loss of the normal muscular architecture with atrophy,

consistent with fibrofatty infiltration from his prior C5 or C6 radiculopathy.

Subacromial bursa was hypertrophic, consistent with subacromial bursopathy.

Final/Working diagnosis:

Scapular dyskinesia, likely secondary to right C5 or C6 chronic radiculopathy with denervation changes to the supraspinatus, infraspinatus, and teres minor.

Subacromial bursopathy

Treatment and Outcome:

The patient was given a rehabilitation program for scapular stabilizers, rotator cuff, postural positioning, stretching anterior shoulders, and trial of Kinesio tape.

The patient returned to ballet, was advised to use caution with lifts.

He was given the option of returning in 4-8 weeks for an ultrasound guided subacromial corticosteroid injection if there was no improvement with rehabilitation.

3071 June 2 4:35 PM - 4:55 PM

Return to Kipping After Shoulder Injury: Introducing a Novel Unloading Rehabilitation Technique

Kevin Messey¹, Sarah Mahasin², David Bazzo¹, Kenneth Vitale¹.

¹University of California San Diego, San Diego, CA. ²King Saud University, Riyadh, Saudi Arabia.

(No relationships reported)

HISTORY: 42-yo F CrossFitter with insidious L shoulder pain x 3 mth, worse on ER localizing to posterior shoulder. Notably worse on kipping, at bottom & top of kip. Mild pain after workout, night pain if sleeps on left. No h/o dislocation. No paresthesias or weakness. No recent trauma but frequently loads shoulder with ballistic exercises & Olympic lifts. Trains for CrossFit 1.5hr x 6 d/wk. Tried PT 6 visits, still could not kip, snatch, pull-up. Currently training for competition in 1 month.

PHYSICAL EXAM:

Forward head posture, L trunk rotation, L shoulder elevation, L scapula anterior tilt. Tender periscapular muscles & bicipital groove. ROM Ext: 0, Flex: 180, ER @ 90: 90, IR @ 90: 60; increased pain with ABD + ER. Rotator cuff strength intact. No instability. Positive Speed's, Hawkins. Positive Crank, O'Brien's. AC joint testing negative. Cervical spine exam normal other than C7 abrasion from barbell loading.

Normal neurovascular exam. **DIFFERENTIAL DIAGNOSIS:** 1. Rotator cuff tear 2. Labral tear 3. Bicipital tenosynovitis 4. Post-traumatic loose body, osteoarthritis 5. Adhesive capsulitis

TEST & RESULTS: X-ray: mineralization at medial surgical neck, possible IGHL injury. MR arthrogram: anterosuperior labral tear from 12 to 3 o'clock; extensive chondral delamination anterior glenoid, focal high-grade chondral loss central glenoid; intra-articular bodies in posterior recess; supraspinatus/infraspinatus tendinosis. **FINAL/WORKING DIAGNOSIS:** 1. Type 1 SLAP tear 2. Supraspinatus/infraspinatus tendinosis 3. Glenoid osteoarthritis 4. Intra-articular bodies 5. Radiological evidence of remote IGHL avulsion

TREATMENT & OUTCOMES: 1. Rest, activity modification, naproxen prn. 2. PT, ART, cupping; still unable to kip or snatch. 3. Athletic Training Services for biomechanical analysis, rehabilitation & injury prevention strategies. Treatments included PNF throwers program, pec minor release, swing stretch, plank T rotation, plank board slide. 4. Re-introduction of kips utilizing Keiser device and harness unloading at 114lbs resulted in pain-free kipping with preserved technique. Progressions included further unloading at reduced assistances of 110, 100, 90, 80, 70, 50 lbs in a 6x6 set. At ≤70 lbs. could reproduce typical rhythm of kipping. 5. Returned to sport at 1 mth and able to compete in CrossFit competition.

3072 June 2 4:55 PM - 5:15 PM

An Atypical Cause of Shoulder Pain in a Male Ballet Dancer

Mark Bender, David Leffers, Sean Spence. *University of South Florida, Tampa, FL.*

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(No relationships reported)

HISTORY: A 17 year old male, with a history of Type 1 Diabetes presented to our clinic with a complaint of left shoulder pain after an injury that he sustained while participating in ballet practice. He reports that his partner lost her balance during a lift which caused him to overcompensate and shift positions quickly. During this maneuver he felt a sudden, sharp pain in his left shoulder and discontinued practicing. Following this incident he was unable to elevate his arm although he did not complain of any numbness or paresthesia's.

PHYSICAL EXAMINATION: Upon exam, there was no evidence of swelling or ecchymosis around the neck/anterior deltoid and he was neurovascularly intact. He had increased pain with deep inspiration but no shortness of breath or additional respiratory abnormalities. Forward flexion and abduction of the arm were limited to approximately 45° due to pain. Passive range of motion was diminished to 90° with inability to reach end range due to pain. There was no pain to palpation along the clavicle or AC joint; however palpation of the first rib at the base of the neck elicited significant pain.

DIFFERENTIAL DIAGNOSIS:

First rib stress fracture
Rotator cuff tear
Cervical sprain

TEST AND RESULTS: A left sided rib series was performed which demonstrated an incomplete fracture of the first rib. No significant displacement was seen although slight elevation of the distal clavicle was noted which appeared to be chronic.

FINAL WORKING DIAGNOSIS: Stress fracture of the first rib

TREATMENT AND OUTCOMES:

Refrain from participating in ballet practice for 4-6 weeks with gradual return to dance
Arm immobilization with a sling
Vitamin D/Calcium supplementation
Repeat isolated rib radiographs at 2 and 6 weeks
Patient was re-evaluated at 2 and 6 weeks post-injury. At 2 weeks the patient was instructed to participate in graded physical therapy but due to insurance issues he was unable to start until 6 weeks post-injury.
At 6 weeks, he displayed full shoulder elevation and abduction and there was no significant pain to palpation over the first rib. He endorsed some mild discomfort over the trapezius and scalene muscles and his shoulder strength was graded 4/5.
Repeat plain films demonstrated proper rib alignment and some early bridging callus formation. He was instructed to follow-up in 1 month and to begin physical therapy

F-51 Basic Science World Congress/Poster - Stress and Behavior

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3096 Board #1 June 2 2:00 PM - 3:30 PM

Anxiety Level Moderates the Acute Impact of Light and Moderate Intensity Aerobic Exercise on Working Memory

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(No relationships reported)

PURPOSE: Accruing evidence suggests that there is an improvement in working memory immediately after a single bout of moderate-intensity aerobic exercise with smaller and more variable effect sizes in healthy young adults than in other groups (Ludyga et al., 2016). Individual differences in the impact of exercise on cognition mediated by a variety of different factors may account for some of this variability. The aim of the current study was to determine whether the impact of both light- and moderate-intensity aerobic exercise on verbal and nonverbal working memory differs in individuals who report higher versus lower levels of trait anxiety.

METHODS: 125 young adults were administered Operation Span (O-SPAN) and Symmetry Span (S-SPAN) tasks twice; once after spending approximately 40 minutes completing questionnaires including the State-Trait Anxiety Inventory (STAI-T); and once after 40 minutes of either moderate-intensity (>60% of age-predicted maximum HR) or light-intensity (<55% of age-predicted maximum HR) aerobic exercise. Session order was counterbalanced across participants and participants were randomly assigned to exercise intensity. A median split on the STAI-T was used to separate participants into lower and higher anxiety groups. The impact of exercise and anxiety on WM was examined in 2 (Intensity) x 2 (Anxiety Level) x 2 (Session) mixed-factorial analyses of variance.

RESULTS: For S-SPAN performance, there was a significant Anxiety x Session interaction ($F = 4.04$; $p = .047$; partial eta-squared = .032) indicating that those reporting higher levels of trait anxiety may benefit slightly more from exercise than those with lower levels of anxiety. For O-SPAN performance, there was a significant 3-way Intensity x Anxiety Level x Session interaction ($F = 6.27$; $p = .014$; partial eta-squared = .05) revealing differing patterns of moderate- and low-intensity exercise for the higher and lower anxiety groups. There were no other significant effects.

CONCLUSIONS: The data suggest that light- and moderate-intensity aerobic exercise may exert different impacts on working memory in individuals reporting lower versus higher levels of trait anxiety; however, effect sizes are small.

3097 Board #2 June 2 2:00 PM - 3:30 PM

Physical Fitness, Physiological and Sleep Responses to Stress in Women

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(No relationships reported)

PURPOSE: Stress-related psychiatric disorders (such as depression) are twice as common in women as in men and have been linked to aberrations in physiological and psychological stress responding. Being physically fit may be protective against the development of adverse symptoms related to stress, however, to date, there has been limited investigation of the relationship between physical fitness and behavioral and physiological responses to stress which considers the profound influence of the ovarian cycle on physiological and behavioral stress responding. This study aims to investigate the relationship between physical fitness and physiological and behavioral (sleep disturbances) responses to stress in women during the follicular phase of the menstrual cycle (when ovarian hormones are low and stable). **METHODS:** Following a two-tiered screening process, 10 healthy women (18-45y) who were medication-free and had regular menstrual cycles were enrolled. Participants completed: (1) enrollment visit, (including mood and sleep assessment and assessment of cardiorespiratory fitness via maximal oxygen consumption during exercise); (2) one-week sleep monitoring period (objective and subjective measures of sleep-wake behavior); and (3) psychosocial stressor protocol for the collection of hemodynamic [blood pressure (SBP, DBP) and heart rate (HR)] and hormonal stress responses. Psychosocial stress testing sessions occurred during the follicular phase of the menstrual cycle to control for hormone fluctuations which can influence the physiological response to stress.

RESULTS: Though not significant at this time, preliminary results from this ongoing study show that higher levels of physical fitness may be associated with lower sleep reactivity to stress ($r = -.43$, $p = 0.17$) and reduced wake after sleep onset (WASO; $r = -.58$, $p = .07$). Consequently, increased WASO was significantly associated with increased SBP and DBP reactivity to an acute psychosocial stressor (r 's = .78, .65; p 's = .01, .05 respectively). **CONCLUSIONS:** If confirmed in our larger sample results suggest that, in women, physical fitness may be protective against the physiological response to stress, perhaps via reduction in stress-related sleep disturbances.

3098 Board #3 June 2 2:00 PM - 3:30 PM

Physical Fitness, Hemodynamic and Affective Responses to Psychosocial Stress in Women

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(No relationships reported)

PURPOSE: Studies suggest that adaptations resulting from regular physical exercise training might positively impact physiological adaptations to psychological stressors. A reduced physiologic sensitivity to psychosocial stressors may be one mechanism by which physical fitness may serve to buffer the deleterious effects of chronic stress. However, to date, there has been limited study of the relationship between physical fitness and physiological and affective stress responding in women which considers the profound influence of the ovarian cycle on physiological and affective responses to stress. This study aims to investigate the relationship between physical fitness and physiological and affective responses to stress in women, while considering ovarian cycle phase effects on the stress response. **METHODS:** Following a two-tiered screening process, 10 healthy women (18-45y) who were medication-free and had regular menstrual cycles were enrolled. Participants completed an enrollment visit, (including perceived stress assessment and assessment of cardiorespiratory fitness via maximal oxygen consumption during exercise); and a psychosocial stressor protocol for the collection of hemodynamic [blood pressure (SBP, DBP) and heart rate (HR)], affective, and hormonal stress responses. Psychosocial stress testing sessions occurred during the follicular phase of the menstrual cycle to control for hormone fluctuations which can influence the physiological response to stress. **RESULTS:** Preliminary results from this ongoing study show a trend for higher levels of physical fitness to be associated with lower SBP ($r = -.58$, $p = 0.08$) and DBP ($r = -.56$, $p = 0.09$) reactivity to stress. Interestingly, higher physical fitness was significantly associated with a more negative affective response to the psychosocial stressor tasks (speech: $r = .70$, $p = .02$, math: $r = .71$, $p = .02$). **CONCLUSIONS:** If confirmed in our larger sample, results suggest a possible dissociation of the physiological and psychological stress responses associated with physical fitness in women during the follicular phase of the menstrual cycle.

3099 Board #4 June 2 2:00 PM - 3:30 PM
Factors Underlying The Contribution Of Psychological Stress To The Induction of Exercise-Related Menstrual Disturbances

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PURPOSE: Our previous findings have shown a significant relationship between the severity of exercise-related menstrual disturbance and an increase in perceived stress. In this analysis, we examined underlying factors that contribute to changes in psychological stress with the induction of exercise-related menstrual disturbances in a 3-month exercise and caloric restriction intervention in sedentary, regularly menstruating women (n=36). **METHODS:** Women (age 18-24 yrs, BMI 18-28 kg/m²) were randomized to either an exercise only group or one of four groups designed to induce an energy deficit through varying combinations of caloric restriction and exercise over 3 menstrual cycles preceded by a Baseline cycle. The intervention included exercise (5 d/wk, 50-85% VO₂max, 20-75 min) and controlled diet. Menstrual function and reproductive hormones were characterized using daily urinary estrone-1-glucuronide (E1G), pregnanediol glucuronide (PdG), luteinizing hormone, and menstrual calendars. Depressive symptoms were assessed with the Beck Depression Inventory (BDI). Presence of eating disorders was assessed using the Eating Disorder Inventory (EDI). Psychological stress was determined with the Perceived Stress Scale. Other factors investigated were anthropometrics, fitness, age, and reproductive factors. **RESULTS:** The intervention caused moderate weight loss (-2.59 ± 0.35 kg), increases in fitness, declines in body fat and declines in E1G and PdG (p < 0.006). Perceived stress increased significantly across the intervention (p < 0.001). Changes in perceived stress were associated with baseline luteal phase PdG AUC (r = 0.387, p = 0.024), change in body weight (p = 0.017, R = 0.401), change in fat free mass (p = .020, r = .391), and the change in BMI (r = 0.419, p = 0.012) such that higher baseline PdG concentrations and greater reductions in BMI and body weight were associated with lower increases in perceived stress. Baseline scores of BDI and EDI were not significantly related. Age, fitness, body composition, luteal phase length, and follicular phase E1G were also not significantly predictive of PSS. **CONCLUSION:** Stress sensitivity as defined by changes in perceived stress and related menstrual disorders may depend on baseline ovarian status and changes intervention induced changes in anthropometrics.

3100 Board #5 June 2 2:00 PM - 3:30 PM
The Effects of an Acute Bout of Yoga on Anxiety Symptoms in Response to a Carbon Dioxide Inhalation Task in Women

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Purpose: Yoga as a physical exercise might be a feasible approach for anxiolysis, yet this has not been systematically investigated in well-designed studies that include an anxiety producing challenge. Such research is particularly salient for women, who are significantly more affected by clinical and subclinical anxiety symptoms than men. This study compared the effect of a single bout of vinyasa-style yoga versus a stretching control condition for improving anxiety symptoms induced by a 5-min, 7.5% CO₂-inhalation protocol in women with self-reported high anxiety sensitivity.

Methods: Eighteen women (mean age=22, SD=5) with self-reported elevated anxiety sensitivity completed 2 experimental conditions (40 min of guided yoga or a light stretching protocol) in a randomized, counterbalanced order. Participants completed the CO₂-inhalation task before, immediately after and 1 hour after the experimental conditions and completed measures of state anxiety and panic before and after each inhalation task. Respiratory measures of tidal volume, ventilation and respiratory rate were collected during each of the inhalation tasks.

Results: Based on the results of the repeated measures ANOVA, there was no evidence for a differential pattern of change in self-reported anxiety or respiratory outcomes in response to the CO₂-inhalation task between the 2 conditions (F(2,16)=1.06; $\eta_p^2=.07$; P>.05). There was a significant main effect of CO₂-inhalation task (i.e., from pre- to post-inhalation) on the self-reported panic and anxiety symptoms in both conditions (P<.05). Collapsed over exposure and condition, there was a reduction in cognitive anxiety over time (i.e., from baseline to immediately post and 1-hour post-condition) (F(2,16)=9.63; $\eta_p^2=.36$; P<.05).

Conclusion: There appears to be an overall effect of general physical activity for attenuating cognitions of anxiety, irrespective of the physiological responses. Light-to-moderate intensity vinyasa-style yoga does not appear to be more efficacious than

a light stretching session for improving symptoms of anxiety and panic in response to the anxiety-provoking stimulus. The inhalation task administered in the present study is a reliable method for mimicking both acute panic and more generalized anxiety symptoms under laboratory conditions.

3101 Board #6 June 2 2:00 PM - 3:30 PM
Relationship Between Food Addictive Behavior and Physical Activity in College-aged Students

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Acute exercise has been associated with reduced cravings for addictive substances. Excessive exercise has been associated with maladaptive eating behavior. It is unclear if a relationship exists between physical activity and food addictive behavior. **PURPOSE:** The purpose of this investigation is to determine if food addictive behavior is influenced by physical activity in college-aged students. **METHODS:** 241 college-aged students (18-24 years of age; 55 male, 186 female) were recruited from University and Community College settings and asked to complete the Yale Food Addiction (YFA) Scale 2.0 and the International Physical Activity Questionnaire (Last 7-Days) (IPAQ) using an on-line platform. The YFA identifies up to 11 diagnostic indicators of food addiction and provides diagnoses of mild, moderate, or severe food addiction. **RESULTS:** 19 of 241 (7.9%) of participants were diagnosed with moderate (2.5%) or severe (5.4%) food addiction (FADD). Participants displayed 1.62±0.15 symptoms of food addictive behavior with 31.5% having 1-3 symptoms, 7.5% having 4-5 symptoms, and 10.4% having 6 or more symptoms. BMI was higher in participants with food addiction (Non-FADD=24.1±0.3 FADD=26.9±1.9, p=0.02); however, no differences were found in vigorous (Non-ADD=1851±251 MET-min/week, FADD=1920±799 MET-min/week), moderate (Non-ADD=777±107 MET-min/week, FADD=869±409 MET-min/week), or walking (Non-ADD=1262±139 MET-min/week, FADD=2051±583 MET-min/week) activity. The distribution of participants with Low (Non-FADD=13.5%, FADD=10.5%), Moderate (Non-FADD=42.1%, FADD=42.1%), and High (Non-FADD=44.4%, FADD=47.4%) levels of physical activity was similar between the groups. Interestingly, participants with High (2.10±0.27 symptoms) levels of physical activity displayed more symptoms of food addictive behavior than participants with Moderate (1.41±0.15 symptoms) and Low (1.06±0.27 symptoms) levels of physical activity (p=0.03). Participants with High (14.1%) levels of physical activity were also more likely to display 6 or more symptoms of food addictive behavior than participants with Moderate (4.9%) and Low (3.2%) levels of physical activity. **CONCLUSIONS:** The results of this investigation suggest that High levels of physical activity may be associated with more symptoms of food addiction.

3102 Board #7 June 2 2:00 PM - 3:30 PM
Neural Response to Food Cues After Moderate and Vigorous Exercise in Women: A Randomized Crossover Trial

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PURPOSE: This study examined the effect of different intensities of acute exercise on attention allocation to visual food cues.

METHODS: This crossover study utilized treatment conditions that were randomized and counter-balanced. Fifty-two adult women, 18-29 years, were compared under three separate conditions: no exercise, 45 min of moderate-intensity exercise at 3.9 METs and 22.5 min of vigorous-intensity exercise at 7.8 METs. To measure attention allocation to visual food cues, participants were shown a passive viewing task consisting of a continual stream of pictures of food (high and low calorie) and non-food stimuli while brain activity was monitored using an EEG. The late positive potential (LPP) component of the scalp-recorded event-related potential (ERP) was used for data analysis.

RESULTS: The 52 women included in the study were on average 21.4 ± 2.2 years old, weighed 62.4 ± 11.2 kg, and had a BMI of 22.7 ± 3.4 kg m⁻². EEG results were analyzed from 39 of the 52 women. There was no significant difference between picture type (high-energy dense, low-energy dense and neutral) and LPP response. There was a significant difference in condition (P = 0.045), with vigorous exercise resulting in a higher (1.94 ± 2.93 μ V) LPP response than either the moderate (1.45 ± 1.95 μ V) or non-exercise (1.40 ± 1.65 μ V) condition. However, the condition (no exercise, moderate exercise or vigorous exercise) by picture type (high calorie, low calorie or non-food) interaction was not significant (P = 0.184).

CONCLUSIONS: The results of this study shows that an acute bout of vigorous exercise did not alter neural response to visual food cues compared to neutral pictures.

There was a global response to all pictures, with the vigorous condition demonstrating a more pronounced LPP response. However, what this response means for appetite is not clear since it was not food specific.

3103 Board #8 June 2 2:00 PM - 3:30 PM
Impact Of Acute Aerobic Exercise On Cue Reactivity To High-fat Foods In College-aged Women

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(No relationships reported)

Acute aerobic exercise has been shown to reduce craving for various addictive substances like cigarettes and alcohol. A similar effect has been seen in children when examining brain fMRI responses to fatty foods. **PURPOSE:** The purpose of this investigation is to examine the impact of acute aerobic exercise on cue reactivity to fatty and healthy foods in typical college-aged women. **METHODS:** Six women (Age=24.7±0.9 years, BMI=26.6±2.5), VO_{2peak}=35.3±4.1 ml·kg⁻¹·min⁻¹) completed 2 experimental sessions. During one session subjects rested for 30 minutes and during the other session subjects exercised for 30 minutes at a moderate exercise intensity (77±1% of Peak HR) on a semi-recumbent bike. Treatments were applied in a counter-balanced fashion and subjects fasted for 4 hours prior to each session. Prior to and immediately following each session, EEG data were collected using a 64-channel EGI Geodesic EEG System 300 series while subjects were exposed to 280 images (40 Distractor (DIS), 120 Fatty Foods (FAT), 120 Healthy Foods (HEALTHY)). Images were presented in a random order and proceeded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). After collection, data were processed to calculate the mean and peak voltage associated with the P300 (200-500 ms post stimulus) in all electrodes. For this investigation, only the electrodes associated with the parietal lobe of the brain were used for comparison and average EEG responses in these electrodes are presented here. **RESULTS:** Reaction time to distractor stimuli was reduced following exercise (Pre=513±8 ms, Post=483±10 ms, p=0.004) as compared to resting (Pre=530±17 ms, Post=522±15 ms, p=0.22) Acute aerobic exercise had no impact on the EEG response to FAT (Mean Response: Pre=0.35±1.42 μV, Post=0.42±1.66 μV; Peak Response: Pre=1.71±1.41 μV, Post=2.08±1.68 μV) or HEALTHY (Mean Response: Pre=-0.39±0.76 μV, Post=0.42±1.28 μV; Peak Response: Pre=1.74±0.82 μV, Post=2.63±1.52 μV) images. **CONCLUSION:** These findings suggest that acute aerobic exercise of moderate intensity does not influence cue reactivity to images of fatty and healthy foods in normal college-aged women.

3104 Board #9 June 2 2:00 PM - 3:30 PM
Neural Activation to Food Cues and Cognition in Sedentary Obese Endometrial Cancer Survivors Seeking Weight Loss

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PURPOSE: Sedentary behavior and obesity increase the risk of endometrial cancer (EC), particularly Type I forms, which are increasing in the U.S. Further, although death rates from most cancers are decreasing, overall mortality rates for EC are increasing; and, obese EC patients have significantly poorer survival rates compared to normal weight EC patients. No prior studies have examined neural activation in response to food cues as well as sedentary behavior and cognition in obese EC survivors. **METHODS:** Therefore, we evaluated appetitive behavior using a visual food cue functional magnetic resonance imaging (fMRI) task as well as sedentary behavior and cognition using Trails A & B and Symbol Digits Modalities Tests in 42 obese EC survivors seeking weight loss. **RESULTS:** We found increased activation in response to high-calorie food cues after eating a meal in brain regions associated with food-related reward (dorsolateral prefrontal cortex, amygdala; whole brain cluster corrected, p<0.05) in obese EC survivors. In addition, cognitive tests suggest scores in obese EC patients are lower than normative data for similar age and gender. We are currently evaluating correlations between sedentary behavior, cognitive scores and neural signals in differentially activated brain regions. **CONCLUSIONS:** To our knowledge, this is the first study to evaluate cognitive and sedentary behavior correlates of neural activation in response to food cues in obese EC survivors and, these data may also help inform future work in other adult obese populations with and without cancer.

This work was supported by NIH NCI R01-CA175100.

3105 Board #10 June 2 2:00 PM - 3:30 PM
Neurocognitive Improvements Following a 12-Month Diet and Physical Activity Intervention

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PURPOSE: Obesity is associated with decreases in cognitive function, including changes in working memory and executive control. Yet, we know very little about whether weight loss through an energy-restricted diet and increased physical activity (PA) improves cognitive function. The aim of this study was to evaluate whether weight loss following a 12-month dietary and physical activity intervention was associated with improved cognitive performance.

METHODS: 115 overweight and obese adults (89 female) participated in a 12-month diet and PA intervention. Participants were middle-age (mean at baseline=44.7±8.5 years) and well educated (mean=16.5±2.5 years). Participants were assigned to one of three groups: One group engaged in dietary restriction alone, while the other two groups engaged in either 150 minutes per week or 250 minutes per week of moderate intensity exercise, in addition to an energy-restricted diet. All participants completed neuropsychological tests measuring decision-making (Iowa Gambling Task; IGT), inhibitory control (color-word Stroop), working memory (N-Back), and processing speed/set shifting (Task Switch). Paired-samples t-tests compared baseline with post-intervention cognitive performance. The results reported below are collapsed across group, as the investigators remain blind to group assignment.

RESULTS: Following the intervention, participants' BMI decreased by 2.4±3.3 kg/m², p<.001. Participants performed significantly better post-intervention on the IGT [t(114)=-2.42, p=.016], N-Back [2-Back RT t(114)=2.686, p=.008], and Task Switch [RT t(113)=3.759; accuracy t(113)=-2.016, p=.046] compared to baseline. There were no significant changes in Stroop Task performance from baseline to follow-up. The changes in cognitive task performance were not significantly associated with change in BMI.

CONCLUSIONS: A 12-month diet and physical activity intervention in overweight and obese adults is associated with improved cognitive performance across multiple cognitive domains. **FUNDING:** This research was supported by funding from NIH/NIDDK grants R01095172 (PI: Erickson) and R01HL103646 (PI: Jakicic).

3106 Board #11 June 2 2:00 PM - 3:30 PM
Benefits of Acute Aerobic Exercise on Neuroplastic Potential in Depression

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Depression affects millions of Americans and is a leading contributor to disability and mortality in the United States. Evidence indicates that neuroplasticity is impaired in those with depression and successful treatment for depression appears to reestablish neuroplastic potential. Aerobic exercise (AE) has well-established antidepressant effects and has been shown to modulate neuroplasticity in non-depressed subjects. To date, the acute influence of exercise intensity on indices of neuroplastic adaptation have yet to be described. **PURPOSE:** To examine the efficacy of acute AE as a neuro-modulatory intervention in non-depressed control subjects. **METHODS:** Thirteen non-depressed subjects (8 female; 34.5 ± 8.7 years old) completed three experimental sessions that included assessment of corticospinal excitability (CE), AE (15 minutes) and paired associative stimulation (PAS) to determine neuroplastic potential. CE was assessed via transcranial magnetic stimulation and surface electromyography of the abductor pollicis brevis muscle before and after exercise, and for one hour after PAS. AE was performed on a stationary cycle ergometer at low intensity (LO), 35% heart rate reserve (HRR); high intensity (HI), 70% HRR; or a non-exercise control condition (CON). The primary outcome was change in peak-to-peak motor evoked potential amplitude relative to baseline assessment. **RESULTS:** Mean post-exercise CE across all time points was increased 26.2% in the LO condition, and 2.9% in the CON condition while the HI condition reduced CE 6.3%. Immediately following exercise, the LO condition produced a rapid 27.1% increase in CE while the HI condition produced a rapid 16.3% decrease in CE. Both the LO and HI conditions demonstrated a homeostatic response immediately post-PAS with a 15.0% reduction and 27.8% increase in CE, respectively. **CONCLUSION:** Lower exercise intensity appears to have a greater influence on increasing CE. Interestingly, the rapid effects of exercise appeared to be reversed by PAS suggesting the presence of homeostatic metaplasticity during these conditions. Modulation of CE via exercise in depression has yet to be established but may underlie the anti-depressant effects of AE. Work examining the influence of AE on CE in depression is currently in progress.

F-52 Free Communication/Poster - Activity Interventions and Programming in Youth

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3107 Board #12 June 2 3:30 PM - 5:00 PM
Improvements in Family Nutrition and Physical Activity during FitKids360: Associations with Adiposity Changes

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Purpose

The Family Nutrition and Physical Activity survey (FNPA) is a validated health behavior survey for assessing childhood obesity risk, but it has not been evaluated as a tool to track behavior change over time. The current study assessed FNPA in youth who completed a pediatric weight management program, and compared associations between FNPA and adiposity changes.

Methods

Youth 5-16 years old with a BMI \geq 85th percentile participated in FitKids360, a 6-week, multidisciplinary, family-based intervention aimed at improving physical activity, nutrition, and sedentary behaviors. The FNPA was parent-reported pre and post intervention, and height and weight were assessed via trained program staff. Total FNPA and subscale scores were calculated, including screen time, physical activity, family meals, food and beverage choices, parental food restrictions and rewards, and sleep routines. Participants were grouped based on BMI percentile (BMI%) changes during treatment, after which FNPA scores were compared across genders, age groups, and BMI-change categories.

Results

A total of 1102 youth (10.7 \pm 3.0 years) initiated treatment, and 790 completed the program (72% retention). Mean FNPA scores significantly increased 5.6 \pm 7.4 points ($p<0.001$) while BMI% decreased -0.43 \pm 2.12 percentile points ($p<0.001$). After adjusting for baseline FNPA, youth <11 years of age had higher post FNPA scores than older youth ($p<0.001$), but FNPA did not differ between genders. When grouped by high ($\leq-0.5\%$), moderate (-0.5 to 0.0%), and low ($\geq 0.0\%$) BMI% changes, youth with high reductions had healthier FNPA scores (63.2 \pm 7.8) than those with low BMI% changes (59.6 \pm 8.1) ($p=0.005$), and a trend towards higher scores than those with moderate reductions (61.7 \pm 7.3) ($p=0.080$). FNPA subscales also differed between BMI% groups, such that greater adiposity reductions were associated with healthier beverage choices ($p=0.034$) and lower screen time ($p=0.005$).

Conclusions

FitKids360 completers improved FNPA scores and reduced age- and sex-adjusted BMI. After adjusting for baseline differences, youth with the highest post-treatment FNPA scores had the greatest improvements in adiposity. The FNPA appears to be a useful tool for tracking progress in obesity-related health behavior changes during family-based pediatric weight management.

3108 Board #13 June 2 3:30 PM - 5:00 PM
The Experimental Effect Of Parental Attentiveness On Children's Physical Activity

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Current evidence supports the notion that children's physical activity levels may be influenced by parental interactions. One potential factor may be parent attentiveness. While evidence from non-experimental studies provides support that when parents are actively attentive it is positively associated with their children's physical activity, it is heretofore unknown what the causal impact of a parent being actively attentive versus non-attentive may be on the amount and intensity of their child's physical activity. **PURPOSE:** To assess the amount, intensity, enjoyment (i.e., liking), and preference of children's physical activity under two conditions; *parent actively attentive* and *parent non-attentive*. **METHODS:** Ten children ($n = 6$ boys, 4 girls) between the ages of 3-6 years old participated in each condition for 30-minutes in which they were taken to a gymnasium and had free-choice access to a variety of physical and/or sedentary activities. In addition to accelerometry data, at the end of each 30-minute session children were asked to indicate their liking. Children were then

asked if they would like to play for an additional 10-minutes. After both conditions were completed, each child indicated which condition was their favorite. **RESULTS:** More counts ($p = 0.04$) were accumulated during the *parent actively attentive* (96,547 \pm 33,075.26 counts) condition than the *parent non-attentive* (48,316.30 \pm 46,101.47 counts) condition. More time ($p = 0.01$) was allocated to sedentary activities during the *parent non-attentive* (19.50 \pm 13.30 minutes) condition than the *parent actively attentive* (2.80 \pm 3.55 minutes) condition. Children liked ($p = 0.004$) the *parent actively attentive* (9.05 \pm 1.21 cm) condition more than the *parent non-attentive* (4.42 \pm 3.18 cm) condition. There was no significant difference ($p = 0.56$) between the proportion of children who chose to participate in the additional 10-minute bonus period during the *parent actively attentive* (50%) condition and the *parent non-attentive* (40%) condition. **CONCLUSION:** When parents are actively attentive children's physical activity increased by 99.82% and reduced sedentary behavior by 85.64%. *Parental attentiveness* during bouts of physical activity may be an important component to consider when children are engaging in physical activity.

3109 Board #14 June 2 3:30 PM - 5:00 PM
Evaluation of a Teacher-Led Physical Activity Intervention in Preschool Children

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More than half of preschool-aged U.S. children spend their time in a structured preschool setting largely engaged in sedentary behaviors. Given the low levels- yet importance of physical activity (PA) for prevention of obesity, preschools may be an ideal environment to engage a large number of children at an early age. **PURPOSE:** To examine whether a teacher-led PA intervention increased moderate-to-vigorous physical activity (MVPA) in preschool-aged children. **METHODS:** An evidence-based PA curriculum was implemented in a local preschool over 12-weeks, 3 times per week by classroom teachers with assistance provided by UVM students enrolled in a service-learning course. Main outcomes were objectively measured, MVPA by accelerometry. Measures were performed at baseline, 2 intervention points, and 1-week post-intervention. A total of 35 children (4-5 years, 12 females, 23 males) who had at least 3 days of valid data were included in the analyses. **RESULTS:** Significant ($p<0.05$) changes were observed in minutes of MVPA/day, sedentary minutes/hour and MVPA/hr. Minutes of MVPA/day significantly increased from pre- to post-intervention (56.55 \pm 3.9 vs. 72.61 \pm 3.9). Significant increases were observed from baseline to both intervention point 1 and post-intervention (8.45 \pm 0.4 vs. 10.8 \pm 0.6 and 10.9 \pm 0.4, respectively). Sedentary time also significantly decreased from 43.42 \pm 0.6 min/hr at baseline to 40.61 \pm 0.5 min/hr at post-intervention. **CONCLUSIONS:** The findings from this study support a teacher-led intervention to increase MVPA in preschool-aged children. These findings are promising as teacher-led PA interventions may be a potentially viable and cost-effective means to accomplish a myriad of health-related goals. Further evaluation of the PA curriculum in a larger cohort and over a longer period of time is warranted.

3110 Board #15 June 2 3:30 PM - 5:00 PM
Effectiveness Of A Low-cost Exercise Intervention For Pediatric Obesity

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PURPOSE: Regular physical activity improves health profiles and quality of life in youth with obesity (YWO), and participation in sport-specific events reportedly improves self-efficacy among youth with little athletic experience. This project retrospectively evaluated the feasibility and efficacy of an ongoing low-cost physical activity intervention to prepare YWO for an athletic event (5K run/walk).

METHODS: The Healthy Lifestyle Clinic (HLC), a multidisciplinary weight management clinic at Le Bonheur Children's Hospital, hosted a race team for a 5K run/walk event. HLC patients were offered a training program designed to be engaging, minimally burdensome for clinical staff, and focused on preparing exercise-naïve YWO to complete a 5K. Training included 3 weekly aerobic sessions (20-45 minutes) with duration and intensity increased based on rating of perceived exertion. Participants completed workout logs and were invited to workouts in the community with HLC staff members. Weekly phone calls were made to monitor progress, engagement, and individualize the program. On average, phone calls lasted <10 minutes. Retrospective review of medical records and patient communications, was IRB approved.

RESULTS: Initially 28 YWO expressed interest in the training program. Twelve YWO (11.4 \pm 2.6 yrs, 151.3.4 \pm 13.3 cm tall, 88 \pm 24.5 kg, 99.1 \pm 0.76 BMI %ile) actively engaged (reporting >70% adherence) with the training, and 6 participants completed

the 5K race (all 1st time racers). Almost 60% of participants attended all community workouts and those who completed the 5K had greater parent engagement than those who did not. Similarly, those who engaged in more frequent phone contact were more engaged in the training program. More than 80% of families who participated requested the program become a recurring HLC offering, indicating a desire for more exercise interventions. Themes of improved physical appearance, self-worth, and athletic competence emerged from patient reports. All those who completed the race expressed likelihood to attempt another race.

CONCLUSIONS: This program was feasible, minimally burdensome, and cost-effective. It had a positive effect on self-reported motivation, physical fitness, and self-efficacy. Parental involvement was a driving factor for program adherence and race completion.

3111 Board #16 June 2 3:30 PM - 5:00 PM
Effects Of 5-week Summer School Program On Inflammatory Markers And Oxidative Stress In Female Adolescents

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Physical inactivity and obesity in adolescents cause a complex health issue. Especially, physical activity levels are markedly decreased during summer vacation in low socio-economic status communities, compared to academic school periods. It was also reported that physical fitness was progressively declined in children who did not participate in exercise programs during summer vacation. Thus, this study seeks to provide further evidence for the role of summer school programs.

PURPOSE: To determine the effects of summer school programs including 2-hour exercise per day on systemic blood inflammation and total antioxidant status in female adolescents.

METHODS: Thirty high school female students were recruited and 15 students were assigned to the summer school attendant group (SA) and completed summer school programs with 2-hour exercise daily for 5 weeks and 15 students were in non-summer school attendant group (NSA). Plasma tumor necrosis factor alpha (TNF- α), C-reactive protein (CRP), and total antioxidants were measured immediately before and after summer vacation. One-way ANCOVA was used to determine differences in TNF- α , CRP, and total antioxidant changes between the groups.

RESULTS: Plasma TNF- α was reduced in SA group after summer vacation, compared with the NSA (7.79 \pm 2.0 pg/ml vs. 8.33 \pm 2.2 pg/ml, respectively, $P=0.001$). CRP level was decreased in the SA group after summer vacation, compared with the NSA (7.7 \pm 0.7 mg/L vs. 8.2 \pm 0.7 mg/L, respectively, $P=0.005$). Total antioxidant concentrations were elevated in the SA group after summer vacation, compared with the NSA (1.96 \pm 0.4 mM/L vs. 1.80 \pm 0.2 mM/L, respectively $P=0.018$).

CONCLUSION: Five weeks of exercise programs in summer school may ameliorate systematic inflammation and decrease oxidative stress in female adolescents. Thus, these findings may support that school-aged adolescents, while attending at summer school programs, have beneficial outcomes on the cardiovascular health, especially in low socio-economic status communities.

3112 Board #17 June 2 3:30 PM - 5:00 PM
Different Exercise Doses On Fitness , Fatness And Inhibition Control Of Adolescents.

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Purpose: To study the effects of different dose of exercise training on cardiorespiratory fitness, body fat percentage and inhibition control of adolescents.

Methods: A physical activity intervention program was conducted among 12-14 years' adolescents. 78 students (38 boys) were recruited into the plan after the approval of parents and teachers. According to the classes, we divided the participants into 3 groups. They were low-dose(30min/d,n=20) or high-dose(60min/d,n=23) aerobic training(12wk,5d/wk), or control condition(usual physical activity,n=24);rates of attendance was 55%. Training intensity was the 50%~70% heart rate reserve. We used the breath-by-breath technique to test the VO_{2peak}. The Bioelectrical Impedance analysis was used to measure the body fat percentage. Inhibition control was measured by a modified Eriksen flanker task. Between-group differences were tested using analysis of covariance(ANCOVA) with adjustment for baseline values and within-group differences were tested using t tests. For statistically significant analyses of variance ($P<0.05$)

Results: Participants had mean VO_{2peak} of 33.0ml/min/kg at baseline survey. 12 weeks later, after adjustment for the baseline value, compared with control group, the exercise groups increased VO_{2peak} greater($F=3.87,p=0.03$). The mean(SE) VO_{2peak}

was 38.78(1.10) in low-dose and 38.46(1.04) in high-dose. But the VO_{2peak} in control group was 34.98(1.03). There was no significant difference between low-dose and high-dose group. For girls, the decrease in body fat percentage in the high-dose physical training group, but not in the low-dose group, was significantly greater than that in the control group($F=3.94, P=0.03$). But there were no significant changes in fatness values of boys from baseline to 3 months. After adjustment for the baseline value, there were no significant changes in inhibition control values from baseline to 3 months in any of the exercise groups vs the control group.

Conclusion: Three months of 30 or 60 min/d aerobic training improved fitness, and demonstrated dose-response benefits on general adiposity for girls. However, the effects of exercise intervention on inhibition control for 12-14 aged students should do further research.

Supported by National Science and Technology Support Programm(2012BAK21B02)

3113 Board #18 June 2 3:30 PM - 5:00 PM
Exercise Intensity and Sleep in Obese Youth Before, During and After Weight Management Camp

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PURPOSE: To compare overall sleep time, sleep efficiency and exercise intensity of participants before, during and after a weight management camp for youth with obesity.

METHODS: Fifteen obese youth, ages 9 to 13 years, were recruited at an open house for an overnight weight management camp. Informed consent/assent was obtained. Subjects wore GENEActiv accelerometers 24 hours/day for approximately one week before, during, and after camp. Data were analyzed to determine the amount of time each participant spent in sedentary (SED), moderate (MPA) and vigorous (VPA), as well as total sleep time (TST) and sleep efficiency (EFF). The participants' activity levels and other subject characteristics were compared during the week of camp and weeks at home.

RESULTS: Complete usable data was obtained from 10 (67%) participants (6 boys, 4 girls). Mean age (\pm SD) was 11.7 \pm 1.2 years. Mean BMI was 32.25 \pm 5.1 kg/m². During camp, participants averaged less daily SED than at home (428.38 \pm 63.20 minutes, $p=0.0003$) and more MPA (363.4 \pm 38.63, $p=0.0001$) and VPA (55.05 \pm 33.96, $p=0.0055$). There was no significant difference in TST between weeks. There was a significant difference in EFF between weeks ($p=0.04$), with the highest EFF occurring during camp (86.7%). Neither BMI nor age were correlated to TST or EFF.

CONCLUSION: Obese youth exercise longer at higher intensities while participating in a summer weight management camp versus on their own at home. Sleep efficiency also improves while at camp. This suggests that accumulating more daily MVPA leads to improved sleep, and further studies are needed to more closely examine this relationship in obese youth.

3114 Board #19 June 2 3:30 PM - 5:00 PM
Effect Of A Physical Activity Intervention On Letter And Number Recognition In Preschoolers

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There is considerable evidence that physical activity (PA) may improve some components of cognition and academic performance in preschool-aged children. Increasing PA in an effort to enhance learning in preschoolers may be ideal, particularly as this age group experiences a high rate of cognitive development and neurophysiological change. However, the literature on PA and academic performance related outcomes, such as school readiness skills, in preschoolers is limited.

PURPOSE: The purpose of this study was to examine the effects of a 12-week PA intervention on school readiness-related cognitive skills (i.e. letter and number recognition) in preschool children. **METHODS:** Two preschool centers (n=41 children; 53.6% male; mean \pm sd: age=4.3 \pm 0.7; BMI percentile=52.5 \pm 26.3) were randomized to a 12-week preschool-based PA intervention (INT; n=19 children) that incorporated short-bout PA lessons embedded into the Massachusetts Early Learning Standards or a health-tracking control group (CON; n=22). School readiness cognitive skills were assessed by recognition of symbols (i.e. letters and numbers) at baseline and at 12-weeks. Chi square and independent t -tests were used to compare baseline characteristics between groups. The effect of the intervention on letter and number recognition was assessed with repeated measures ANOVA. **RESULTS:** There were no significant baseline differences between groups. Mean change scores for letter recognition (INT: 3.5 \pm 6.8, CON: 5.5 \pm 4.9) and number recognition (INT: 0.9 \pm 4.3, CON 1.7 \pm 2.3) were higher in the CON group compared to the INT group. There was not a significant effect of the intervention on pre- to post-scores. **CONCLUSION:** The 12-week PA intervention utilized in this study did not elicit a significant improvement in the letter and number recognition of preschoolers. Further research may be valuable

to examine the benefits of a preschool PA intervention by utilizing longer intervention periods, additional bouts of academically-tailored PA, and more comprehensive measures of preschool cognitive skills.

3115 Board #20 June 2 3:30 PM - 5:00 PM
Effect Of A Curriculum-Based Physical Activity Intervention On Classroom Behavior Variables In Preschool-Age Children

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Few studies have examined the impact of physical activity (PA) programs during the preschool day, with only two rooted in an academic curriculum. PA has been shown to improve components of classroom behavior in preschoolers. Poor classroom behavior can be indicative of early attention-deficit/hyperactivity disorder (ADHD) symptomology, which is seen in children as young as three years old. However, no studies have examined curriculum-based PA to improve classroom behavior. **PURPOSE:** To examine the impact of a curriculum-based PA intervention on classroom behavior variables in preschoolers. **METHODS:** Children (n=52, mean±sd: age=3.6±0.8 years, BMI percentile=50.1±27.1) attending two preschools were randomized to the Preschool Activity, Diet, and Sleep (PADS) intervention or the health tracking (CON) group. PADS consisted of integrating PA lessons into Massachusetts Early Learning Standards. The Strengths and Difficulties Questionnaire (SDQ) behavioral screening tool was used to assess classroom behavior which includes a total difficulties score and subscales encompassing hyperactivity/inattention, emotional problems, conduct problems, peer problems, and prosocial behavior. The SDQ was completed by classroom teachers for each child at baseline, 6 weeks, and 12 weeks. A repeated measures ANOVA was utilized to examine intervention effects on children's classroom behavior variables. **RESULTS:** Children at the CON school exhibited greater hyperactivity/inattention (PADS=2.3±2.5, CON=4.1±3.5), emotional problems (PADS=0.3±0.6, CON=2.6±2.4), conduct problems (PADS=0.8±1.3, CON=2.9±3.2), peer problems (PADS=0.3±1.0, CON=1.2±1.4), and total difficulties (PADS=4.0±3.8, CON=10.9±8.0) at baseline compared to the PADS school. There were no statistically significant effects of time or intervention by time for classroom behavior variables. **CONCLUSION:** These data suggest a curriculum-based PA intervention did not lead to change in teacher-reported classroom behavior variables. Lack of intervention effect in this population could be due to lack of specificity of intervention components targeting classroom behavior. Future studies should incorporate cognitive skills linked to early ADHD symptomology in PA lessons, include objective behavior measures, and utilize a larger sample size.

3116 Board #21 June 2 3:30 PM - 5:00 PM
The Impact Of A School-based Lifestyle Intervention On Attitudes And Behaviors In Children

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A number of healthy eating determinants such as area deprivation, family involvement, knowledge, and attitudes are associated with obesity prevention in children. School-based interventions have achieved improved weight status, health knowledge, attitudes, and behaviors. **PURPOSE:** Therefore, the purpose of this study was to determine immediate and long-term changes in body mass index and psychosocial variables following a 10-week school-based lifestyle intervention designed to improve weight status in children. **METHODS:** One hundred and thirty eight participants (8.67 ± 0.51 years of age, 64 boys and 74 girls) took part in the study. All participants had height, weight, and psychosocial variables assessed at pre-intervention, post-intervention, and 6-months post-intervention. The Pupil Questionnaire which measured healthy eating attitudes, knowledge and behaviors was used. A repeated measures study design was employed such that participants served as their own control and then completed a 10-week intervention consisting of healthy eating and physical activity education, physical activity, parental involvement, and behavior change. Changes in outcome measures within the group across time was assessed using a one-way repeated measures analysis of variance (RMANOVA) with adjustment for covariates where appropriate. **RESULTS:** Results from the RMANOVA revealed no significant within-group main effect for time. Subsequent analysis of the data indicated a significant within group effect of the intervention at different time points such that from pre-intervention to post-intervention, fruit attitudes (CI = -0.056 to -0.002, ES = -0.26, p = 0.02), vegetable attitudes (CI = -0.081 to -0.009, ES = -0.34, p = 0.005), and healthy eating

attitudes (CI = -0.22 to -0.02, ES = -0.29, p = 0.006) improved. From post-intervention to 6-months, vegetable attitudes approached a significant decrease (CI = -2.533E-5 to 0.07, ES = 0.13, p = 0.05) and HE attitudes decreased (CI = 0.005 to 0.19, ES, 0.26, p = 0.03). **CONCLUSION:** Fit for School may be an effective means for improving healthy eating attitudes and behaviors in primary school children in the short-term if the duration of the intervention is increased, but these changes may not be sustained without on-going support.

3117 Board #22 June 2 3:30 PM - 5:00 PM
Longitudinal Efficacy of Skiku on Physical Activity and Sleep Quality in Alaska Native Youth

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PURPOSE: Increased exposure to Western Civilization has led to an increased incidence of obesity in Alaskan Native villages. Physical activity and sleep patterns may be altered in these rural settings as well. The purpose of this study was to evaluate the efficacy of a novel cross country skiing program (ie., Skiku) on the levels of physical activity and sleep quality of Alaska Native children. **METHODS:** After a year of exposure to the Skiku program that included bi-annual instruction from high school- to Olympic-level coaches, we worked with the tribal elders to configure a culturally appropriate method of assessment devoted to physical activity and sleep quality. In order to gain a longitudinal understanding of the program efficacy, we visited the village during early April of 2014 and 2016. At both times, we requested that the children (age 7 to 15) wear ActiGraph activity monitors for a minimum of four days. Data collected from these time points were evaluated using ActiLife software algorithms to determine activity levels as well as sleep quality. **RESULTS:** The average amount of time spent performing moderate-vigorous activity significantly increased from 161.2±47.3 min/day to 468.0±98.6 min/day from 2014 to 2016, respectively. There was no change in sleep quantity (558.6±43.0 min/day and 552.8±61.9 min/day; 2014 and 2016 respectively) or quality (87.0±5.8% and 85.6±9.3%; 2014 and 2016, respectively) between the two years. **CONCLUSION:** The implementation of this program has significantly increased the activity levels of children involved. The World Health Organization recommends that children between the ages of 5-17 perform a minimum of 60 minutes of moderate to vigorous physical activity per day to maintain optimal metabolic health and psychological resilience. This program has demonstrated its long term efficacy in promoting healthy lifestyle changes by increasing moderate-vigorous activity in children.

3118 Board #23 June 2 3:30 PM - 5:00 PM
University-Driven Exercise Programming Event Reduces Student Stress Prior to Final Exams

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Levels of sedentaryness and stress are at historical highs among college students. These occurrences are not mutually exclusive; a negative correlation exists between physical activity (PA) and mental health. This correlation, paired with evidence linking PA to increased brain activation and memory function gives cause for a PA intervention nearing final exams. Accordingly, UNLV implemented Fitness4Finals (F4F). **PURPOSE:** To determine the effect of F4F on end-of-semester physiological stress (PS), perceived academic stress (PAS) and academic self-efficacy (ASE) in college students, and examine the relationship between PS and PAS. **METHODS:** 24 participants were grouped by intent to participate in F4F (F4F, n=9) or not participate (Non F4F, n=15). PS (salivary amylase) and PAS were measured at three time-points: the Friday prior to study week (Base), the Friday prior to exam week (Post F4F) and prior to student's first final exam (Pre-Exam). Data were analyzed using a mixed-measures ANOVA, at the p<0.05 significance level. **RESULTS:** A significant group difference was found for PAS at Post F4F ($F_{(1,19)} = 4.403, p = .049$). Though not significant, mean scores revealed lower salivary amylase and PAS for the F4F group across time points. F4F group showed lower ASE at baseline, surpassing the Non F4F group at Post F4F and Pre-Exam time points, while Non F4F stayed unchanged (Table 1). Salivary amylase and PAS trended toward significant correlation at Base ($r = -.388, p = 0.091$) but not Post F4F or Pre-Exam. **CONCLUSION:** Participation in F4F eases academic stress, albeit temporarily. F4F participants display lower physiological and psychological stress overall and increase academic self-efficacy as they near exams. Acute physiological stress markers do not appear to correlate with reported academic stress. Overall, an end-of-semester, university-driven exercise program such as F4F is beneficial in combating climatic stress through increases in PA.

Table 1. Physiological stress, psychological stress and self efficacy across time

	BASE	POSTF4F	PRE-EXAM
F4F			
Salivary Amylase	155.4±159	226.2±239.2	219.2±188
Academic Stress	77±15.4	67.3±18.2	68.6±9.8
Self Efficacy	68.29±12.9	74.14±18.9	78.14±14.4
NonF4F			
Salivary Amylase	219.2±188	242.3±232.6	233.8±288.5
Academic Stress	81.2±14.8	82.6±14.5	75.4± 16.8
Self Efficacy	69.93±14.6	70.29±17.3	69.93±19.8

3119 Board #24 June 2 3:30 PM - 5:00 PM
Examining The Effectiveness Of Spark And Active Video Games On Children’S Health-related Physical Fitness

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Purpose: Active Video Game (AVG) has potential in increasing children’s physical activity participation. However, it is not clear whether AVG can help improve individuals’ health-related physical fitness. The purpose of this study was to examine the effectiveness of Sports, Play, and Active Recreation for Kids (SPARK) and AVG on children’s health-related fitness.

Methods: A total of 63 third and fourth graders participated in the study. The third graders (n = 29, 10 for boys) experienced the SPARK curriculum taught by a student teacher while the fourth graders (n = 34, 14 for boys) engaged in the AVG group practicing XBOX Kinect™ dance games. All participants completed three, 50-minute exercise sessions per week for six weeks. Health-related fitness was measured using FitnessGram including 15-meter PACER test, curl-ups, and push-ups tests prior to and immediately after the intervention. A one-way MANOVA with repeated measures by controlling for BMI and gender was conducted to assess the effects of time and interventions on fitness variables.

Results: No group difference in the pre-tests was found. There is a significant effect of time (F = 14.2, p < .001, η² = .20) and the interaction between time and intervention groups on the performance of the PACER test (F = 72.2, p < .001, η² = .56). The participants in both groups increased their PACER test scores with the AVG group demonstrated significantly higher improvement than the SPARK group. No time or intervention effects were found on the muscular strength and endurance tests.

Conclusion: AVG using XBOX Kinect™ seems to be effective in improving children’s aerobic fitness performance. Schools can use AVG as an alternative way to traditional physical activities for children to receive health benefits.

3120 Board #25 June 2 3:30 PM - 5:00 PM
Establishing Classification Criteria for an Energy Balance Knowledge Test for Fourth and Fifth Grade Children

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PURPOSE: Children show knowledge deficiency about energy balance, a key factor underlying body weight fluctuation. We previously developed and validated a written test, which has shown good validity and utility in capturing children’ knowledge about energy balance, but no criteria were established to classify scores for meaningful interpretation. The purpose of this study was to develop criteria to determine the knowledge levels.

METHODS: Six Iowa schools participated in this study, with 570 children completed the pre-test and 587 completed the post-test. An obesity prevention program was implemented between the two assessments. Data were screened for outliers and examined for normal distribution. Cluster analysis was conducted to establish three levels of energy balance knowledge: high, moderate, and low. ANOVA was subsequently used to verify the classification. Thresholds for knowledge levels were determined based upon the maximum and minimum values at each level. Scores measured at pre- and post-tests were evaluated by referencing to the new criteria.

RESULTS: The cluster analysis resulted in three knowledge levels: high (M: 75.3%, 66.7-96.3%; n=392), moderate (M=57.4%, 51.9-63.0%; n=436) and low (M=39.4%, 14.8-48.2%; n=328). Knowledge sum score was significantly different across the three groups (F_{(2,1153)}} = 2700.14, p<0.001). Differences between every two levels were clear (high vs. low: p<0.001; high vs. moderate: p<0.001; moderate vs. low: p<0.001).

The cut-points were 50.0% between low and moderate levels and 64.8% between moderate and high levels. The proportion of children in high, moderate and low levels were 20.9%, 41.9% and 37.2% respectively at pretest and 46.6%, 33.6% and 19.8% respectively at posttest.

CONCLUSION: The knowledge classification was found to be empirically sound. The obesity prevention intervention showed preliminary efficacy in knowledge increase, with more children placed in the high knowledge group and less children in the low knowledge group.

This study was supported by the Society of Health and Physical Educators, United States of Agriculture, and Iowa State University College of Human Sciences

3121 Board #26 June 2 3:30 PM - 5:00 PM
Playground And Garden Activity Levels In Young Children

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Outdoor time is mandated by most states in early childhood education settings. Most facilities have a playground for children to engage in physical activity (PA) during their outdoor time. However, garden programs are increasing in popularity for children, providing educational opportunities while contributing to children’s daily PA.

PURPOSE: To determine the differences in time spent in PA between two outdoor environments (playground and garden) in preschool children. **METHODS:** Ten children (4.7 ± 0.6 years) enrolled in a university laboratory preschool participated in this study. PA was assessed using an ActiGraph GT3X+ accelerometer that was worn on the right hip. Each child completed four randomly ordered free living conditions (30 min each), which included two bouts of unstructured PA on the playground and two bouts of semi-structured PA in the garden. Accelerometer data were classified as minutes in sedentary behavior and combined PA of varying intensities (light, moderate, and vigorous) using the Pate cut points. Data were combined to make one 60 min bout for each environment. Sessions were combined in order to determine the number of minutes per hour spent in sedentary and PA. This variable is consistent with the Institute of Medicine (IOM) recommendation of 15 minutes of PA per hour in order to determine whether these types of outdoor activity are supportive of meeting PA goals. Paired samples T-Tests were conducted to look at differences in PA (min/hour) between the playground and garden. **RESULTS:** On average, the children spent 35.8 min/hour in PA on the playground and 29.0 min/hour in PA on the garden. The children spent less time in sedentary behaviors (24.2±6.8 vs. 31.0±8.4 min/hour; p=0.025) and more time in moderate PA (15.3±5.1 vs. 10.8±6.1 min/hour; p=0.034) on the playground than in the garden. There were no differences in light (18.0±2.4 vs. 17.0±3.4 min/hour; p=0.365) or vigorous PA (2.6±2.1 vs. 1.2±1.9 min/hour; p=0.131) between the playground and the garden. **CONCLUSIONS:** Children spent less time being sedentary and more time in moderate PA on the playground than the garden. However, the children exceeded IOM activity guidelines in both environments. These results suggest that gardens may be a conducive environment to provide an opportunity for children to meet PA recommendations.

3122 Board #27 June 2 3:30 PM - 5:00 PM
Physiological Change During a 13-Week Aerobic Dance Class Among College Age Women

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One predictor of lifelong activity participation is increased self-efficacy toward physical activity (PA) (Weiss, O’Loughlin, & Piatt, 2007). Many colleges and universities require PA but little emphasis is placed on whether students experience physiological change. If measurable changes were identified, it could improve self-efficacy and potentially lead to lifelong activity participation. **PURPOSE:** The purpose of this study was to see if a statistical change could be identified in a variety of physiological variables among a group of college age women enrolled in a PA course. **METHODS:** Thirty one women with an average age of 20.53 (±1.11) years participated. Participants were enrolled in either a 13-week aerobic dance fitness (FIT) course (n = 19) or a non-fitness course, which served as the control group (n = 12). Pre-test assessments were completed during the first week of the semester. The assessment included anthropometric measurements, resting systolic blood pressure (rSBP) and heart rate, a submaximal treadmill test, ACSM abdominal curl (ABcurl) and push up tests, ACSM Sit and Reach (SR), and bioelectric impedance for body fat assessment. Post-test assessments were completed during the final week of class. To be included in the study, participants must not have been absent for more than two days during the semester. **RESULTS:** Paired sample t-test statistics were conducted to determine significant changes in each group (p < .05). A significant decrease in rSBP (-4.63 9.11 mm/hg) was observed in the FIT group (t = 2.22, p = .041). Significant increases in SR (0.83 1.51 inches) as well as ABcurl (9.05 14.50) performance (t =

2.39, $p = .028$; $t = 2.72$, $p = .014$) respectively. No significant change was seen in the control group. However, when a Repeated Measures ANOVA analysis was conducted, all significant differences disappeared. This was likely due to the large standard deviations and non-normal distribution of the sample data. **CONCLUSION:** During a 13-week aerobic dance course, this study was unable to find statistically significant differences in a variety of physiological variables among a group of college age women when compared to a control group. More research is needed to determine if a larger sample size might uncover significant changes and whether these changes are sustained among this group. IRB# 1415-0009

3123 Board #28 June 2 3:30 PM - 5:00 PM
Effects of Hypoxic/Altitude Training on Bone Health in Obese Adolescents under Weight Loss
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PURPOSE: To explore the effects of short-term stimulated hypoxic training or altitude training on body weight, bone mineral content (BMC), bone mineral density (BMD) and bone area (BA) in obese adolescents undergoing dietary weight loss.

METHODS: Forty seven healthy obese adolescents ($BMI=30.82-35.93 \text{ kg/m}^2$) were included in this study. The interventions lasted for four weeks. The plain group (PG, $n=18$) lived in the plain (Shanghai, China) and trained 5 hours every day. The altitude group (AG, $n=11$) lived in real altitude (Duoba, Qinghai, China; 2360m) and trained 5 hours per day. The hypoxic group (HG, $n=18$) slept in simulated 2300m normobaric hypoxia 8-10 hours every night and trained 2 hours in hypoxia and 3 hours in normoxia every day. All groups underwent dietary restriction and the energy intake ranged from 1322 to 2081 kcal/day. Heart rate was monitored every ten minutes during exercise to ensure the intensity was in the target range, which was 40% of the heart rate reserve and determined by the Karvonen equation. BMC, BMD and BA were measured by dual x-ray absorptiometry before and after intervention. A three (PG, AG and HG) by two (Pre and Post) analysis of variance (ANOVA) was used for statistical analysis.

RESULTS: Body weight decreased significantly after four weeks in all three groups (all $p<0.05$). There were significantly more weight reductions in the HG and PG groups than in the AG group (10.18% and 9.34% vs. 7.56%, both $p<0.05$). There was no significant group difference between the HG and PG groups. Total BMC increased significantly in the PG group ($p<0.05$) but not in the HG and AG groups. There were no significant group differences in changes of BMC. Total BMD increased significantly in all 3 groups (all $p<0.05$), but no significant group differences were seen on the BMD changes. Total BA did not change over the 4-week intervention in all groups.

CONCLUSIONS: Four weeks of diet plus plain training, diet plus stimulated hypoxic training and diet plus altitude training resulted in weight loss and similar improvements in BMD. Future studies are needed to identify the health benefits of hypoxic/altitude training for this population. (Supported by NSFC 31471139 and CISSFRF 16-18)

3124 Board #29 June 2 3:30 PM - 5:00 PM
A New Racket Sport That Provokes Similar Heart Rate As Soccer And Basketball In Children
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Physical inactivity often increases during childhood as does the risk for early-onset of lifestyle-related diseases. The development of new sports, if deemed to be of sufficient intensity, may add diversity to the more traditional options in order to promote healthy lifestyles. **PURPOSE:** To compare children's average and maximum heart rate percentage (HRP) while playing a new racket sport with heart rate while playing two traditional sports. **METHODS:** 22 girls and 32 boys (age=10.4±0.1yr; body fat=23.2±1.5%; ht=147.4±0.9cm) played three sports for 25 minutes in a randomized order on different days: Soccer (SC), Basketball (BK) and Spiribol (SP). SP is played inside a 7m-diameter circle separated into two playing areas. A tennis ball attached to 2m of rope is suspended from a 2.2m-high pole in the middle of the circle. The goal of the game is to hit the ball with a racket and be the first to role the rope up the pole. Four SP familiarization sessions were performed prior to the study due to its novelty. Average and maximum HRP was measured with a Polar H7-Bluetooth 4.0. Body fat was measured with bioelectric impedance. A repeated measures ANOVA was used for analysis. **RESULTS:** Average HRP of the three sports were inside the thresholds for being considered healthy activities, although differences ($p<0.05$) were obtained between all of them (SC 80.9±1.3; BK 84.0±1.3; SP 73.4±1.2). However, average HRP in girls was not different between SC (78.3±2) and SP (73.8±2) but both were lower

than BK (83.6±2). In boys, average HRP for SC (83.4±1.5) and BK (84.4±1.6) was not different but both were higher than SP (73.1±1.5). Maximum HRP was similar for SC and BK (93.5±1.1 and 94.7±1, respectively) and both were higher than SP (85.3±1.2). Similar significant differences were observed when maximum HRP was differentiated by gender. **CONCLUSION:** SC and BK both elicit slightly higher HRP compared to SP. However, SP is a new sport that appears to provide heart rate responses within the healthy threshold of intensity for children so it could be a good alternative to traditional sports. In addition, SP can be played in a smaller area that makes it more practical when space is limited. Further research is needed to determine enjoyment and satisfaction levels when playing SP, as well as if more familiarization results in higher average and maximum HRP.

3125 Board #30 June 2 3:30 PM - 5:00 PM
Can a Parental Modeling Physical Activity Intervention Improve Physical Activity and Body Composition in Adults and Young Children
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PURPOSE: This study examined the impact of an 8-week parental modeling physical activity (PA) intervention on parent and child PA and body composition.

METHODS: Twenty-six parents participated in an 8-week PA intervention with their 1 - 5 year old child. The adults were randomly placed into an intervention ($n=19$) or control ($n=7$) group. The intervention group received weekly phone calls with a coach. The coach discussed strategies to change parent and child PA. PA (activity monitor) and body composition (height, weight, and circumferences) were assessed before and after the intervention. Body mass index (BMI) and BMI z-scores were calculated. Time spent in sedentary behavior, light, moderate, and vigorous PA was determined using cut points by Freedson et al. (adult), Trost et al. (1 - 2 year old children), and Butte et al. (3 - 5 year old children). Data analyses were conducted using the intention-to-treat method. A series of 2 (group: control/intervention) X 2 (time: pre/post) ANCOVAs were run to examine the effect of the intervention on PA levels in the parents and children adjusting for wear time. A series of 2 (group: control/intervention) X 2 (time: pre/post) ANOVAs were run to examine the effect of the intervention on body composition (weight, BMI, waist circumference) in the parents and children (BMI z-score). Effect sizes (ES) were calculated and significance was set at $p<0.05$.

RESULTS: Among the parents, group, time, and interaction effects were non-significant for PA levels, weight, BMI, and waist circumference ($p>.05$). ES indicated the intervention group had medium reductions in sedentary behavior (-.57) and increases in vigorous PA (.65), whereas controls had small reductions in sedentary behavior (-.14) and medium reductions in vigorous PA (-.76). Regarding the children's data, the PA levels and BMI z-scores were similar by group and time ($p>.05$). Small decreases in sedentary behavior (-0.18), light (-.21), and mod (-.11) PA were observed in the intervention children, whereas control children had small increases in sedentary behavior (.24), and large decreases in light (-.92) and moderate (-.90) PA.

CONCLUSIONS: A parental modeling PA intervention may have positive effects on parent's and children's PA levels. Supported by: Research/Creative Activity Award, East Carolina University

3126 Board #31 June 2 3:30 PM - 5:00 PM
The Effects of Different Exercise on Chronic Inflammatory Markers in Obese Youth
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PURPOSE: With the increasing number of overweight and obese individuals around the world, it is not only a mental stress to the one who is overweight or obese, but also economic and social burden to the society. It is known to us that the obesity is a chronic inflammatory status, the purpose of this research is aimed to discuss the effects of aerobic and resistance exercise on chronic inflammatory in obese youth by testing some key chronic inflammatory markers.

METHODS: With the diet controlling, 37 volunteers (male-18, female-19) were divided into 2 groups, such as the aerobic exercise (AE, with the intensity of 30%-40% heart rate reserve for 1 hour per day for 4 weeks, 6 days/week by jogging or aerobics) group (male-10, female-10, 21.1±2.0 years, BMI=30.28±2.17) and resistance exercise (RE, with intensity of 80%-90% heart rate for 1 hour per day for 4 weeks, 6 days/week by resistance exercise) group (male-8, female-9, 21.1±1.6 years, BMI=30.10±2.35). The exercise time lasted for 4 weeks and there had three times to take the venous blood samples of the volunteers to test the contents of TNF- α and IL-6 by using ELISA AE the beginning, 4 weeks later and 8 weeks later (the last 4 weeks without diet controlling and exercise).

RESULTS: The body weight of AE and RE groups decreased significantly after 4 weeks, and it maintained AE a low level after 8 weeks (AE: 92.13±13.68 kg to

84.08±11.90 kg, then to 83.86±11.59 kg, RE: 86.68±13.91 kg to 79.79±11.82 kg ($p<0.01$) then to 79.72±12.36 kg). In addition, the body fat rate of the subjects also has the same tendency as the body weight (AE: 38.71±5.79% to 34.21±6.91% ($p<0.01$), then to 33.09±7.42%; RE: 38.84±5.54% to 34.65±6.51%, $p<0.01$, then to 33.99±7.33%). The level of TNF- α decreased significantly after 8 weeks in both groups (AE: 16.29±2.55 ng/ml to 14.93±2.48 ng/ml, RE: 16.60±2.22 ng/ml to 14.13±1.82 ng/ml, $p<0.05$). The contents of IL-6 decreased significantly after 4 weeks, but increased after 8 weeks later.

CONCLUSIONS: Both aerobic and resistance exercise are helpful to lose weight by reducing the body fat. And the chronic inflammatory of the body is inhibited after 4 weeks aerobic and resistance exercise by decreasing the level of TNF- α and IL-6.

3127 Board #32 June 2 3:30 PM - 5:00 PM
School Based Pedometer Intervention: Are Standard Reporting Protocols Masking Potential Benefits In Previously Inactive Subpopulations?

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Intervention outcomes, expressed by mean changes, often overlook variable responsiveness. This may mask some intervention successes. **PURPOSE:** To explore individual variability in children completing a pedometer intervention. **METHODS:** Six schools ($n=152$) were ranked and paired by socio-economic status, with one per pair randomly allocated to a six-week teacher-led pedometer intervention (PI, $n=81$) or control (C, $n=71$). Actigraph GT1M accelerometers assessed physical activity (PA) for 7 days. Evenson cut points identified total daily sedentary (SED), light PA (LPA) and moderate-to-vigorous PA (MVPA) expressed as percentage (%) of total daily wear time. For analysis, a PA return of 480+ mins/d, ≥ 3 school days for pre and post-tests was needed. Mean pre daily MVPA mins were used to categorise subgroups; Non-Achievers <30 (NA1), NA 31-44 (NA2), NA 45-59 (NA3), Achievers >60 (ACH). **RESULTS:** From 84 included participants ($F=60\%$, 9.9 ± 0.3 yrs), no significant differences were found between PI ($n=52$) and C ($n=32$) for increases in % time in MVPA (0.30 ± 0.67 v 0.13 ± 0.29), LPA (2.03 ± 4.63 v -0.05 ± 4.25) and reducing % of SED time (2.33 ± 5.89 v -0.08 ± 5.52). More PI (17 to 27%) than C (16 to 19%) pupils met 60mins/d guidelines. Versus C, two PI groups improved MVPA. The greatest increases were in NA1 (1.52% above C) and $+2.05\pm 2.34\%$ from pre-test. PI-ACH decreased % time in MVPA from pre to post ($-2.75\pm 2.85\%$). All PI subgroups increased % time spent in LPA versus C, with NA2 improving 3.54% above C and PI-NA1 having the greatest improvement ($+3.60\pm 6.37\%$). All PI groups had more favourable SED results; three reducing SED time. The greatest reduction versus C was NA3 (3.95%). The greatest total reduction was in PI-NA1 ($-5.65\pm 7.80\%$). Greater proportions of participants met the 60mins/d guidelines in three PI groups versus C. The largest increase was seen in NA3 (+31%); both ACH groups showed a decline (PI 100 to 67%; C 100 to 40%). **CONCLUSIONS:** Despite no significant overall PI effects versus C, a greater % of participants met the 60mins/d guidelines. PI found clusters of responsiveness. Pre-PI NA benefited most demonstrating positive changes in eight of nine activity outcomes compared to C, maybe at the expense of the most active. While participant numbers are small, they justify examining sub-population variability in subsequent research.

3128 Board #33 June 2 3:30 PM - 5:00 PM
High-intensity Circuit-training Improves Physical Capacity And Cardiometabolic Risk Markers In Overweigh Adolescents

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Introduction: Despite the well-known benefits of exercise training of moderate intensity for improving cardiometabolic health in overweight adolescents, it remains to be determined the extent of benefits provided by high intensity exercise.

Purpose: to evaluate how much a high-intensity circuit-training (HICT) program would change health related fitness and cardiometabolic risk factors in overweight adolescents.

Material and Methods: 18 students (age 16 ± 0.9 yrs and BMI 28.2 ± 0.26) were submitted to HICT program (3 days/week, 1hour/session, for 9 weeks in their school

facilities). Before and after the HICT program, anthropometrics and body composition [body weight (BW), waist circumference (WC), and fat mass (FM) and free fat mass (FFM)], physical fitness (Fitnessgram), blood pressure and fasting biochemical analysis [Glucose (Gluc), low density lipoprotein-cholesterol (LDL-C), triglycerides (TG), alanine aminotransferase (ALT) and aspartate transaminase (AST)] were assessed.

Results: HICT induced significant reductions in BW (77.15 ± 13.01 vs. 75.96 ± 12.35 Kg), WC (93.10 ± 10.43 vs. 90.31 ± 11.66 cm), FM (27.80 ± 6.61 vs. 24.64 ± 6.29 Kg) and an increase in FFM (49.37 ± 9.33 vs. 51.33 ± 9.29 Kg) ($P<0.001$). Both systolic (128 ± 12.7 vs. 117 ± 7.2 mmHg) and diastolic (66 ± 7.8 vs. 62 ± 4.4 mmHg) blood pressure were also significantly reduced ($P<0.001$). Regarding physical fitness, the HICT resulted in a significant improvement in the curl-up (38.1 ± 25.6 vs. 59.5 ± 28.9 rep), push-up (9.7 ± 6.9 vs. 16.5 ± 6.4 rep), horizontal jump (131.3 ± 25.6 vs. 141.3 ± 28.9 cm) and 20m shuttle run test (29.1 ± 11.9 vs. 38.9 ± 6.4 laps) ($P<0.001$). Finally, Gluc (85.9 ± 12.4 vs. 76.8 ± 12.3 mg/dL), LDL-C (151.7 ± 25.8 vs. 93.9 ± 27.8 mg/dL), TG (66.5 ± 21.4 vs. 62.3 ± 23.5 mg/dL), ALT (18.1 ± 5.5 vs. 12.0 ± 4.1 U/L) and AST (18.0 ± 6.5 vs. 13.9 ± 3.1 U/L) were all significantly reduced ($P<0.001$) after the HICT program.

Conclusion: Our results support the notion that a short-term high-intensity circuit-training program improves physical fitness and modulate positively physiological health markers in overweight adolescents.

FUNDING: CIAFEL: European Regional Development Fund through the Operational Competitiveness Programme and FCT (UID/DTP/00617/2013).

Moreira-Gonçalves, D: FCT (SFRH/BPD/90010/2012).

Schmidt, C: CAPES (BEX 0554/14-6).

3129 Board #34 June 2 3:30 PM - 5:00 PM

The Effects Of 6-week Agility Ladder Drills During Recess Intervention On SEBT In School Boys

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PURPOSE: The purpose of this study was to examine the effects of 6-week agility ladder drills during recess time on dynamic balance ability in school boys aged 7-13.

METHODS: Seventy one school boys (9.82 ± 1.90 years; 1.38 ± 0.13 m; 33.28 ± 9.64 kg; BMI 17.25 ± 3.18 kg m⁻²) were assigned randomly into a control ($n = 37$) and experimental ($n = 34$) groups. The experimental group performed 3 agility ladder training sessions per week for 6 weeks. Each training session included six sets of the training programme which consisted of 6 exercises in the order of side jump, in and out, hopscotch, left and right leg hop, and icky shuttle, with 30 seconds rest between each set. Both groups were assessed using Star Excursion Balance Test (SEBT) before and after 6-week recess intervention.

RESULTS: A statistically significant increase in post-training SEBT scores from 6.2% to 19.1% was seen in all directions for the experimental group, with a score that was better than the control group for both limbs. Repeated measure ANOVA revealed a significant main effect for time was observed on the three normalised reach distances of left limb, $F(1, 69) = 2.054$, $p = .000$; partial $\eta^2 = .305$; three normalised reach distances of right limb, $F(1, 69) = 2.054$, $p = .000$; partial $\eta^2 = .313$; and six normalised reach distances of both right and left limbs, $F(1, 69) = 2.054$, $p = .000$; partial $\eta^2 = .305$. There was no statistically significant interaction effect between time and group (control and experimental group) on the three composited distances of left limb, $F(1, 69) = 2.054$, $p = .156$; partial $\eta^2 = .029$; three normalised reach distances of right limb, $F(1, 69) = 1.825$, $p = .181$; partial $\eta^2 = .026$; and six normalised reach distances of both right and left limbs, $F(1, 69) = 2.054$, $p = .000$; partial $\eta^2 = .305$.

CONCLUSIONS: The dynamic balance ability of the school boys was significantly enhanced in 6-week agility ladder drills training after recess intervention.

3130 Board #35 June 2 3:30 PM - 5:00 PM

The Influence Of Contextual Factors On Recess Physical Activity Among Elementary School Children

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PURPOSE: Childhood obesity remains a major public health concern in the United States. Physical activity (PA) opportunities, particularly within the school day, can prove particularly potent in attenuating childhood obesity etiology. Given the rapid decline in physical education in elementary schools, school recess has increasingly become a vital unstructured time during the school day that may facilitate positive behavior change and maximize opportunities for PA. However, the child characteristics and contextual/environmental factors that may influence engagement in PA during recess are unclear. Therefore, the aims of the present study were: (1) assess the

relationship between sex, weight status, and PA during recess; and (2) determine the influence of recess duration (15min vs. 30min) and timing (i.e., before lunch vs. after lunch) on recess PA, following adjustment of individual factors.

METHODS: Children in fourth and fifth grade (N=151, 91 females) were recruited from two public suburban schools in the Midwest. PA during recess was measured using accelerometry (ActiGraph WGT3x+) over five days. Height and weight measurements were used to determine BMI (kg/m²). Recess was offered either prior to or immediately following lunch in each school, for 15 or 30 minutes, respectively.

RESULTS: A negative relationship was found between BMI and vigorous PA ($r=-.207$, $p=.02$), as well as step count ($r=-.178$, $p=.05$). Further, sex was negatively correlated with MVPA ($r=-.315$, $p=.00$ [male=0, female=1]). Significant interaction effects for PA were found between recess timing and recess duration ($F = 11.68$, $p = .00$) whereby for children who had a longer recess duration, scheduling recess after lunch yielded the greatest MVPA. In contrast, for children in the shorter recess group, MVPA was significantly lower when recess was scheduled after lunch rather than beforehand. These interactions persisted even after adjusting for sex and BMI.

CONCLUSION: These findings reveal that individual and contextual factors such as recess timing and duration may influence the level of activity during recess; longer recess periods may yield greater MVPA outcomes when scheduled after lunch. Future experimental research is warranted to determine whether modification of these variables improves children's PA in the school setting.

3131 Board #38 June 2 3:30 PM - 5:00 PM

Geographic Variances in Achieved Moderate-to-Vigorous Physical Activity Within a Structured Afterschool Program

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PURPOSE: The afterschool time has been identified as an important opportunity for achieving moderate-to-vigorous physical activity (MVPA) for children. For children's health, afterschool physical activity programs should be structured to yield maximal MVPA minutes. The purpose of this study was to examine the differences in the average MVPA during 30-minute period using a structured program design among children who participated at four different geographic locations. **METHODS:** Data was collected from a total of 2963 children who participated in a 30-minute after-school physical activity program (i.e., Active Science) in multiple YMCAs in the following regions: New England (n=688, male n=285, age M= 9.73 ± 0.63), Mid-Atlantic (n=758, male n=432, age M= 9.04 ± 0.98), Midwest (n=711, male n=339, age M=8.18 ± 0.51) and Southeast (n=806, male n=396, age M= 8.83 ± 1.59). Children wore accelerometers to track their MVPA during the program time. **RESULT:** The average time and standard deviation of MVPA for New England, Mid-Atlantic, Midwest, and Southeast were M=12.97 ± .39, M=10.605 ± .58 M=13.585 ± .72, M=8.355 ± .60 respectively. ANOVA showed that there were significant differences between the regions, $F(3,2959)=115.68$, $p \leq .001$. Post Hoc Test showed that New England and Midwest were significantly higher in MVPA than the Southeast $p \leq .001$ and Mid Atlantic $p < .01$. There was no significant difference between New England and the Midwest. **CONCLUSION:** Children participating in a standardized afterschool program at different geographic locations can obtain significantly different MVPA. While further research is needed to determine the causation of these geographical differences, the findings emphasize that the quality of program implementation (e.g., program strategies) should be considered in addition to the quantity of the program (e.g., program time). Regardless, afterschool physical activity programs should continue to focus on improving MVPA.

3132 Board #37 June 2 3:30 PM - 5:00 PM

The Correlation of Parental Support in Primary School Children Obesity and Physical Activity

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(No relationships reported)

PURPOSE: The aim of this study was to determine the correlation of parental support between obesity and physical activity in primary school children.

METHODS: All data was collected from '2009 Taipei City School Children Physical and Mental Health Survey' in present study. We extracted the data from sixth grade students as analyze sample. The grouping criterion of parental support to exercise is whether the parents take children to exercise outside every week. The differences between two groups are analyzed by age-adjusted ANCOVA, Chi-square test and multivariate logistic regression analysis. Age-adjusted ANCOVA was used to determine the differences of anthropometric data, including weight, height, body mass index (BMI), waist circumference, hip circumference and waist-to-hip ratio (WHR). Chi-square test and age-adjust multivariate logistic regression analysis were used to analyze the proportion differences in children obesity, exercise partner choice preference. The statistical significant level was defined as $\alpha = 0.05$.

RESULTS: Children in the parent-support group had significantly lower height, weight, BMI, waist circumference, WHR and screen time compared to parent-non-support group ($p < .05$). Compared to the children in parent-support group, the children in parent-non-support group had higher proportion of obesity ($p=0.6$), proportion of finding exercise partner was 11.8% lower ($p < .05$). The proportion of children won't do exercise without partner was also 11.3% higher than those children in parent-support group ($p < .05$). Furthermore, the proportion of accumulating exercise time below 210 minutes per week was 2 % higher in parent-non-support group ($p < .05$). Moreover, the proportion of the obese parents was also noticeably higher in parent-non-support group.

CONCLUSIONS: Parental support is an important factor which affects children obesity status and physical activity. More importantly, the parents' obesity prevalence will affect whether they support their children to exercise or not. Our results suggest that parental participation and parental weight management may be included in the strategy of children obesity prevention.

3133 Board #38 June 2 3:30 PM - 5:00 PM

Association between Physical Activity Self-efficacy and Physical Activity Engagement in Chinese College Students

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Physical activity self-efficacy has been considered as an important correlate of physical activity behaviors. However, evidence on association between physical activity-related self-efficacy with different domains and physical activity engagement is still limited.

PURPOSE: To investigate the association between physical activity self-efficacy for learning efficiency, physical fitness, psychological functioning, and overall health status and physical activity engagement in college students. **METHODS:** This cross-sectional study was comprised of 1,836 college students (1,138 males, 698 females) in China. Physical activity engagement and physical activity self-efficacy were assessed by a self-administered questionnaire. For physical activity engagement assessment, the duration of physical activity in each physical activity participation was divided into four categories as follows: <20, 20-40, 40-60, and >60 minutes; and the frequency of physical activity was divided into six categories as follows: 0, 1, 2, 3, 4, and >5 times/week. Furthermore, physical activity self-efficacy for learning efficiency, physical fitness, psychological functioning, and overall health status was evaluated by five scales (1-5) from "not effective" to "effective". Higher scores indicate higher levels of physical activity self-efficacy. The association between physical activity self-efficacy and physical activity engagement was examined using chi-squared test. **RESULTS:** In male students, participants with higher physical activity self-efficacy for learning efficiency (P for trend = 0.006), physical fitness (P for trend = 0.006), psychological functioning (P for trend < 0.001), and overall health status (P for trend = 0.023) tended to have higher frequency of physical activity engagement. These findings were also observed in association between physical activity self-efficacy and duration of physical activity engagement (P for trend < 0.05 for all). Similarly, physical activity self-efficacy was also significantly associated with physical activity engagement in female students. **CONCLUSION:** This study indicates that higher physical activity self-efficacy is associated with higher physical activity engagement in Chinese college students. Prospective studies are warranted to confirm these findings.

3134 Board #39 June 2 3:30 PM - 5:00 PM

The Differentiation Effect of College Students' Status on Physical Activity and Psychosocial Perception

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An increasing number of young adults with physically vulnerable conditions are entering college each year (Maslow et al. 2011). Since only 50.4% of college students meet the physical activity (PA) recommendation, it is essential to find out the differences of college students who are healthy and who are vulnerable.

PURPOSE: This study is to examine the difference of PA behaviors (i.e. intensity, frequency, and time) and psychosocial perceptions (i.e. attitude, subjective norm, perceived behavioral control, and intention) among college students (healthy group vs. vulnerable group).

METHODS: A cross-sectional design was used and total 684 college students were recruited from five universities in Shanghai, China. There were 451 students in healthy group (67% were female, $M_{age} = 19.3 \pm 1.0$) and 234 students were in vulnerable group (71% were female, $M_{age} = 19.47 \pm 1.0$). Students were identified as vulnerable by certified physicians [i.e., specific diseases (49.6%), short-term injury (29.9%), physical weaknesses (18.8%), and disabilities (1.7%)]. All participants completed a validated questionnaire assessing their attitude, subjective norm, perceived behavioral control and intention (Hagger et al., 2007), and PA behaviors including intensive, time, frequency and overall PA (Yu et al., 2013).

RESULTS: A descriptive discriminant analysis (Hubery, 1994) revealed that the four subgroups (gender x group) differences accounted for 19% of the variance among the eight variables, and males in healthy group were significantly different from the other three subgroups. Among those, intensity (88.9%) and time (27%) in PA behaviors, and intention (15.4%) and attitude (4.7%) in psychosocial perceptions emerged as the promising dominant contributors to the group differences.

CONCLUSIONS: Consistently with previous studies, males in healthy group more likely participate in intensive PA and persist longer than other subgroups, and they have more positive attitude and intention to engage in PA. Colleges need to focus on PA interventions among females on both conditions and males with vulnerable conditions.

3135 Board #40 June 2 3:30 PM - 5:00 PM
Using Theory of Planned Behavior to Examine Chinese Adolescents' Moderate and Vigorous Physical Activities

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In China, academic excellence is often considered the most important indicator of success in adolescents, while physical activity (PA) is often discouraged because it drains energy and garn time away from academic study (Yu et al., 2006). However, recent research has indicated vigorous PA (VPA) rather than moderate PA (MPA), emerges as the significant predictor of cardiovascular health, as well as a protective factor against mental health complaints (Gerber et al., 2014). The theory of planned behavior (TPB; Ajzen, 1985) is a prominent theoretical model that examines the antecedents (i.e., attitude, subjective norm, perceived behavioral control, and behavioral intention) of planned behaviors such as PA. As such, research has indicated higher VPA demonstrated higher behavioral intention, while higher MPA demonstrated lower behavioral intention in Western cultures (Rhodes & de Bruijn, 2010). **PURPOSE:** To test the measurement and structural parameters of the TPB among a sample of Chinese adolescents in a MPA and a VPA context. **METHODS:** Participants were 219 ninth grade students (53% female, $M_{age} = 16.33 \pm .55$) from three high schools in Zhengzhou, China. Participants completed validated questionnaires that assessed their attitudes, subjective norms, perceived behavioral control, behavioral intention, and self-reported MPA and VPA behaviors. **RESULTS:** Correlation analyses revealed a pattern of positive relationships among the study variables. Confirmatory factor analyses and structural equation models revealed good-fitting models within both the MPA model ($\chi^2 [84] = 180.77, p > .01, CFI = .94, RMSEA = .07, SRMR = .06$) and VPA model ($\chi^2 [84] = 189.37, p > .01, CFI = .93, RMSEA = .08, SRMR = .06$). Standardized path coefficients indicated attitude ($\gamma = .15$), subjective norm ($\gamma = .18$), and perceived behavioral control ($\gamma = .46$) were significantly positively associated with behavioral intention ($p < .01$). In addition, standardized path coefficients indicated behavioral intention was significantly positively associated with VPA ($\beta = .23, p < .01$), but not MPA ($\beta = .04, p = .55$). **CONCLUSION:** This study further supported the heightened relationship between behavioral intention and VPA in Chinese adolescents. Thus, the findings highlighted the importance of enhancing TPB constructs to foster VPA in Chinese adolescents.

3136 Board #41 June 2 3:30 PM - 5:00 PM
The Effects of Resistance Training Programs on the Physical Self-Perceptions of College Females

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While it is generally accepted that exercise enhances physical self-perceptions (PSPs), the impact of resistance training programs on females' self-perceptions is unclear. Because exercise is an important public health behavior, and because PSPs have motivational associations, research on this topic may have important implications for exercise promotion. **PURPOSE:** To investigate the effects of two different types of resistance training programs on the PSPs of college age females. **METHODS:** College students with no background in resistance training ($n = 20$) were randomized to a muscular strength (MSTR $n = 10$), or a muscular endurance (MEND $n = 10$) resistance training group. A comparison (COM) group ($n = 10$) was recruited from inactive college students. The resistance training groups followed strength- or endurance-oriented progressive resistance training programs for nine weeks. Participants completed the Physical Self-Perception Profile (PSPP) pre- and post-intervention. Height, weight, skinfolds and circumference measurements were also taken pre and post. **RESULTS:** Analyses utilized ANCOVAs followed by Bonferroni-adjusted (p set at $< .017$) pairwise comparisons. The only physical change was a significant reduction in the sum of skinfolds in the MSTR group ($p = 0.013$). Analyses of PSPP changes showed significant effects for MSTR on the physical condition subscale ($p = 0.004$,

and on the strength competence subscale ($p = 0.015$) and a near-significant effect on the attractive body adequacy subscale ($p = 0.018$) that may be practically significant. **CONCLUSION:** Strength-oriented resistance training produced improvements in some aspects of college females' physical self-perceptions.

3137 Board #42 June 2 3:30 PM - 5:00 PM
Family Factors Associated with Physical Activity and Sedentary Time in Children Living in Puerto Rico

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PURPOSE: The purpose of this study was to examine associations among parental perceptions of their children's skills and participation in physical activity (PA) and parental intentions of changing health behaviors with objectively measured PA in Puerto Rican children. **METHODS:** Seventy-three children (mean±SD; age, 8.9±1.3 yrs; BMI 33.1±10.4 kg·m⁻²) wore an ActiGraph GT3X accelerometer on their right hip for seven days to estimate time spent in sedentary behaviors (SB), light (LPA) and moderate-to-vigorous (MVPA) PA, and total activity counts for the vertical axis (TAC_{va}) and vector magnitude (TAC_{vm}). Children also completed a motor proficiency test (MPT), a sit-up test (SUT), and sum of skinfolds (SOS) from two sites (triceps and sub-scapular) was obtained. Parents completed questions on their perceptions (PP) of their child's abilities and parental intentions (PI) to modify family health related behaviors. Partial correlations, controlling for accelerometer wear time, were used to examine relationships between PP, PI, MPT, SOS and SUT, with time spent in SB, LPA, MVPA, and TAC_{va} and TAC_{vm}. **RESULTS:** Significant differences were found between boys and girls for time spent in SB (239.3±74.6 vs. 296.2±128.4, respectively, $p=0.024$), and MVPA (126.4±40.7 vs. 85.7±42.3, respectively, $p<0.001$). In girls, PP of child's speed while running was associated with TAC_{va} ($r=0.43$) and TAC_{vm} ($r=0.39, p<0.05$). PP of how eating behaviors of the family influence eating habits of their children was correlated with SB ($r=0.43$), MVPA ($r=0.41$), TAC_{va} ($r=0.50$), and TAC_{vm} ($r=0.52$; all $p<0.01$). PI of limiting the amount of sweetened beverages was correlated with SB ($r=0.47$) and TAC_{vm} ($r=0.37$; all $p<0.05$). In boys, MVPA and TAC_{va} were negatively correlated with SOS ($r=-0.38$ and -0.35 , respectively; $p<0.01$). MVPA was positively correlated with PI to engage in 30-min of PA at least 5 d/wk. ($r=0.36, p<0.05$). TAC_{vm} was positively correlated with parental report of age that their child first walked without support ($r=0.36, p<0.05$). **CONCLUSIONS:** Several modifiable factors related to PP and PI are related to time spent in SB and PA in Puerto Rican children. Parents with intentions to positively make changes in behaviors could affect positively impact time spent in PA.

3138 Board #43 June 2 3:30 PM - 5:00 PM
Physical Activity Level Increase Follow Up Health Educational Program In Overweight And Obese Children: Pilot Study

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PURPOSE: This study aimed to investigate the impact of a Health Educational Program for Children at 5 days of Camp and 12weeks follow up on the physical activity level (PAL) and sedentary behaviour (SB) in overweight and obesity children. **METHODS:** Health Educational Program for Children (HEPchild) designed for children who are overweight or obese and was divided into two phases: The first phase (PHASE 1) consisted of pré assessments and five-day camp (CAMP); and PHASE 2 corresponded to the 3 months follow-up, and a post follow-up assessments. Thus, the sample that attended the PHASE 1 was 20 children (9.4 ± 1.1 years; 9 boys: 10.2 ± 0.9 years; 11 girls: 9.2 ± 1.3 years), 5-days summer camp on a farmplace to develop educational, with interdisciplinary team (Physical Educator, Endocrinologist, Psychologist, Educator and Nutritionist). The Phase 2 children and family's were followed for 3 months (a weekly meeting for two hours in a total of 12 meetings). The end of the study composed by 12 children (8 girls and 4 boys, 9.4 ± 0.96 years), who completed 75% of the meetings. To check the PAL and the SB was applied the questionnaire proposed by Militão et al. (2013) and analyzed physical activity level at sports, in leisure time during the week, level in leisure time during weekend, moving to and at school, sedentary behavior during the week and weekend. **RESULTS:** After FO 25% of children remained more active (> 1500 and <3000METs per week) in comparison to before CAMP. In contrast the amount of sedentary children (<600METs week) decreased by 15% and the insufficiently active (600 at 1500METs per week) increased by 15%. No child was classified as very active (> 3000METs per week) in any time. The PAL leisure time during the week and during the weekend significant

increase, 26.06% and 14, 1%, respectively, when comparing to pre CAMP and 12 weeks of follow-up. SB during the week and the weekend showed a significant mean reduction of 177.14 and 41.43 minutes respectively.

CONCLUSIONS: The Health Educational Program for Children contributed to the increase in physical activity level and reduced sedentary behaviour in overweight and obese children.

3139 Board #44 June 2 3:30 PM - 5:00 PM
Feasibility and Acceptability of Implementing Physical Activity Programs at a Residential Center for High-Risk Youth

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With increased health concerns among youth, establishing a healthy lifestyle at young ages is prudent. Even more, youth exposed to adverse experiences face compounded risks for health concerns; it is essential to equip caregivers and youth with tools to reduce risks. Well-established physical activity (PA) programs may be such a tool. **PURPOSE:** To determine feasibility and acceptability of implementing a group PA program at a care facility for high-risk youth, and success of reaching ACSM's moderate-vigorous physical activity (MVPA) guidelines. **METHODS:** Group exercise programs were implemented at a high-risk care facility for two summers. Activities of appropriate METs from Addendum of PA for Children were employed 3 days/week, 60 min/day, and aimed to keep all youth engaged throughout program duration. MVPA-momentary time sampling, 20-m dash tests for VO₂max estimation, and staff interviews were conducted. **RESULTS:** MVPA assessments indicated program success in engaging 34 of 37 children in ACSM's recommended PA guidelines throughout the duration of the program. Estimated maximal exercise capacity increased from pre- to post-program (9.7 ± 0.5 vs 11.0 ± 0.5 MET, $p = 0.047$). Qualitative interviews with staff indicated 100% acceptance rate and desirability of program return, and 80% of staff stated non-elicited, agreed-upon program outcomes for participants: reduced bickering, aggravation of peers, and sedentary time; and increased positive behaviors, state of calm, sleep patterns, desirability of participation in activities, and appetites. Identified components of program success were group- and individual-based mindsets, full participation of staff, and structure and consistency. **CONCLUSION:** Findings endorse feasibility and acceptability of establishing structured group MVPA programs in care facilities for youth, in addition to enhancing well-being outcomes for participants. Rigorous involvement in determining benefit of PA programs among this population is needed to justify work in providing refined, structured exercise programs to residential settings; doing so may provide an impactful tool for the care and well-being of these individuals.

Note: informed assent and consent forms were obtained for each participant. Supported by Washington State University.

3140 Board #45 June 2 3:30 PM - 5:00 PM
Examining The Relationship Between High School Physical Education With Current Fitness Outcomes In College Students

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Physical education during K-12 can positively impact fitness outcomes, though the transition to college often leads to a decline in regular physical activity (PA) participation. The impact of high school PE on fitness outcomes and PA participation in college is unclear. **PURPOSE:** To examine how PE experience in high school was related to fitness and PA outcomes among college students. **METHODS:** Participants were college student volunteers ($n=537$) that completed a fitness assessment and online survey. Aerobic fitness (YMCA cycle ergometer protocol), muscular endurance (push-up and curl-up tests), body composition (BMI and bioelectrical impedance) and blood lipids were assessed. The survey assessed participant demographics, current PA, and PE outcomes (number of semesters of PE in high school, PE enjoyment, taking PE when not required). All analyses were conducted separately for males and females. Pearson correlations examined the relationships between the fitness, behavioral and PE outcomes. Independent t-tests and ANOVAs were examined differences in fitness and behavioral outcomes by PE outcomes. **RESULTS:** The final sample was 56.6% male ($n=298$) and 43.4% female ($n=227$). Among males, PE enjoyment was related to VO₂max ($p=.04$), curl ups ($p=.03$), and PA ($p=.02$). Number of semesters of PE in high school was negatively associated with triglycerides ($p=.01$) and total cholesterol ($p=.02$) and positively associated with moderate physical activity ($p=.02$). Males who took PE when it wasn't required were more vigorously active ($p=.02$) than those who did not. Among females, number of semesters of PE in high school was negatively associated with triglycerides ($p=.004$) and total cholesterol ($p=.02$). PE enjoyment

was positively associated with VO₂max ($p=.04$) and push-ups ($p=.03$). Females who took PE when it wasn't required had a higher VO₂max ($p=.04$) and vigorous physical activity ($p=.03$) compared with those who did not. **CONCLUSIONS:** PE experience in high school is related to fitness and behavioral outcomes during college years, with different relationships for males and females. Enjoyment of PE should be examined further for long-term impact. PE programming and policy has the potential to impact health and behavior in later life stages and has implications for lifelong wellness.

3141 Board #46 June 2 3:30 PM - 5:00 PM
Sport And Physical Activity Lesson Participation And Health-related Variables In Low-income Youth

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Youth sports participation is positively associated with several psychosocial variables. Minimal research is available on associations between sports team and physical activity lesson (S/PA) participation and health-related outcomes. The benefits of S/PA may be particularly salient in low-income youth, who report low levels of physical activity, lower quality of life, and poor diet. **PURPOSE:** To explore the relationship between S/PA participation and physical activity, diet, and health-related quality of life (QoL) in low-income youth. **METHODS:** A sample of students ($N=754$, 10.4 ± 1.0 y; 53% males; 56.2% black, 30.1% multi-racial/other, 13.7% white; 44.0% overweight) completed a survey including the Physical Activity Questionnaire for Children (PAQ-C; 9 items, max 5), KidsScreen-27 (psychological, peer-, and parent-related dimensions, max 100), and School Physical Activity and Nutrition Survey (SPAN; 25 items, max 3 per item). Single items described fruit and vegetable intake, and a junk food index was calculated (6 items, max 18). Participants self-reported S/PA participation (sports teams and/or dance/martial arts class) during the last year. Height and weight were measured to determine body mass index. One-way ANOVA was used to determine if physical activity, diet, or health-related QoL differed among S/PA participants and non-participants. **RESULTS:** Approximately 59% of youth participated in at least one S/PA. Physical activity ($F(2,751)=15.011$, $p<0.05$), fruit intake ($F(2,746)=4.933$, $p<0.05$), parent-related QoL ($F(2,749)=10.413$, $p<0.05$), and peer-related QoL ($F(2,747)=6.170$, $p<0.05$) were higher in S/PA participants compared to non-participants. However, junk food intake was higher in S/PA participants compared to non-participants ($F(2,746)=6.490$, $p<0.05$). **CONCLUSIONS:** In this sample, S/PA participation was associated with higher physical activity, fruit intake, and peer- and parent-related QoL. Our findings support previous research in a similar population of youth sport participants who had healthier dietary behaviors than non-participants. Our finding that junk food intake was higher in S/PA participants could be explained by time constraints and/or the belief that junk food consumption is acceptable as a result of being physically active.

Funded by: Crim Fitness Foundation

3142 Board #47 June 2 3:30 PM - 5:00 PM
The Effects of Different Types of Exercise on Chinese College Students' Energy Expenditure

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Purpose: To examine the effect of light physical activity (LPA), moderate PA (MPA), vigorous PA (VPA), and active video games (AVGs) on college students' energy expenditure (EE). Gender differences in EE were also investigated.

Methods: Twenty-four college students (12 males; $M_{age} = 23.5$, $SD = \pm 1.06$) completed four separate 10-minute exercise sessions on LPA (treadmill walking at 3.0 kph), MPA (treadmill walking at 5.0 kph), VPA (treadmill running at 7.0 kph), and AVGs (Xbox 360 Kinect Just Dance play) in a highly controlled laboratory. EE (total calories) was objectively measured by ActiGraph accelerometers.

Results: Repeated-measures ANOVA revealed significant differences in EE across different exercise sessions [$F(1, 23) = 160.1$, $p < .01$, $\eta^2 = 0.88$]. In detail, VPA ($M_{EE} = 75.25$, $SD = 35.12$) yielded significantly higher EE than LPA and AVGs ($p < .01$). Similarly, MPA ($M_{EE} = 70.74$, $SD = 28.77$) triggered significantly greater EE than LPA and AVGs ($p < .01$). LPA ($M_{EE} = 30.04$, $SD = 13.38$) generated significantly higher EE than AVGs ($M_{EE} = 21.16$, $SD = 18.59$) ($p < .01$). Notably, no significant EE difference emerged between VPA and MPA ($p > .05$). In addition, independent t-tests indicated that males burned more calories than females in LPA ($M_{EE} 38.65$ vs. 21.42 , $p < .001$), MPA ($M_{EE} 84.49$ vs. 57.00 , $p < .01$), and VPA ($M_{EE} 100.74$ vs. 49.76 , $p < .001$). No significant gender difference in EE during AVGs play ($M_{EE} 23.58$ vs. 18.74 , $p > .05$).

Conclusion: Findings suggest that a 10-minute exercise session in treadmill running at 7.0 kph has the highest EE, followed by treadmill walking at 5.0 kph, 3.0 kph, and

AVGs in college students. Additionally, calories burned during treadmill walking at 5.0 kph is roughly equivalent to the energy cost of treadmill running at 7.0 kph. Notably, calories burned during AVGs play has not yet reached the light-intensity physical activity level of slow treadmill walking. It is plausible that the novelty of AVGs led to the low intensity of AVGs play. Lastly, males tend to expend more calories than females during treadmill walking/running but no significant EE difference was observed between genders during AVGs play. Future study may offer AVGs training tutorial prior to experiments to elicit greater EE.

3143 Board #48 June 2 3:30 PM - 5:00 PM

Physical Activity Self-efficacy As A Predictor Of Achieving MVPA Guidelines In University Students

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Few studies have examined characteristics associated with physical activity levels in university students seeking weight loss treatment, though it has been shown that physical activity is associated with weight loss in interventions with general adult populations. Understanding the characteristics predicting university students' achievement of moderate- to- vigorous physical activity (MVPA) could better inform interventions designed to increase physical activity. **PURPOSE:** To identify predictors of meeting MVPA guidelines among university students enrolled in an intervention aimed at attaining or maintaining a healthy body weight. **METHODS:** At 2 campuses, 128 university students (66% female; mean age=21.6, SD=3.1; mean BMI=31.6 kg/m², SD=3.7) completed demographic questions, the International Physical Activity Questionnaire (IPAQ), and physical activity self-efficacy at baseline. MVPA was calculated for each participant based on the days and minutes of self-reported activity, with meeting guidelines defined as 150 minutes/week of combined MVPA. **RESULTS:** A higher percentage of males met the MVPA guidelines (73%) compared to females (58%) and published national averages (49%). Logistic regressions revealed that PA-SE ($p < 0.05$) was a significant predictor of meeting MVPA guidelines, while age, BMI, gender and race/ethnicity were not significant. No significant male/female differences in PA-SE were found. However, physical activity self-efficacy was a moderately strong predictor of achieving MVPA for both females (OR=2.22, $p < 0.05$) and males (OR=3.99, $p = 0.15$), although not statistically significant for males. **CONCLUSION:** Higher levels of physical activity self-efficacy appear to be substantially associated with the likelihood of whether or not female university students achieved MVPA guidelines, while no other demographic variables usually associated with MVPA levels were significant. Further examination is needed to determine if the effects of physical activity self-efficacy on meeting MVPA guidelines that were found here are causal and could therefore suggest different behavioral treatment strategies for the promotion of MVPA in male and female university students.

Supported by: NIH Grant R01DK100916

3144 Board #49 June 2 3:30 PM - 5:00 PM

Household Support for Physical Activity in Adolescent Girls Recruited from Lower SES Neighborhoods

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Tangible (e.g. adult facilitation) and intangible (e.g. encouragement) forms of support for physical activity engagement could be an important contributor of physical activity engagement for adolescent girls from low socioeconomic status (SES) households. However, limited research has examined associations between household support and physical activity in this population. **PURPOSE:** The purpose of this study was to examine the association between the perception of household support and physical activity levels of adolescent girls recruited from low SES neighborhoods. **METHODS:** Thirty-six girls, between the ages of 13-17 years, were recruited from lower SES neighborhoods. A trained researcher took participants' height and weight and administered two questionnaires to assess: (1) household support for physical activity (including support from the adult in the household the participant perceived themselves as being closest with and each additional adult in the household); and (2) minutes per day in moderate-to-vigorous physical activity (using the 3-Day Physical Activity Recall). Participants also reported their perception of barriers and facilitators of physical activity. **RESULTS:** Participants (N=36; 60% non-Hispanic black) had a median age of 14.9 [13.8, 15.9] and median BMI percentile of 90.5 [58.5, 97.0]. Total support ($r = 0.221$; $p = 0.224$), tangible support ($r = 0.126$; $p = 0.492$), and intangible support ($r = 0.197$; $p = 0.174$) from the closest adult in the household

was positively associated with physical activity but these results were not statistically significant (adjusted for age, BMI, and race/ethnicity). There were significant negative associations between BMI and both total adult household support for physical activity ($r = -0.514$; $p = 0.001$) and the support provided by the closest adult in the household ($r = -0.553$; $p < 0.001$). The most frequently reported facilitator of physical activity was support from family and friends ($n = 15$; 42%). **CONCLUSIONS:** While household support for physical activity was not significantly associated with measured physical activity, there was a significant negative association between BMI and household support for physical activity. This suggests adolescents with a higher BMI receive less support for physical activity, which may warrant further investigation.

3145 Board #50 June 2 3:30 PM - 5:00 PM

Girl Scout Troop Meeting Time-segmented Patterns Of Physical Activity Driven By Task.

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Fewer than half of children are currently meeting recommended physical activity (PA) guidelines of at least 60 minutes of moderate-to-vigorous physical activity (MVPA) per day, with fewer girls than boys meeting guidelines. Girl Scouts (GS) is a potential target setting for increasing PA in girls, though little is known about the time-segmented patterns of PA and the systemic drivers of these patterns during troop meetings. **Purpose:** To determine the microsystem influences on GS troop meeting time-segmented patterns of PA. **Methods:** Girl Scout Troop leaders (troop $n = 7$) were randomized to receive an intervention training on implementing policies to promote physical activity and healthy eating or a standard control. Meetings (7 meetings/troop) were observed and girls in attendance ($n = 76$, 9-13 years old, mean \pm SD = 10.51 \pm 1.19 years) wore GTIM accelerometers. Two observers attended each meeting and recorded the start and stop point of time segments based on task (i.e., opening-closing, snack, active recreation [AR], Girl Scout curriculum [GSC]). The time-segmented episode accelerometer data were analyzed using Evenson cut-points. **Results:** A total of 182 time segments were observed (mean/day \pm SD = 3.77 \pm 1.24) with 24 AR (0.47 \pm 0.58), 63 GSC (1.31 \pm 0.80), 54 opening-closing (1.13 \pm 0.94), and 41 snack (0.85 \pm 0.58) segments. Mixed random effect models indicated treatment troops had significantly more AR segments per day (mean/day \pm SD = 0.89 \pm 0.12) than control troops (0.18 \pm 0.10). A significantly greater ($p < 0.01$) percentage of time was spent in MVPA during AR (mean \pm SE = 17.19 \pm 1.11%) compared to GSC (0.39 \pm 0.81%), opening-closing (3.22 \pm 1.06%), and snack (0.61 \pm 0.87%). A significantly greater percentage of time ($p < 0.01$) was spent in MVPA during opening-closing segments compared to GSC and snack. A significantly greater ($p < 0.01$) percentage of time was spent sedentary/inactive in GSC (67.9 \pm 3.6%) compared to AR (32.26 \pm 4.1%) and open-closing (55.28 \pm 3.66%), and during snack (72.2 \pm 3.6%) compared to open-closing and AR. **Conclusion:** Troop meeting time-segmented patterns of physical activity were influenced by task. Intervention leaders devoted more time segments to AR than control leaders. Adding time segments conducive to PA to GS troop meeting could increase the percentage of time spent in MVPA.

3146 Board #51 June 2 3:30 PM - 5:00 PM

Parental Support for Physical Activity and Sedentary Behavior among Chinese Schoolchildren

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Physical activity is essential for the development of children and adolescents. Among different social and environmental factors, parental support plays important role on influencing young people's physical activity. However, the associations between different kinds of parental support and physical activity among Chinese children and adolescents have not been explored thoroughly with a large size of samples. **PURPOSE:** To explore the roles of different kinds of parental support (encouragement, accompany, financial support and model) on influencing moderate-to-vigorous physical activity (MVPA) and sedentary behavior (SED) among Chinese school-aged children. **METHODS:** The data used in analyses derived from the Physical Activity and Health of Children and Adolescents Survey 2015 in Shanghai, China. 78516 students (grade 1-12) from all 17 districts of Shanghai, representing 5% of the population of schoolchildren, were randomly selected to participate in the self-report questionnaire survey. Finally, the present study contains 61429 participants (girl 49.3%, mean age 11.77 years). Descriptive statistics and logistical regression were used to examine the associations between MVPA, SED and various kinds of parental support by gender. **RESULTS:** Compared to the low parental support groups, young people in high encouragement, accompany, financial support, and model (the highest among four factors) (boy: OR=1.60, 95% CI: 1.52-1.69; girl: OR=1.63,

95% CI: 1.54-1.73) groups are more likely to being at least 1h MVPA daily. On the contrary, compared to the high parental support groups, young people in low accompany and model groups are more likely to being at least 2h SED daily during both weekdays and weekend. **CONCLUSIONS:** Various kinds of parental support have influence in schoolchildren for them to be physically active regardless the gender. Parents as the model and parental accompany have the biggest influence for youth being active. This study suggests that efforts should be focused on parents and their behavior when design and implement interventions aiming to promote young people's physical activity. Supported by Shanghai Shuguang Program (14SG46), Shanghai Pujiang Program (16PJC075), and Science and Technology Commission of Shanghai Municipality (16080503400).

3147 Board #52 June 2 3:30 PM - 5:00 PM
Effects Of School-based Intervention Program Of Exercise And Nutritional Counseling On Metabolic Markers (Ghrelin, Leptin, Insulin) In School-aged Obese Adolescents from Monterrey México

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Studies show that energy imbalances cause the generation of obesity, metabolic markers play a fundamental role in the promotion and inhibition of satiety having as a consequence gain or loss weight, furthermore physical activity (PA) has been associated with endocrin regulation and with positive dietary changes.

PURPOSE: To assess the effect of a School-based Exercising and Nutrition Counseling Intervention On metabolic Markers (ghrelin, Leptin, Insulin) In School-aged Obese Adolescents from Monterrey México. **METHODS:** An experimental study with a sample of 51 adolescents (13±2 yrs) randomly distributed in two groups: Control (CG) and experimental (EG). CG had 4 weekly sessions of 60 minutes of PA and one weekly session of nutritional counseling. EG engaged in regular school activities. Metabolic markers were measured in serum and analyzed into LUMINEX platform. **RESULTS:** After pre-post test, results showed in EG at post-test that ghrelin significantly decreased (p=.005) the increase of leptin (p=.008) and insulin (p=0.05). No differences were observed after the comparison in CG. **CONCLUSIONS:** The change in the levels of leptin and ghrelin suggests a possible change in the metabolic behavior, showing that the practice of physical activity combined with nutritional counseling are factors of change in the integrated approach to obesity. In future studies, it is recommended to increase the duration of the program, and to suggest changes on diet.

3148 Board #53 June 2 3:30 PM - 5:00 PM
Patterns and Correlates of Sedentary Behaviour in Children Attending Child Care

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 (No relationships reported)

Public health authorities recommend that young children should not be sedentary for more than 30-60 minutes at a time. **PURPOSE:** 1) describe the frequency and duration of SED bouts, as measured by accelerometry, in a sample of children attending family day care; and 2) explore associations between selected child care policies and practices and patterns of SED. **METHODS:** A random sample of 41 registered family day care programs (FDCPs) participated in the study. Within each FDCP, participating children (N=193) wore an ActiGraph GT1M accelerometer for the duration of child care attendance. A SED bout was defined as ≥ 4 consecutive 15 sec epochs (1 min) with counts less than 25. Non-wear time was quantified by summing the number of consecutive 0 counts accumulated in sequences of 60 min or longer. Children were included in the analyses if they had ≥ 3 days in which wear time was ≥ 75% of the attendance time (N=127, 68 Boys, 59 girls, mean age = 3.5 ± 1.1 y). Provider reports of policies and practices related to SED were obtained using items from the Nutrition and Physical Activity Self-Assessment for Child Care. **RESULTS:** Boys accumulated 36.6 SED bouts daily, with median bout duration of 2.0 min. The daily number of bouts lasting 1-4, 5-9, 10-14 and 15+ min was 30.8, 3.3, 1.0, 0.8, and 1.4, respectively. SED time accrued in each category was 57.2, 22.2, 12.1, and 41.0 min, respectively. Girls accumulated 41.6 SED bouts daily, with median bout duration of 1.8 min. The daily number of bouts lasting 1-4, 5-9, 10-14 and 15+ min was 67.1, 22.9, 11.1, and 34.6, respectively. SED time accrued in each category was 57.2, 22.2, 12.1, and 41.0 min, respectively. Gender differences were statistically significant for the number of bouts and the frequency of SED bouts 1-4 min. Children attending FDCPs meeting child care standards for the provision of outdoor play, prolonged sitting, screen time, portable play equipment, and staff engagement during free play exhibited significantly

fewer SED bouts and accrued significantly less SED in bouts lasting 1-4 mins. **CONCLUSIONS:** SED during child care attendance is accumulated in mostly short bouts. Few children exhibited prolonged SED bouts ≥ 20 mins. Child care practices related to sitting time, screen time, and active play may reduce the frequency of SED bouts.

3149 Board #54 June 2 3:30 PM - 5:00 PM
Effects Of A School-based Exercising And Nutrition Counseling Intervention On Sleep Parameters (Sleep Time, Sleep Latency And Number Of Awakenings) And Time In MVPA In School-aged Obese Adolescents From Monterrey México.

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Obesity has positioned itself as a public health problem worldwide with multifactorial characteristics. Different studies define sleep time as obesogenic factor while others found a correlation with the levels of moderate to vigorous physical activity. (MVPA) **PURPOSE:** To assess the effect of a School-based Exercising and Nutrition Counseling Intervention On sleep parameters (sleep time, sleep latency and number of awakenings) and time in MVPA In School-aged Obese Adolescents from Monterrey México. **METHODS:** An experimental study with a sample of 51 adolescents (13±2 yrs) randomly distributed in two groups: Control (CG) and experimental (EG). CG had 4 weekly sessions of 60 minutes of PA and one weekly session of nutritional counseling. EG engaged in regular school activities. Sleep variables and levels of MVPA were monitored by triaxial accelerometer (ActiGraph wGT3X-BT) for at least 7 consecutive days. **RESULTS:**

Pre-post test comparison showed in de EG significative changes on sleep latency when MPVA increased (P=.006), other differences were observed on the decrease in awakenings on sleep (P<.001). No changes were observed on MPVA. CG increased only sleep latency (P<.001), on the other parameters no changes were found. **CONCLUSIONS:** The practice of physical shows a significant relationship with sleep parameters which seems to be a favorable factor in the treatment of obesity in adolescents. We suggest further studies to modify the duration of the intervention and use other indirect instruments for analyzing the quality of sleep

3150 Board #55 June 2 3:30 PM - 5:00 PM
The Effect of Physical Activity on Attention in Elementary School Students

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Schools have always incorporated physical activity (PA) into the school day, but of late opportunities for PA have come under pressure. Research suggests that PA, particularly bilateral and coordinated PA, has a positive effect on attention in adolescent children, offering support for the continued inclusion of PA during the school day. **PURPOSE:** The purpose of this investigation is to compare the effects of bilateral and coordinated exercise, typical recess activities, and quiet reading on attention in elementary school children. The d2 test measures processing speed, rule compliance, and quality of performance. Performance on the test is determined by evaluating the total number (TN) of items processed, the number of errors made during the test, and by calculating concentration performance (CP). **METHODS:** 14 fifth grade students (6 girls and 8 boys, Age= 10.6±1 years) and 12 fourth grade students (8 girls and 4 boys, Age = 8.7±1 years) were included in this investigation. Students completed 3 sessions, separated by 7 days. In the first session students completed the d2 attention test after a regular academic class period to act as a control (CON). Subsequently, students were randomly assigned to a sequence of experimental conditions to be completed over the next 2 weeks. Fifth graders completed either 30 minutes of quiet reading (QR), or coordinated exercise (CE), while 4th graders completed either 30 minutes of typical recess (REC) activities or CE. Coordinated exercise consisted of a sequence of bilateral activities requiring gross and fine motor movement using various balls. Ten minutes following the activities, students completed the d2 test again in a quiet classroom. **RESULTS:** TN increased from baseline in each condition in 5th (CON=323+10, QR=416+16, CE=414+20, p<0.001) and 4th graders (CON=287+17, REC=381+19, CE=374+20, p<0.001). CP similarly increased from baseline in each condition in 5th (CON=138+3, QR=177+7, CE=178+10, p<0.001) and 4th graders (CON=131+9, REC=160+6, CE=157+8, p=0.001). **CONCLUSION:** It appears that a break from the concentration required in class is most beneficial to attention. However, the additive positive impact of PA on the reduction of risk for chronic disease supports the continued opportunity for PA during school as a more beneficial strategy to improve attention.

3151 Board #56 June 2 3:30 PM - 5:00 PM

Effects Of A Sit-stand Desk In A College ClassJeremy Frost¹, Donna Terbizan, FACSM². ¹St. Cloud State University, St. Cloud, MN. ²North Dakota State University, Fargo, ND. (Sponsor: Dr. Donna Terbizan, FACSM)

(No relationships reported)

Increased amount of daily sitting time has been linked to increased risk of disease, independent of the amount of daily physical activity. A number of devices have been developed to address prolonged sitting in work and educational settings (e.g., sit-stand desks, treadmill-desks, cycle-desks, stepping desks). However, very little research has investigated the effect of a sit-stand desk on cognitive mood and performance in the college classroom. **PURPOSE:** To determine the effect of using adjustable-height (sit-stand) desks in a college class on attention (AT), stress (ST), musculoskeletal discomfort (MD), anxiety (AN), and academic performance (EXAM). **METHODS:** A total of 18 subjects (12 intervention, mean age 22.1, mean credits 13.9) completed the 13 week intervention (week 3-15 of the semester). Adjustable-height sit-stand desks were placed in the back and one side of the classroom for students to use as they desired. Participants completed a weekly visual analogue scale (VAS) for AT, ST, MD, and AN, and were given space to provide optional comments on why they answered the way they did. Class sessions were video recorded to allow for direct observation of attention (OAT) in weeks 9, 12, and 13. Exams were taken at week 4, 6, 8, 10, 12, 14, and 15. **RESULTS:** The main findings indicated a significant interaction effect for AT ($F[12, 166] = 2.79, p = 0.002$) and ST ($F[12, 166] = 2.15, p = 0.017$), and significantly ($p=0.002$) lower overall MD for the intervention (12.81 ± 3.45) vs. control (35.12 ± 4.80) group. Exam scores were not different between groups. There was no difference in direct observation of attention (OAT) between groups (total $n=15$; control= 6) at week 9, 12, or 13. Age was correlated with overall observation of attention scores ($r=0.54, p=0.038$), and ST with AN scores all weeks except 5 and 11 (r range = $0.61-.95, p<0.05$). **CONCLUSION:** A strength of this study is the week to week data collection on various measures of cognitive mood and performance, and overall discomfort levels. Use of a sit-stand desk was associated with lower MD scores and more variability in AT and ST scores. Future studies should utilize increased sample sizes to determine the dose of standing that would result in changes in AT, ST, MD, AN, OAT, and EXAM in a university setting. This research was supported by a SCSU Faculty Research Grant.

3152 Board #57 June 2 3:30 PM - 5:00 PM

Percentage Of Time Spent In Physical Activity When Indoors Vs. Outdoors In Young ChildrenRobert T. Marcotte¹, David R. Bassett, Jr, FACSM¹, Jennifer I. Flynn², Dawn P. Coe, FACSM¹. ¹University of Tennessee, Knoxville, TN. ²Maryville College, Maryville, TN. Email: rmarcott@vols.utk.edu

(No relationships reported)

In the early childhood education setting, there is scheduled time during the day for outdoor physical activity (PA). Similarly, outdoor PA may occur during the day when the children are at home on the weekends. **PURPOSE:** To compare the percentage of waking time spent in PA (combined light, moderate, and vigorous intensities) when young children (ages 3 - 6y) are indoors vs. outdoors, on a school day and a weekend day. **METHODS:** Participants were 20 preschool and kindergarten children ($4.6\pm 0.8y$). PA was assessed using the ActiGraph GT3X+ accelerometer worn on the right hip, over the clothing, during one school day and one weekend day. Accelerometer data were filtered to remove the time period when the children were napping in order to capture only waking hours. Filtered data were analyzed using cut points by Pate et al. (2006) to determine the percentage of time children spent in PA. Environmental condition (indoors vs. outdoors) was determined using the lux values recorded by the ActiGraph GT3X+ and a previously validated cut point (240 lux) by Flynn et al. (2014). A 2x2 repeated measures ANOVA was used to examine the percentage of time in PA by environment (indoors vs. outdoors) and by day (school day vs. weekend day). **RESULTS:** Children spent a significantly greater percentage of time engaged in PA when they were outdoors vs. when they were indoors (59.2 ± 13.0 vs $26.7\pm 7.4\%$; $p<0.001$). Additionally, children spent a greater percentage of time in PA on the school day vs. the weekend day (50.1 ± 10.7 vs $35.8\pm 11.9\%$; $p=0.001$). There was no interaction between day and environmental condition. **CONCLUSIONS:** Children engaged in a significantly greater percentage of time in PA when outdoors, and on a school day (as opposed to a weekend day). These results may be due the outdoor environment being more conducive for PA. It appears that spending more time outdoors may help young children to meet guidelines for accumulating at least 120 minutes of PA per day (Active Start, 2009).

3153 Board #58 June 2 3:30 PM - 5:00 PM

Comparisons Of Heart Rate And Energy Expenditure Across Three Exergaming Consoles In College-age Adults

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Purpose: Exergaming, playing video games that require players to be physically active, has opened up new avenues for increasing energy expenditure (EE). However, little research has compared the physiological benefits of the same game across different consoles. This study investigated: 1) the differences in degree of EE for the same song's dance in the same exergame across three different major gaming consoles each using a different method of recognizing player movement, and 2) whether exergaming could elicit moderate-to-vigorous levels of intensity ($\geq 40\%$ heart rate reserve [HRR]) based on heart rate average (HR_{avg}) measurements. **Methods:** Twenty-five healthy college-aged students (19 females and 6 males) participated in this study. Data collection comprised of baseline testing, a 30-second exergaming familiarization period with each console, and a play session. During gameplay, participants danced to a 3minute and 55second song on each console; they also danced to a non-interactive video of the same song lasting for the same duration. Participants rested for 5 minutes between sessions. Console order was counterbalanced across participants. EE was obtained from a chest-mounted heart rate (HR) monitor. The HR_{avg} was obtained from the heart rate monitor for each session. **Results:** One-way repeated measures ANOVA ($\alpha = .05$) indicated no significant differences in EE across the three gaming consoles and the control video, $F(2.74, 65.86) = 0.65, p = .570$. In terms of HR_{avg} , a paired-sample t -test indicated that the HR_{avg} during exergaming on one console (117 ± 18 bpm) was significantly greater than the control video (112 ± 16 bpm), $t(24) = -3.03, p = .006$. About a third (28%-36%) of the participants met moderate levels of exercise intensity while exergaming on all three consoles. **Conclusion:** Exergaming can be incorporated into daily physical activity to work toward meeting the current physical activity guidelines; however exploration on factors (e.g., psychological) influencing the motivational level of individuals engaging in exergaming is necessary to help reach the moderate-intensity. As limitation exists with the estimation of EE via the use of HR monitors, the use portable indirect calorimetry may increase the accuracy of EE measurement.

3154 Board #59 June 2 3:30 PM - 5:00 PM

Comparison of Accelerometer Step Counts and Total Physical Activity in 2-year Old Child-Parent Dyads

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Step counts are a simple, practical way to monitor physical activity, and daily steps have been shown to be strongly correlated with accelerometer activity counts in adults and children as young as 3 years of age. However, no such data exists in 2-year-old children. **PURPOSE:** To compare daily step counts with accelerometer measured time spent in physical activity in 2-year olds, and to examine the interrelationships between parents' and childrens' steps. **METHODS:** Physical activity (PA) and step counts were recorded for one week using hip-worn accelerometers in 2-year-old children and one parent dyads attending an urban Early Head Start program. Data reduction was conducted in MATLAB, and estimates of total physical activity time (TPA) and steps/day were calculated. Costa (2014) and Freedson (1998) cut-points for PA intensity were used for children and parents, respectively. Tudor-Locke (2009) step cut-points were used to calculate adult steps/day. Standard accelerometer wear time procedures were applied to yield sufficient reliability ($r > 0.70$). Descriptive data are presented as Mean (standard deviation;SD), Median (interquartile range;IQR), or Frequencies (%). Spearman correlations were used to test for relationships of interest, with an *a priori* significance level of $p < 0.05$. **RESULTS:** Seventeen child-parent dyads meeting wear time reliability were included in the analysis shown in Table 1. There was a strong positive correlation ($\rho = 0.74, p < 0.01$) between TPA steps/day and total PA min/day in children, and a moderate correlation ($\rho = 0.58, p < 0.02$) in parents. There was no significant correlation between children's and parents' average TPA steps/day. **CONCLUSION:** Step counts were highly correlated with TPA time in both 2 year-olds and their parents, suggesting step counts can be used interchangeably with PA counts in 2-year-old children and parents. Parent and child steps were not correlated and, thus, their PA does not appear to be interdependent.

Variable	Child	Parent
Age	31(3) mo.	30(4) yr.
Female n(%)	11(64.7)	17(100)
Median Steps/day	5331(2365)	6491(2418)
Wear Time (hrs/day)	10(2)	14(2)
Wear Days	6(2)	7(1)
Meeting Target Recommendation for PA n(%)	14(82.4)	3(17.7)

3155 Board #60 June 2 3:30 PM - 5:00 PM
Discordance Between The Perceived And Actual Activity-supportive Built Environment Among College Students

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(No relationships reported)

An individual's environment has a major impact on their activities, travel mode, and health. Thus, to improve physical activity (PA), active transportation, and health, it is important to understand a society's awareness of their environment. **PURPOSE:** To evaluate discordance between perceived and actual presence of factors associated with the built environment. **METHODS:** A survey of 170 college students' (19±.89 years) familiarity with their environment for PA and PA participation was conducted in Spring 2015. Objectively measured environmental audits of the environment were conducted simultaneously using an environment audit (WASABE). Variables included for the present study include: presence of trails, presence of parks, sidewalk maintenance, and perceived activity of those in the neighborhood. A continuous discordance score (-4 to 4) was created by summing the frequency by which an individual differed from the audit on each variable. A score of -4 represents always perceiving the presence of a variable when there was not one (negative discordance). A score of 4 represents always perceiving the absence of a variable when there was one (positive discordance). Paired-samples t-tests assessed discrepancies between the perceived and actual environment. Pearson correlations examined the relationship between fitness and discordance. A linear regression identified which factors within the individual (i.e., demographics, PA and environmental) most predicted discordance. P values were set at <.05. **RESULTS:** T-tests indicated significant differences between perceived and actual results for: the presence of bike trails (t=10.69), the presence of parks (t=5.81), and the presence of people being physically active (t=2.49). Positive discordance was correlated with a lack of moderate PA (r=-.27). There were no significant correlations with negative discordance. Predictors of discordance in either direction included: not owning a bike (β=-0.83), rarely using bike trails/routes (β=-.27), and not living near a park (β=-1.33). **CONCLUSION:** Students are unfamiliar with their environment, which may influence their activities and travel mode. Those who do not participate in activities that would place them in their neighborhood environment are even more unaware of their surroundings than others.

3156 Board #61 June 2 3:30 PM - 5:00 PM
Community Health and Fitness Programs for Children: Outcomes of the Fit Kids Program in Connecticut

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PURPOSE: Obesity prevalence among children has tripled in the past 30 years. The majority of obese 5-10 year-olds have at least one chronic disease risk factor and have a 70% chance of remaining obese as an adult. Community based exercise and nutrition programs that take place in a school setting have the potential to reach up to 95% of children. The purpose of this study is to report the outcomes of the Fit Kids Program (FK) in Connecticut. FK was created collaboratively by a community health department and university and is provided to community schools three times per year. **METHODS:** FK consists of 8-12 weekly sessions comprised of 30 minutes each of physical activity and nutrition education that takes place after school. Sports skills and training such as endurance and agility are combined with nutrition education including food tastings and preparation demonstrations. FK has served over 500 school children. Variables routinely assessed pre and post include BMI, vertical jump (VJ), hand grip strength (HG), physical activity self efficacy (PASE) and content retention (CR). Descriptive and inferential statistics are assessed including mean changes and the level of significance via paired t-tests. For this study, data collected pre and post from 2012-2015 is reported and compared.

RESULTS: 215 children between 5 and 12 years of age (mean 8.2) were assessed between 2012 and 2015. Significant changes included consistent improvements in CR over all years. Increases in CR ranged from 13-30% (p value ranges = .000-.028). Significant increases in HG ranging from 6.25-11% (p value ranges = .027-.045) were observed in 2013 and 2014. Significant increases in PASE ranging from 5.3-6.4% (p value ranges = .006-.035) were observed in 2014. The most compelling changes relative to the number of variables were observed in 2015 including an increase of HG by 9% (p = .006), PASE by 25% (p = .000), and CR by 14.5% (p = .000). BMI and BMI percentiles did not change significantly over all years; however observed mean ranges for BMI between 17.3 and 21.00 and BMI percentile ranges between 55 and 63 were within normal limits. VJ did not increase significantly.

CONCLUSION:

Compelling and consistent improvements in CR among children in addition to increases in PASE and and HG support continuing a collaborative effort and commitment to the health of children.

3157 Board #62 June 2 3:30 PM - 5:00 PM
Associations among Objectively-determined Physical Activity, Cardiorespiratory Fitness and Cognitive Function in Preschool Children

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Purpose: Early childhood years (ages 4-6 years) are deemed a critical period to develop a physically active lifestyle to curb obesity epidemic. Evidence has shown that physical activity (PA) and cardiorespiratory fitness are linked to enhanced cognition in children. However, favorable results toward this linkage are still inconsistent in preschool children. Therefore, this study examined the associations among preschool children's objectively-determined PA, cardiorespiratory fitness and cognitive functioning across time.

Methods: Thirty-two preschoolers (16 boys; 59.4% Asian; $M_{age} = 4.72$, $SD = \pm .73$) participated in this study. Children's cognitive function, cardiorespiratory fitness, 5-day moderate-to-vigorous PA (MVPA) was assessed at baseline (Time 1) and 6 months (Time 2) later. Their cognitive function was assessed with the Executive Function Scale for Early Childhood. A modified YMCA 3-Minute Step Test and ActiGraph accelerometers were used for assessing children's cardiorespiratory fitness and MVPA, respectively.

Results: Pearson's correlation analyses showed different relation patterns among variables across time. In detail, there was a small positive relationship between MVPA and cognitive function at Time 1 ($r=0.14$, $p=0.23$), but negative relationship emerged between these two variables at Time 2 ($r=-0.27$, $p=0.08$). A small yet positive correlation was seen between fitness and cognitive function over time (Time 1, $r=0.02$, $p=0.46$; Time 2, $r=0.12$, $p=0.27$). Yet, regression results indicated that MVPA (Time 1, $\beta=0.14$, $p=0.47$; Time 2, $\beta=-0.29$, $p=0.14$) and cardiorespiratory fitness (Time 1, $\beta=0.05$, $p=0.98$; Time 2, $\beta=0.16$, $p=0.39$) failed to significantly predict children's cognitive function at both times (Time 1, $R^2=0.02$, $p=0.77$; Time 2, $R^2=0.10$, $p=0.27$). **Conclusions:** Findings suggest that the associations among preschool children's cognitive function, MVPA, and cardiorespiratory fitness may still be inconclusive. Based upon the regression analysis, many other factors other than PA and cardiorespiratory fitness would explain children's cognitive function. Future studies with a larger sample size and more reliable cognitive function assessment are warranted.

3158 Board #63 June 2 3:30 PM - 5:00 PM
Effect Of Wu Qin Xi Exercise On Balance Function In College Students

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Wu Qin Xi, created by Hua Tuo - a physician of the Eastern Han Dynasty, is a group of physical and breathing exercises imitating the movements of five animals. Previous studies show it has evident effects on improving cardiovascular function and neural function, and increasing bone mineral density in older adults. **Purpose:** The purpose of this study was to examine the effect of a 6-week Wu Qin Xi exercise program on balance function in college students. **Methods:** Twenty four college students (age: 19±1 years, 12 males, 12 females) were randomly divided into two groups (C: control group; E: exercise group) with 12 subjects in each group. Both groups maintained their routine daily activities, except that subjects in the E group participated in a Wu Qin Xi exercise program 30 min each time, 6 times each week, for 6 weeks. Before and after the 6-week period, all subjects were tested for postural

stability (PS), limits of stability (LOS) and fall risk (FR) by using the Biodex Balance System. Paired t-tests were used to determine changes within each group, and independent t-tests were used to determine group differences in changes over the 6-week period. **Results:** All 24 subjects completed the study. Over the 6-week period, there were no significant changes in PS, LOS and FR in the C group; however, there were significant improvements in PS (from 0.58 ± 0.17 to 0.51 ± 0.09 , $p < 0.05$) and LOS (from 40.08 ± 10.95 to 47.00 ± 11.04 , $p < 0.01$) in the E group. There was no significant change in FR in the E group. Compared to the C group, the E group had significant improvements in PS (C: -0.01 ± 0.00 vs. E: -0.08 ± 0.07 , $p < 0.05$) and LOS (C: -0.83 ± 0.75 vs. E: 6.92 ± 2.41 , $p < 0.01$) from baseline to the post-exercise assessment. There was no significant group difference in changes of FR over the 6-week period. **Conclusion:** A 6-week Wu Qin Xi exercise program significantly improved balance function in college students. Future, larger studies are needed to explore the effect of Wu Qin Xi exercise on fall risk in this population.

3159 Board #64 June 2 3:30 PM - 5:00 PM
Parental Support for Moderate and Vigorous Physical Activity In Children and Adiposity as a Mediator.

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PURPOSE: To determine whether the associations between different types of parental support and children's MVPA is mediated by their adiposity. **METHODS:** The sample comprised 138 Portuguese children (mean age 8.08 ± 1.32 years); 29.9% were overweight and 37.2% obese. MVPA was objectively assessed during 7 days using accelerometers ActiGraph GTX3, Body Mass Index (BMI), and percentage of body fat (%BF) through DEXA (dual energy X-ray absorptiometry - model Explorer-Hologic). Parents self-reported their weight and height, and intangible/tangible parental support were assessed by questionnaire. Linear regressions and mediation (Sobel test) analysis were used. **RESULTS:** Children with lower %BF had higher MVPA levels ($\beta = -1.17$, $p < 0.05$) and were more supported by parents with intangible type ($\beta = -1.11$, $p < 0.05$). No associations were found between tangible parental support and children's MVPA. Additionally, children with higher levels of intangible support showed higher levels of MVPA ($\beta = 3.21$, $p < 0.05$), however, significant differences disappeared after controlling for %BF ($\beta = 1.91$, $p > 0.05$). The Sobel test showed that the positive association between intangible parental support and children's MVPA was full mediated by %BF ($z = 2.09$, $p < 0.05$), with a percentage of indirect effect of 40.5%. **CONCLUSION:** Intangible parental support is important predictor of children's MVPA, however this influence is mediated by children's adiposity. Supported by the FCT under grand number SFRH/BD/101410/2014 and UID/DTP/00617/2013

3160 Board #65 June 2 3:30 PM - 5:00 PM
Association Between Active Commuting To School And Sleep Duration In Ecuadorian Youth

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 (No relationships reported)

PURPOSE: Active commuting has been associated to longer sleep duration in adolescents, however, the literature is still limited. Thus, the aim of this study was to investigate the association between the mode of commuting to and from school and sleep duration in Ecuadorian youth. **METHODS:** A total of 732 students (13.6+2.1 years, 65.3% boys) belonging to 3 schools from Riobamba (Ecuador) were recruited via convenience sampling in class. Participants completed a self-reported paper-based questionnaire about personal data, usual mode of commuting to and from school and regular sleep-wake schedule at night on normal school days. Via sleep-wake schedule, sleep duration was calculated for each individual. They were classified as active (walk or bike), and passive (motorbike, bus, car or another motorized transport). Participants were also classified into two groups: sleeping at night for at least 8 hours/day or less than 8 hours/day. Binary logistic regression analyses were applied to examine the association between the mode of commuting (active vs passive) to and from school and the sleep duration (<8 hours/day and >8 hours/day) after correction for confounding factors (age, gender). **RESULTS:** The main mode of commuting used by Ecuadorian students was passive (86.4%), whereas active modes were less used (12.6%). The main passive mode chosen was the car ($\approx 40\%$), followed by public bus ($\approx 21\%$) and school bus ($\approx 17\%$). Active commuters were more likely to sleep at least 8 hours/day than passive commuters showing a trend towards an increase in the sleep duration (OR, 95% CI 1.50, 0.945 to 2.409, $p = 0.085$). **CONCLUSIONS:** Active commuting to school

could be associated with sleep duration in youth. The links between lifestyle factors, sleep duration and active commuting to school need to be investigated in greater depth in order to promote public health strategies in youth.

3161 Board #66 June 2 3:30 PM - 5:00 PM
School Day Physical Activity and Classroom Behavior in Disadvantaged Children

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Increased physical activity has been shown to improve classroom behavior in children. No study has examined the relationship between classroom level behavior and school day physical activity in disadvantaged children from low-income schools. **PURPOSE:** The purpose of this study was to examine the cross-sectional relationship between classroom level on-task behavior and average school day physical activity throughout one school week. **METHODS:** A total of 106 classrooms were recruited from five low-income schools from a school district located in the Mountain West Region of the U.S. Classrooms were recruited from the 1st through 6th grades and class sizes ranged from 16 to 28 students. On-task classroom behavior was assessed at the beginning of the 2015-2016 academic school year using momentary time sampling methods for an observation duration time of 15-minutes. Classrooms were stratified into those that achieved 80% on-task behavior and those that did not. Physical activity was assessed at the student level using Yamax pedometers and Actigraph accelerometers that were worn for the entire school day for one school week. Step counts and time in MVPA were averaged at the classroom level to account for clustering of observations within classrooms. A multivariate analysis of variance (MANOVA) test was used to examine the relationship between a categorical classroom behavior variable and classroom-level physical activity. **RESULTS:** Classrooms that achieved at least 80% classroom behavior displayed higher school day step counts ($\Delta = 449$ steps, $p < 0.001$, Cohen's $d = 0.26$) and time in MVPA ($\Delta = 3.6$ minutes, $p < 0.001$, Cohen's $d = 0.28$) compared to classrooms that displayed lower classroom behavior. **CONCLUSION:** Classrooms that display higher levels of on-task behavior tend to record higher levels of average school day physical activity. The results provide further evidence of the relationships between favorable classroom behavior and physical activity. Future research needs to examine this relationship for potential causation and bi-directionality so that effective interventions can be employed.

3162 Board #67 June 2 3:30 PM - 5:00 PM
Parental Barriers And Active Commuting To School: An Association In Spanish Children And Adolescents

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PURPOSE: Active commuting may provide a significant source of physical activity in youth. Parental barriers may be important to promote active mode of transportation. This study analyzes the association between parental barriers and mode of commuting to school in Spanish children and adolescents. **METHODS:** Parents of children (n=628) and parents of adolescents (n=151) from Granada (Spain) completed a paper-based questionnaire about perceived parental barriers to active commuting to school and children's mode of commuting to school. Data were analyzed using the logistic regression analyses to determine the association between parental barriers and mode of commuting. **RESULTS:** Concerning the association between number of barriers and mode of commuting to school, the parents of children with higher number of barriers were associated with passive modes of commuting (Odds Ratio (OR): 1.128; 95% Confidence Interval (CI): 1.06-1.20; $p = 0.010$), but there were not significant associations for the parents of adolescents ($p = 0.087$). Regarding parents of children, the following barriers were associated with children's passive modes of commuting: crime (OR: 0.634; 95% CI: 0.42-0.94; $p = 0.025$), distance (OR: 2.95; 95% CI: 1.98-4.39; $p = 0.000$) and parents' convenience (OR: 5.83; 95% CI: 1.24-27.40; $p = 0.026$). Children were passive when their parents perceived distance and convenience as barriers for active commuting to school and did not perceive crime as a barrier. In parents of adolescents, traffic speed (OR: 1.928; 95% CI: 0.08-0.90; $p = 0.034$), absence of policeman (OR: 2.872; 95% CI: 1.02-8.08; $p = 0.046$) and distance (OR: 3.544; 95% CI: 1.64-7.67; $p = 0.001$) were associated with adolescents' passive modes of commuting. **CONCLUSION:** Parental barriers have a negatively effect on active modes of commuting to school in children but not in adolescents because they might be frequently more autonomous. Intervention programs to promote active commuting must be focused on parental barriers as parents' convenience for children and presence of police for adolescents and perception of distance for both of them.

3163 Board #68 June 2 3:30 PM - 5:00 PM
Building Resilience In Pre-adolescents, Through Physical & Artistic Recreation
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Abstract:

Purpose: The present study aimed to compare the effect of recreational programs in the overall value of resilience and each of its dimensions, according to measurement, group and sex of the population.

Methods: The intervention was carried out by performing 14 sessions of two types of recreational programs, one based on physical recreation and another on artistic recreation. Each treatment lasted 32 hours in total, with one session per week. The research design was quasi-experimental. Eighty-six (86) sixth grade students, ages 11 to 14, from a primary school in social vulnerability participated in the study. The sampling was non-probabilistic. School Resilience Scale (E.R.E) for children between 9 and 14 years old was used. A three-way analysis of variance 2x3x2 (ANOVA) for repeated measures in a factor (measurements * group * sex) was performed.

Results: There was significant interaction ($p < .01$) between measurements * group in the overall value of resilience. Bonferroni Post hoc analysis showed that physical recreation and artistic recreation treatment significantly improved ($p < .05$) the value of the overall resilience. In addition, the effect on resilience did not differ significantly by type of program, in the post-test measurement.

Conclusions: The findings support the use of recreational programs as a useful and effective way to build resilience in pre-adolescent students in areas of a social vulnerability context.

3164 Board #69 June 2 3:30 PM - 5:00 PM
Are Parental Barriers Related To Youths' Gender And Mode Of Commuting To School?
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Purpose: Understanding parental barriers is crucial to promote active commuting to school (ACS). This study examines parental barriers for ACS among Spanish youths (aged 9-16) and their association with gender and usual mode of commuting of their children. **Methods:** Parents of children (n=628) and parents of adolescents (n=151) from Granada (Spain) completed a paper-based questionnaire about perceived parental barriers for ACS and their children's mode of commuting to school. Data were analyzed using the Chi-square test. **Results:** The most common barriers reported by parents of children were traffic volume (48.7%) and dangerous intersection (45.0%), whereas the most frequent barriers reported by parents of adolescents were distance to school (50.3%) and dangerous intersections (39.6%). Compared to parents of children, a greater proportion of parents of adolescents reported distance to school (children 37.1%; adolescents 50.3%; $p=0.003$) and crime (children 28.6%; adolescents 36.9%; $p=0.047$) and smaller proportion reported traffic volume (children 48.7%; adolescents 32.9%; $p=0.000$) as barriers to ACS. Among parents of children, crime was more reported as a barrier by parents of girls than parents of boys (girls 33.2%; boys 24.2%; $p=0.013$). In children, parents of non-active commuters to school more frequently reported absence of a policeman on crosswalks (passive 20.8%; active 14.5%; $p=0.044$), absence of adults to walk with (passive 28.9%; active 19.9%; $p=0.44$), no sidewalks or bike lines (passive 44.8%; active 36.6%; $p=0.041$), distance to school (passive 44.8%; active 36.6%; $p=0.000$), time required to ACS (passive 17.5%; active 9.1%; $p=0.002$) and weather conditions (passive 36.4%; active 27.7%; $p=0.023$) as barriers for ACS compared to parents of active commuters. In adolescents, parents of active commuters reported less importance to absence of a policeman on crosswalks (passive 30.1%; active 16.0%; $p=0.041$) and distance to school (passive 64.4%; active 37.3%; $p=0.001$) than their counterparts. **Conclusion:** The main parental barriers for ACS in children were traffic volume and intersection safety whereas for adolescents were distance and intersection safety. Among Spanish parents, parental barriers for ACS were influenced by children's age, gender and usual mode of commuting to school.

3165 Board #70 June 2 3:30 PM - 5:00 PM
Eating Behaviour Correlates in Children Referred to a Telehealth Program for Overweight and Obesity Treatment
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Purpose: To describe the relationships between emotional eating behaviours and demographic, anthropometric, and behavioural characteristics of children referred to a comprehensive telehealth program for the treatment of overweight and obesity.

Methods: Correlational analyses were conducted using baseline scores from self-reports on the Dutch Eating Behavior Questionnaire for Children (DEBQ-C), the Dutch Eating Behavior Questionnaire (DEBQ), the Godin Leisure-Time Exercise Questionnaire (GLTEQ), and physician-reported anthropometric/demographic measures obtained from referrals to the program.

Results: Data from girls ($n = 20$), age 8-17 yr, revealed a significant positive correlation between the Emotional Eating subscale of the DEBQ-C and DEBQ and age ($r = 0.70, p = 0.0006$), a non-significant negative correlation with standardized BMI score ($r = -0.19, p = 0.4$), and a significant negative correlation with total physical activity ($r = -0.54, p = 0.01$), as reported through the GLTEQ. Data from boys ($n = 21$), age 8-18 yr, revealed a significant positive correlation between the Emotional Eating subscale of the DEBQ-C and DEBQ and age ($r = 0.62, p = 0.003$), a non-significant negative correlation with standardized BMI score ($r = -0.08, p = 0.7$), and a significant negative correlation with total physical activity ($r = -0.60, p = 0.004$), as reported through the GLTEQ.

Conclusion: In both boys and girls, emotional eating behaviors were reported to increase with age, decrease with higher levels of physical activity, and show no significant correlation with standardized BMI scores. This provides further evidence for the protective effect of physical activity in children. This research has important implications for the future treatment of children with overweight and obesity.

Funding was provided by the Childhood Obesity Foundation and the Provincial Health Services Authority.

F-53 Free Communication/Poster - Cancer

Friday, June 2, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

3166 Board #71 June 2 2:00 PM - 3:30 PM
Dual Energy X-ray Absorptiometry Is Comparable To Computed Tomography For Visceral Adiposity Measurement In Cancer Patients And Survivors
 Adriana M. Coletta, Ann H. Klopp, David Fogelman, Yisheng Li, Naveen Garg, Karen Basen-Engquist. *MD Anderson Cancer Center, Houston, TX.*
 (No relationships reported)

Purpose: New software to measure visceral adipose tissue area with dual energy x-ray absorptiometry (DXA) was developed and proposed as an alternative method to abdominal computer tomography (CT) scan. The DXA software has previously been validated in apparently healthy populations; however it is yet to be determined if visceral adiposity measurement by DXA is comparable to CT in a cancer patient population. Use of DXA instead of CT may provide various benefits to cancer patients, notably less radiation exposure. Therefore the purpose of this study was to determine the level of agreement between DXA and CT when measuring visceral adipose tissue area in cancer patients and survivors.

Methods: Patients seen in the gastrointestinal and diagnostic imaging clinics were pre-screened for eligibility and approached during their regularly scheduled visit. Interested patients underwent a CT scan at L₄-L₅, as part of their medical care, and a whole-body DXA scan within 48 hours of their CT scan. Bland-Altman analysis evaluated the difference between paired measurements against their mean, and the 95% confidence limits of the mean difference between CT and DXA measurements. Linear regression was also used to assess the correlation between methods. All analyses were conducted for the total sample and by sex.

Results: A total of 99 patients (62±12 years, 28.5±7.4 kg/m²), 53 female (61±13 years, 28.3±8.5 kg/m²) and 46 male (62±11 years, 28.6±5.9 kg/m²), participated in the study. The majority of patients were non-Hispanic (90%), Caucasian (89%), diagnosed with adenocarcinoma (76%) at the site of the pancreas (46%) or colon (20%), and had stage 4 cancer (46%). Compared to CT, DXA underestimated visceral adipose

tissue area by 6.0 cm² (95%CI 4.8, 16.8) or 4.4%. A significant positive correlation was observed for visceral adiposity measured by DXA and CT ($r=0.90$, $p<0.001$). For women, DXA overestimated visceral adipose tissue area by 10.3cm² (95%CI -20.4, 0.2) or 9.6%. For men, DXA underestimated visceral adipose tissue area by 24.8 cm² (95%CI 7.2, 42.5) or 14.7%. Significant positive correlations between methods were observed for women ($r=0.90$, $p<0.001$) and men ($r=0.90$, $p<0.001$).

CONCLUSIONS DXA scan has the potential to serve as an alternative to CT scan for measurement of visceral adipose tissue area in cancer patients and survivors.

3167 Board #72 June 2 2:00 PM - 3:30 PM

Cardiac Rehabilitation In Men With And Without Prostate Cancer: A Retrospective, Case-control Analysis

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(No relationships reported)

Background: Prostate cancer (PCa) is the leading cancer diagnosis among men, second only to skin cancer. Advancements in detection and treatments have led to significant improvements in survival. Deleterious changes to metabolic health that often accompany PCa treatment paradigms have unfortunately increased cardiac morbidity in this population. Accordingly, men with PCa may be referred to cardiac rehabilitation (CR) programs following a significant cardiac event. While evidence supporting the role of exercise for cancer survivors is abundant, the differential effect of a CR program on men with and without a history of PCa is unknown. **Purpose:** To compare the effect of CR on cardiorespiratory fitness (measured via VO₂peak) and measures of body composition (body fat percent and body mass index) in men with and without a history of PCa. **Methods:** A retrospective, case-control analysis of men that have completed CR was performed. Cases (i.e. men with PCa) and controls (no PCa) were matched on age and cardiovascular morbidity requiring CR. All men completed the same program consisting of aerobic exercise (5 times per week) and resistance training (2-3 times per week) for a total of 26 weeks. Baseline comparisons between PCa and non-PCa CR participants were conducted by independent-samples t-test. The effect of PCa on CR outcomes was assessed using repeated-measures analysis of covariance comparing PCa and non-PCa participants using baseline outcome measures as covariates. **Results:** Twenty-seven (n=27) cases were matched with (n = 27) controls during CR participation that completed the program between January 2004 and January 2011. VO₂peak increased in both groups (PCa: 16.4 ± 4.2 to 20.2 ± 5.8 mL·kg⁻¹·min⁻¹, $p=0.001$; non-PCa: 16.9 ± 5.1 to 19.6 ± 6.2 mL·kg⁻¹·min⁻¹; $p=0.001$). There were no changes in body composition in either group following participation in CR. There were no statistically significant differences between groups in change in any of the outcomes ($p>0.05$). **Conclusions:** Men with and without PCa that participate in CR experience comparable improvements in VO₂peak.

3168 Board #73 June 2 2:00 PM - 3:30 PM

A Home-based Walking Program Is Feasible For Cancer Patients Prior To Undergoing Bone Marrow Transplant.

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Previous research has shown that patients with low fitness level prior to stem cell transplant have higher incidence of post-transplant complications. **PURPOSE:** To examine the feasibility of a home-based walking intervention in Brazilian patients with hematological cancers prior to undergoing a stem cell transplant in the Sistema Unico de Saude (SUS). Pre to post intervention physical function and patient reported outcomes (PROs) were also evaluated. **METHODS:** This single arm study enrolled 11 patients who scored >50 on the Karnofsky performance status scale, presented no contra-indication for participating in light to moderate regular walking, and were cleared by their oncologist to participate in the study. The home-based walking intervention initiated with patients undergoing 20 minutes of moderate intensity (10-12 on the Original Borg Scale) per week progressing up to 150 minutes by week 7. After week 7, patients were asked to maintain the 150 minutes of walking at moderate intensity until transplant day. Feasibility was determined by the number of patients approached to participate in the study (>90%) and the number of patients (>60%) that were able to achieve at least 70% of the planned intervention. Physical function (6 minutes walk test (6MWT) and TUG test) and PROs (Depression (Beck Depression Scale), fatigue (Piper Fatigue Scale), and quality of life (QOL) (SF-36) were assessed prior and after the walking intervention. **RESULTS:** All (100%) eligible

patients enrolled in the study. Out of the 11 patients, 1 patient was excluded because stopped chemotherapy treatment. Out of 10 patients, only 1 was not able to adhere to the study intervention. All other patients completed at least 70% of the planned walking intervention with some (66%) engaged in more than 150 minutes per week. Significant improvements from pre to post intervention in the 6MWT (344.4 ± 117.8 and 490.6 ± 111.2 meters, $p=0.001$) and PROs (Depression, 12.11 ± 7.08 and 7.89 ± 4.65, $p=0.006$; Fatigue, 62.00 ± 25.98 and 26.22 ± 10, $p=0.002$; overall QOL 23.11 ± 4.34 and 26.33 ± 2.45) were observed. **CONCLUSION:** Brazilian patients enrolled in the SUS not only were able to participate in the home-based walking intervention, but improvements in physical function and PROs were observed.

3169 Board #74 June 2 2:00 PM - 3:30 PM

Smartphone Application to Home-based Exercise on Psychological Wellbeing and Physical Functioning for Breast Cancer Survivors

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Mobile technology has become an increasingly essential instrument for those who are responsible for healthcare and facilitating the interactions between health professionals and patients. **PURPOSE:** the purpose of this study is to design a smartphone application to self-monitoring resistance and exercise prescription, health knowledge, daily physical activity and compare this application to traditional intervention on psychological wellbeing (PW) and physical functioning (PF) in breast cancer survivor. **METHODS:** Thirty patients with breast cancer (age = 46 ± 7 year) were randomly assigned into control (CON) or intervention (INT) groups with 15 patients in each group. INT was provided a smartphone equipped with a mobile health application for self-monitoring of biometrics and performed a resistance and aerobic exercise prescription 5 times/week and 30 minutes/time. PW and PF measures were taken at baseline and 12th week. Fourteen patients in each group completed the study. Data were analyzed by means of independent t test. **RESULTS:** Result indicated that the INT had significant improvements than the CON on PW outcomes: anxiety ($t=2.93$, $P<0.05$) and depression ($t=3.34$, $P<0.05$) and on PF measures: 6 min walking ($t=3.57$, $P<0.00$, arm curl ($t=2.45$, $P<0.05$) sit and reach test ($t=2.75$, $P<0.05$). The body composition ($t=0.89$, $P=0.45$), weight ($t=1.08$, $P=0.14$), BMI ($t=0.99$, $P=0.74$), blood pressure ($t=0.61$, $P=0.87$) were not significantly different between groups, but the pain ($t=3.64$, $P<0.00$), fatigue ($t=3.98$, $P<0.00$) and sleep disturbance ($t=4.57$, $P<0.00$) decreased significantly between CON and INT during twelve weeks excises. **CONCLUSIONS:** This study suggested that the smartphone application significantly improve PB and may be the effective way to decrease depression and anxiety and enhance PF in breast cancer survivors. Future study should determine whether home-base smartphone system can promote them to maintain long-term exercise effect. The work presented in this article was supported by grant from the Ministry of Science and Technology of China (2015FY111600)

3170 Board #75 June 2 2:00 PM - 3:30 PM

Translation Of An Aging-in-place Intervention To Reduce Disability And Sedentarism Among Rural Cancer Survivors

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PURPOSE: Rural-dwelling cancer survivors face multiple socioeconomic, behavioral, and environmental barriers to achieving recommended levels of physical activity. Many older cancer survivors also report that symptoms of cancer and other chronic conditions interfere with functioning, leading to more time spent sitting or lying down. These prolonged periods of inactivity negatively impact overall health and cancer rehabilitation. Common symptoms such as fatigue, impaired sleep, and pain can also interfere with activities of daily life. Reducing sedentarism (conceptually distinct from promoting activity) may be a more achievable goal for rural-dwelling cancer survivors experiencing symptom-related disability. Therefore, we adapted an aging-in-place intervention originally developed for urban-dwelling disabled older adults, to meet the needs of rural-dwelling older cancer survivors living in the Northeast U.S. **METHODS:** Drawing on translational methods outlined by Dr. Anna Marie Napoles, we established the infrastructure for a translation partnership, identified clinician and community stakeholders and methodological experts, and sought their input via semi-structured interviews. Direct and interpretive content analysis methods, as described by Hsieh and Shannon, were used to code and interpret the interview data relevant to answering two primary questions: (1) What are the critical needs of cancer survivors

living in the region with relation to promoting activity and reducing disability?; and (2) How should the original intervention be adapted to meet those needs in a way that is feasible, acceptable, and sustainable? **RESULTS:** Participants indicated a need for an intervention that could be tailored to individual goals and was accessible in the community, outside of clinical settings. This presentation highlights cancer survivor, clinician, and multi-disciplinary perspectives on critical components of the adapted intervention and associated study protocols. **CONCLUSIONS:** Stakeholder input is essential to the design and translation of sustainable clinical interventions. This work lays the foundation for a phase 1 pilot study of the adapted approach.

3171 Board #76 June 2 2:00 PM - 3:30 PM
Does Supervised Exercise Programming At Diagnosis Impact Future Physical Activity Levels In Breast Cancer Survivors?

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Purpose: Low physical activity levels are associated with increased risk of breast cancer recurrence and reduced survival. Only 32% of breast cancer survivors engage in ACSM's 150 mins of moderate to vigorous activity per week recommended guidelines. Women who engaged in regular physical activity post diagnosis had a 20-50% lower mortality risk from breast cancer than those who did not. The purpose of this analysis is to identify whether breast cancer survivors participating in the Nutrition and Exercise during adjuvant Treatment (NEXT) trial had changes in their physical activity levels during and 1-year post treatment.

Methods: Stage I-III female breast cancer survivors (51 ± 11 yrs.), participated in the NEXT trial. Six-month physical activity recall measured at baseline, end of study (EOS) (average length = 45 weeks) and one year follow up via Minnesota Leisure Time Physical Activity Questionnaire, scored as average weekly minutes of moderate to vigorous physical activity (MVPA). Due to non-normal distribution of physical activity, a generalized estimating equation with a gamma log link, with pairwise contrasts to determine changes in individual levels of activity between time points. Data are estimated marginal mean ± standard error.

Results: 73 women were assessed at baseline, 59 at end of study and 35 at one year follow up. MVPA did not statistically change from baseline to EOS (176 ± 23 to 192.23 ± 12.6 mins). There were statistically significant differences in MVPA between EOS and one year follow up (288 ± 50 min, p=0.04), and between baseline and one year follow up, (p<0.01). At baseline, 43% of participants did not meet the ACSM recommended 150 mins/week of MVPA, however this improved to 63% of participants at both end of study and one year follow up.

Conclusion: Breast cancer survivors enrolled in a supervised exercise program concurrent to and immediately after adjuvant treatment maintained MVPA levels. Furthermore, there was an increase in those meeting the current physical activity guidelines at both end of study and one year follow up.

3172 Board #77 June 2 2:00 PM - 3:30 PM
Hydration Status In Cancer Patients: Exercise Is Not A Palliative Care

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PURPOSE: Hydration is a controversial area in cancer, associated to a compartmentalization of body fluids an increased mortality. Sedentary and cells toxicity contributes to this imbalance. The water's amount swings out of the reference ranges with a predominant percentage in the extracellular site. The role of aerobic and resistance exercise to reduce edema in a short - mid time in cancer is not well investigated. The study aims to evaluate the eventual efficacy of a mixed and individualized medium-long term exercise program in the improvement of the patients' hydration status. **METHODS:** From a large cohort of 145 cancer patients, a subgroup composed of 35 subjects (7 male and 28 female, 58±10 yrs, 72.6±16.3 kg, 26.7±5.9 BMI) affected by colon and breast cancer and clinically stable, were enrolled for the Exercises prescription program, aerobic and resistance, following the ACSM guidelines, for at least 12 months. Hydration status was evaluated by Bioelectrical Impedance Analysis (BIA) using 101, Akern-RJL Systems, at T0, T6, and T12. **RESULTS:** Significant changes were detected for what concerns the redistribution of body water. There was a significant improvement of Intra Cellular Water % at T6 (T0: 51.61±4.43 vs T6: 52.93±4.11; p<0.01) and at T12 (T0: 51.61±4.43 vs T12: 54.24±3.41; p<0.001). While it appears evident a significant reduction of Extra Cellular Water % at T6 (T0: 48.38±4.43 vs T6: 47.06±4.11; p<0.01) and at T12 (T0: 48.38±4.43 vs T12: 45.75±3.41; p<0.001) despite the absence of a significant variations of the Total Body water%. A significant (p<.005) improvement of Fatty Free Mass

(FFM) was also observed. **CONCLUSIONS:** Like a poplilip, a mixed moderate intensity exercise contributes to a correct water distribution in the active intracellular compartments in cancer patients. Those results appear to be already relevant after 6 months and they become even more evident after 12 months.

3173 Board #78 June 2 2:00 PM - 3:30 PM
Strength Training Following Hematopoietic Stem Cell Transplantation: Designing Interventions for Eventual Translation into Clinical Practice

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 (No relationships reported)

PURPOSE: Intensive cancer therapy followed by hematopoietic stem cell transplantation (HCT) results in highly distressing symptoms, impaired functional ability and diminished quality of life. These problems are amendable to exercise interventions but dependent upon participant uptake for eventual translation into clinical practice. This study reports subject attrition, compliance, adherence, and progression from the strength training arm (n = 37) of our intervention study, Strength Training to Enhance Early Recovery (STEER) after HCT.

METHODS: This single-blind controlled study randomized subjects to STEER versus usual care plus attention control with health education. STEER consisted of a progressive resistance program using elastic resistance bands tailored to the individual's capabilities and integrated seamlessly into existing clinical practice. Subjects received instruction and began active range of motion two times per week while hospitalized for HCT followed by a six-week moderate intensity program (three sessions per week/18 sessions total) post hospital discharge. STEER employed a combined supervised/unsupervised approach.

RESULTS: Four subjects died during the course of the study, unrelated to the STEER intervention (attrition rate 10%). Post-hospitalization, subject compliance with STEER was high (83%, SD = 22) as well as adherence to the exercise prescription (89%, SD = 25). Most subjects (90%) were able to progressively increase their prescription by adding repetitions, sets, number of exercises or band resistance.

CONCLUSIONS: STEER was tested in a challenging group of patients during a period of complex, frequently changing needs. Our study took advantage of common clinical situations following HCT, such as frequent clinic visits during the first six weeks following hospital discharge and downtime in clinic when subjects wait to see their healthcare provider. Using downtime in clinic to exercise is an efficient use of subjects' time. The intervention was specifically designed to minimize subject burden and maximize benefits. Subjects had high compliance and adherence to the STEER intervention which (1) reflects a patient-centered approach; (2) demonstrates effective tailoring to HCT subject's capability; and, (3) facilitates eventual translation into practice.

3174 Board #79 June 2 2:00 PM - 3:30 PM
Self-reported Ltpa Versus Expected Ltpa In Rural Cancer Survivors: Missing The Mark

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The evidence of the benefits of exercise for those diagnosed with Cancer has grown significantly indicating that leisure time physical activity is associated with lower risks of many types of cancer. As part of an ongoing study of rural cancer survivors in West Central Pennsylvania we sampled subjects regarding their levels of leisure time physical activity and compared those levels to ACSM recommendations. **Purpose:** To describe the levels of self-reported total lifetime leisure time physical activity hours vs ACSM recommended expected hours. **Methods:** A sample of 39 rural cancer survivors completed questionnaires which included a modified Historical Leisure Activity Questionnaire. Grouped by age (13-17, 18-22, 23-34, 35-50, 51-65, and 66-80), Total MET Hours were calculated and compared to ACSM recommendations of 2.5 hours of moderate intensity activity per week. The comparator of a 5 MET activity was used in the calculation of the benchmark Total MET Hours value. This study was approved by the Saint Francis University IRB. **Results:** Thirty-three (33) questionnaires were returned and 27 were analyzed. Participants were predominantly white, non-Hispanic, with a mean age of 60 years (27 to 77 years). The mean age of Cancer diagnosis was 51 years, (9 to 70 years). Breast Cancer (n=11) and Prostate (n=4) were primary Cancers reported. Significant differences (p<0.05) from actual to expected Total MET hours were found for each age group, except for the 13-17 group. The following groups demonstrated significantly lower Total MET Hours than expected: 18-22 (p<.017), 23-34, (p<.016), 35-50 (p<.000), 51-65 (p<.001), and 66-80 (p<.043). Average percent difference ages 13-50 is 636% actual to expected MET Hours. **Conclusion:** This pilot data supports the evidence that reduced physical activity is associated with a cancer diagnosis, and suggests that lifetime physical activity levels may play a role in the incidence of Cancer in a rural population. Support was provided in part, by the Department of Physical Therapy.

3175 Board #80 June 2 2:00 PM - 3:30 PM

Breast Cancer Survivors Speak about Triathlon and Dragon Boat Team Training

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Motivations for Breast Cancer Survivors (BCS) to exercise after cancer treatment are not well understood and many BCS do not exercise at recommended levels. Goal-oriented team exercise training, such as triathlon training and dragon boating, may improve exercise activity. **PURPOSE:** The overall objective of this study was to determine the motivations to participate in goal-oriented team triathlon training among a group of BCS dragon boat racers. **METHODS:** Female breast cancer survivors (age=63.5(SD 4.1)) yr, BMI =25.8(SD 4.4)) who were members of a BCS dragon boat team (membership length=6(SD 4.1) seasons) were recruited to participate in a focus group after completing a 14 wk individualized triathlon training program. Training comprised two supervised group sessions and three home-based sessions per week. The training program culminated with participation in a sprint triathlon (Athleta Iron Girl, 0.5 mi swim, 12 mi bike, 3.1 mi run). Dragon boat training occurred twice weekly during triathlon training. Common themes related to dragon boat and triathlon training participation were analyzed. **RESULTS:** Four women participated in the focus group from which the following themes emerged: (1) Champion for Exercise from personal contacts, (2) Team motivation to join another team, (3) Sharing Life Experiences while not focusing on cancer helped in supporting each other, (4) Having Fun and not focusing on cancer was important, and (5) Integrating New and Renewed types of exercise into daily lives. Overall, survivors recognized their improved activity levels during triathlon training. They also expressed a desire for future volunteer participation to encourage others in the program. **CONCLUSIONS:** Goal-oriented team triathlon training for BCS dragon boat racers can improve exercise activity. Structured exercise as a part of a team with a common goal may have facilitated successful participation. Thus, goal-oriented team training could lead to better health for BCS. **FUNDING ACKNOWLEDGEMENT:** Aurora Research Institute/Aurora Health Care

3176 Board #81 June 2 2:00 PM - 3:30 PM

Effects Of Resistance Plus Aerobic Training On Body Composition In Breast Cancer Survivors On Aromatase Inhibitors

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Background: Treatment for breast cancer is multi-modal and often includes estrogen blockade that can alter body composition. Aerobic training can reduce body fat, while resistance training improves lean mass and, bone mineral density (BMD); however, it is unclear whether exercise retains its efficacy during aromatase inhibition. Our study determined the influence of combined aerobic + resistance training on body composition of breast cancer survivors (BCS) that use aromatase inhibitors. **Methods:** Women cancer survivors are randomized to 9 months of exercise [Resistance + aerobic training] (EX): n= 18 or stretching group (SG): n=18]. Body composition was measured by DXA (total body and trunk fat mass % body fat (BF); lean body mass (LBM); spine and total hip BMD at baseline, 3, 6 and 9 months. The exercise group performed by 40 minutes with 7 resistance exercises on machines followed by 30 minutes of treadmill (aerobic) training 3x/wk. Separate 2 x 3 repeated measure ANOVAs were used to compare groups. **Results:** Retention in the study was 94% in EX and 72% in SG. Adherence to training was 78.2%. Significant group x time interactions were found for total and trunk fat mass, and % body fat, (p<0.001), where women in EX lost fat compared to slight gains among women in SG. There were no significant group x time interactions for LBM, total hip or spine BMD.

Table 1. Mean score changes in EX and SG groups from baseline to 9 months

	EX M (SD)	SG M (SD)	*p value
Total Fat Mass (kg)	-2.43 (1.77)	0.26 (0.78)	0.03
Trunk Fat Mass (kg)	-1.26 (1.06)	0.66 (0.69)	0.01
Body Fat (%)	-2.23 (1.63)	0.65 (1.53)	0.01
Lean Mass (kg)	0.63 (1.02)	-0.51 (1.96)	0.12
Spine BMD (g/cm ²)	-0.03 (0.06)	-0.02 (0.03)	0.94
Total Hip BMD (g/cm ²)	-0.002 (0.04)	0.007 (0.01)	0.22

Conclusion: This study demonstrated the potential efficacy of combined training to decrease total and trunk fat mass, an indicator of central adiposity, in breast cancer survivors on aromatase inhibitor therapy, in which fat mass is considered risk factor for recurrence of cancer, metastasis and other chronic disease. A combined modality program did not slow bone loss in this population, thus modifications to the program to include specific osteogenic training may need to be considered to target this health outcome.

3177 Board #82 June 2 2:00 PM - 3:30 PM

Exercise Effects on Symptom Cluster, Cortisol, Heart Rate Variability and QOL in Breast Cancer Survivors

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Exercise may mitigate a cluster of related symptoms in Breast Cancer Survivors (BCS). This cluster includes fatigue, sleep disturbances, pain, depression, and cognitive changes. In addition, Cortisol Awakening Response (CAR), a function of stress, Heart Rate Variability (HRv), an indication of cardiac autonomic balance, and quality of life (QOL) may relate to this symptom cluster.

PURPOSE: To examine the effect of triathlon training on a BCS symptom cluster and to determine the relationships between the symptom cluster and CAR, HRv and QOL. **METHODS:** Female BCS (N = 26; age = 49 (8) yr) participated in a 14 wk. sprint triathlon training program. Training consisted of 2 supervised and 3 unsupervised sessions per week. Pre- and Post- training measures included CAR, HRv, and QOL (FACT-B), along with fatigue (FACIT-F), and PROMIS questionnaires for cognition (Applied Cognition-General Concerns-Short Form), depression (Emotional Distress-Depression), pain (Pain Interference-SF), and sleep (Sleep Disturbance-SF). Except for QOL and FACIT-F, higher questionnaire scores represent worse function.

RESULTS: Data are mean (SD). After training, CAR decreased, (pre= 12.8 (6.8), post= 8.5 (7.3) nmol/L, p= 0.03) and HRv increased, (pre= 44.8 (28.2), post= 68.6 (55.4) ms, p= 0.04). Further, QOL (pre= 117.4 (14), post= 125.1 (11), p< 0.01), fatigue, (pre= 41.0 (9.1), post= 47.2 (4.1), p< 0.01), cognition (pre= 16.4 (8.4), post= 13.1 (5.8), p= 0.02), depression, (pre= 10.7 (4.6), post= 9.2 (2.5), p= 0.04), and pain improved (pre=10.6 (3.9), post= 8.9 (2.2), p= 0.03). Sleep did not change. No training variables were associated with CAR or HRv. Before training, QOL correlated with depression (rs= - 0.70), cognition (rs= -0.64) and fatigue (rs= 0.80). Further, sleep correlated with pain (rs= 0.37) and depression correlated with cognition (rs= 0.54). Similar correlations were observed after training.

CONCLUSIONS: Triathlon training for BCS improved all symptoms in a cluster except sleep. QOL was related to cognition, depression and fatigue. CAR and HRv were not related to any of the symptoms studied. However, the decreased CAR and increased HRv from exercise in BCS could have positive health implications.

Funding was provided by Vince Lombardi Cancer Research Foundation/Aurora Health Care

3178 Board #83 June 2 2:00 PM - 3:30 PM

Investigating Physical Activity Levels And Distance-delivered Interventions Amongst Survivors Of Childhood Cancer

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Purpose: This study aimed to assess physical activity levels in childhood cancer survivors (CCS), compare these to recommended guidelines, and investigated the feasibility of distance-delivered physical activity interventions amongst CCS.

Methods: CCS (aged \geq 16) and parents (survivors aged $<$ 16) from 11 hospitals in Australia and New Zealand participated in this study. Participants self-reported their moderate-vigorous physical activity (MVPA). This was compared to American Cancer Society's physical activity guidelines (150 min/week for adults, 300 min/week for children). A systematic review and meta-analysis were conducted to determine the feasibility (adherence, retention and recruitment) and effect of distance-delivered interventions on physical activity levels, physical and psychological function after intensive treatment.

Results: 329 CCS (age=27.7 \pm 7.2years, 20.3 \pm 8.3years since diagnosis) and 254 parents of CCS (age=14.0 \pm 2.8years, 10.9 \pm 2.9years since diagnosis) participated. Adult CCS reported mean MVPA of 115.9 \pm 129.8 min/week and children had MVPA of 231.3 \pm 227.8 min/week, which was in both cases lower than recommended guidelines (both $p<0.001$). Only 31.3% of adults and 29.1% of children achieved recommended MVPA guidelines. Our systematic review included 13 studies (n=270 participants), while 4 (n=102 participants) were included in the meta-analysis. Distance-delivered physical activity interventions were feasible in CCS (mean recruitment rate=64%, retention rate=85%, adherence rate=88%), but did not increase physical activity levels from baseline to post intervention ($p=0.09$). Participation in physical activity interventions displayed a positive effect on physical function ($p=0.002$) and psychological outcomes ($p=0.001$).

Conclusion: Over two-thirds of child and adult CCS are not achieving recommended physical activity levels. Strategies including education and early monitoring are needed to increase MVPA levels to lower the risk of cardiovascular and metabolic co-morbidity. CCS may experience barriers including fatigue, access to facilities or lack of guidance, but our investigation into distance-delivered interventions to increase physical activity levels suggests that such interventions could represent a viable option to tackle this important issue.

3179 Board #84 June 2 2:00 PM - 3:30 PM

Exploring Prostate Cancer Survivors' Exercise Motivation, Facilitators And Barriers Following Participation In The TrueNTH Program

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The TrueNTH Lifestyle Management program is an international program aimed to improve the survivorship and wellness of men with prostate cancer. As part of the national network, an initial 12-week exercise program, 3 days per week, was carried out at a university-based location in Edmonton Canada.

PURPOSE: To better understand the motivation, facilitators and barriers to exercise following participation in the TrueNTH exercise program.

METHODS: An optional post-program satisfaction questionnaire was administered and a focus group session conducted with 16 of the 22 program participants (mean age: 65.5 years). Quantitative data from the patient satisfaction questionnaire were analyzed descriptively and qualitative data from the focus group were used to clarify and further describe quantitative results.

RESULTS: Main findings included high satisfaction with the program (100%) and mean improvements in 8 repetition maximum strength of 8.5 lbs for bench press and 31.6 lbs for the leg press. Results from the Behavioral Regulation in Exercise Questionnaire (Version 3) showed high scores for intrinsic (3.28) and identified integration (3.25), and low scores for amotivation (0.083) and external regulation (1.18). Qualitatively participants reported benefits for body image, muscular strength as well as psychosocial wellbeing. Facilitators of exercise included supervised exercise, social support of other prostate cancer survivors, and a positive exercise environment. Survivors reported feeling "safe" and "at home" at the centre despite incontinence, use of a catheter, and issues with body image. Barriers included limited options for class times and transportation issues.

CONCLUSION: Prostate survivors taking part in the TrueNTH program were highly motivated, enjoyed, and valued the benefits of the exercise program. This examination of site-specific exercise facilitators and barriers allows for adaptation of programming to the local context.

3180 Board #85 June 2 2:00 PM - 3:30 PM

Effects of Exercise Training on Circulating Level of Sclerostin in Breast Cancer Survivors

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Wingless and integration site growth factor (Wnt) signaling is a tumorigenesis-related signaling pathway. Sclerostin is one of endogenous negative regulators of Wnt/ β -catenin signaling. Accumulating evidences indicate that higher serum level of sclerostin is associated with osteoporosis and bone metastasis in breast cancer patients.

PURPOSE: To investigate whether exercise training elicits changes in the serum level of sclerostin in breast cancer survivors. **METHODS:** Thirty-nine breast cancer survivors after anti-cancer treatment and forty healthy women volunteers participated in this study. Breast cancer survivors were randomized to either an exercise group or a control group for 12 weeks. All participants completed health-related fitness tests and measurements of anthropometric and serological biomarker variables. Independent *t*-test and Wilcoxon signed-rank test were performed to analyze the changes of variables between- and within-groups, respectively. **RESULTS:** Breast cancer survivors showed higher levels of serum sclerostin compared to age-matched healthy women at baseline (115.6 \pm 58.8 vs. 86.5 \pm 53.2 pg/mL, $p=0.016$). Exercise training for 12 weeks remarkably improved muscle strength, endurance and flexibility, and reduced body fat percentage, waist circumference and visceral fat area in breast cancer survivors. The exercise training reduced the serum levels of insulin, leptin and interleukin-8 as well (all $p<0.05$). Moreover, circulating sclerostin levels were significantly decreased by the exercise training (124.4 \pm 17.0 vs. 106.3 \pm 42.6 pg/mL, $p=0.021$), but there were no differences observed in control group during this clinical trial periods (116.3 \pm 42.6 vs. 114.2 \pm 66.9 pg/mL, $p=0.295$). **CONCLUSION:** These findings suggest that sclerostin may be a notable serological parameter reflecting the beneficial effects of exercise training in breast cancer survivors.

F-54 Free Communication/Poster - Cardiorespiratory Responses to Acute Exercise

Friday, June 2, 2017, 1:00 PM - 6:00 PM

Room: Hall F

3181 Board #86 June 2 2:00 PM - 3:30 PM

Assessment of Heart Rate Variability After Maximal Exercise in Trained Postmenopausal Women

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The increased parasympathetic tone achieved with endurance training may provide important cardioprotection after menopause. Inability to restore autonomic balance postexercise is a risk factor for sudden cardiac death as sympathetic stimulation has an arrhythmic effect. Until recently, most of the studies on recovery heart rate variability (HRV) have focused on young men. **PURPOSE:** The purpose of this study was to compare the HRV response from rest through maximal exercise and recovery in postmenopausal women (PNW) who trained at moderate (MOD) or vigorous (VIG) intensities. **METHODS:** Thirty-six PMW women volunteers who self-reported exercising at either MOD (3-5.9 METS; n = 18; 58.9 \pm 4.4 yr, 59.2 \pm 6.8 kg, 160.9 \pm 10.0 cm, 32.4 \pm 5.7 ml/kg/min), or VIG intensities (>6 METS; n = 18; 59.7 \pm 5.2 yr, 68.3 \pm 10.2 kg, 167.0 \pm 7.4 cm, 34.5 \pm 5.1 ml/kg/min) participated. HRV and cardiorespiratory fitness (Bruce protocol) were measured in the laboratory. The HRV was measured with a heart rate monitor at rest for 5 minutes in the supine position with the participant breathing normally. HRV was also measured in the last minute of the $\dot{V}O_2$ max test and after 2 minutes of active recovery. Comparison of HRV in MOD and VIG was performed using a factorial ANOVA with repeated measures on time. HRV values were log transformed due to skewness. An alpha of .05 was considered statistically significant. Data are presented mean \pm SD. **RESULTS:** The two groups (MOD, VIG) responded similarly over the three time periods for selected HRV indices of root mean square of sequential deviations (rMSSD), and high (HF) and low frequency (LF) power values ($p>.05$). There were significant main effects for rMSSD, HF and LF. Specifically, maximal exercise significantly lowered rMSSD (3.3 \pm 0.08 vs. 1.2 \pm 0.06) and lnLF (4.1 \pm 0.05 vs. 3.3 \pm 0.13) and increased lnHF (3.3 \pm 0.14 vs. 4.0 \pm 0.10; $p<.01$) from resting. However, two minutes of active recovery significantly restored lnHF (3.3 \pm 0.11) and lnLF (4.1 \pm 0.08) from maximal values ($p<.01$). **CONCLUSION:** Our findings suggest that both moderate and vigorous exercise

training enhance HRV recovery in the immediate postexercise period following one bout of maximal exercise in older women. These data further document the benefits of regular aerobic exercise in the improvement of cardiac electrical stability.

3182 Board #87 June 2 2:00 PM - 3:30 PM
Effects of Submaximal Downhill Running on Plasma Cytokine Expression in Young, Endurance Trained Individuals
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Strenuous exercise has been shown to dramatically alter levels of anti- and proinflammatory cytokines; proteins involved in regulation of systemic inflammation. **PURPOSE:** To determine if a single bout of submaximal downhill running will elicit a change in expression of specific circulating cytokines. **METHODS:** Healthy endurance-trained men (n=5) and women (n=3) aged 18-35 were screened for exercise contraindications using a health history questionnaire, blood chemistry, and body composition. A VO_{2max} test and downhill running familiarization were completed to determine experimental running speed at 70% VO_{2max} . After abstaining from exercise, caffeine, alcohol, NSAIDs, and other drugs for 48 hours, subjects ran on a 15% decline for 30 minutes at 70% VO_{2max} and ~70% HRR. Fasting blood samples were obtained immediately before and after the run, as well as after 30 minutes, 60 minutes, and 24 hours of rest. Plasma was immediately separated, aliquoted, and stored at -80°C. ELISA kits specific to each cytokine were used to measure cytokine levels at each time point. Samples were run in duplicate. **RESULTS:** There were no significant changes in IL-15 or Myostatin at any time point. Compared to baseline, IL-1ra showed an increase of 46.9% (p=0.009), 60.9% (p=0.001), and 38.8% pg/ml (p=0.028) at 0 minutes, 60 minutes and 24 hours after exercise, respectively. For IL-10, there was an increase of 19.6% (p=0.01), 28% (p=0.003), and 37.1% (p=0.0009) at 30 minutes, 60 minutes, and 24 hours after exercise, compared to baseline. **CONCLUSION:** In endurance trained subjects, a 30 minute submaximal bout of downhill running caused an increase in the anti-inflammatory cytokines IL-1ra and IL-10 for up to one day, and no significant change in the inflammatory cytokines IL-15 or myostatin. IL-1ra exhibited the greatest increase 60 minutes after exercise, while IL-10 was increased significantly at 30 minutes, 60 minutes, and 24 hours, with the greatest effect seen the day after exercise. This increase in systemic anti-inflammatory cytokines is consistent with literature investigating cytokine levels immediately after eccentric exercise. Further, IL-15 levels were highly variable, and divided subjects into two groups that were not explained by any demographics studied. This result has not been previously reported and deserves further study.

3183 Board #88 June 2 2:00 PM - 3:30 PM
Similar Oxygen Consumption and Metabolic Cost of Thermo-Neutral and Hot Yoga.
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 (No relationships reported)

Hot yoga has gained enormous popularity in recent years due, at least in part, to increased environmental challenge associated with hot compared to traditional (thermo-neutral) yoga. However, it is not clear that hot yoga is more intense than traditional yoga and whether it meets current physical activity guidelines. **PURPOSE:** To examine energy expenditure as well as objective (i.e., % VO_{2max}) and subjective (i.e., RPE) measures of exercise intensity during identical yoga sessions performed in a hot and thermo-neutral environment in healthy adults. **METHODS:** Using a cross-over, randomized order design, 14 participants completed two identical 20-minute yoga sessions in a hot ("H"; 35.3 ± 0.8°C; humidity: 20.5 ± 1.4%) and thermo-neutral ("TN"; 22.1 ± 0.2 °C; humidity: 27.8 ± 1.6%) environment performed one week apart. Oxygen consumption (VO_2) was measured during steady-state yoga to determine exercise intensity (% VO_{2max}) and to determine energy expenditure (kcal/min). Heart rate and rate of perceived exertion (RPE) were also collected during steady-state yoga to determine exercise intensity (%HRmax) and participant perception of intensity using the Borg Scale (6-20). **RESULTS:** There were no differences in exercise intensity based on % VO_{2max} during hot vs. thermo-neutral yoga (30.9 ± 2.3 vs. 30.5 ± 1.8%, p=0.68) or energy expenditure (5.12 ± 0.50 vs. 4.97 ± 0.39 kcal/min, p=0.42). However, exercise intensity was significantly higher during hot vs. thermo-neutral yoga based on %HRmax (67.0 ± 2.3 vs. 60.8 ± 1.9%, p=0.01) and RPE (11.8 ± 0.9 vs. 10.7 ± 0.8, p=0.04). Furthermore, hot yoga would be classified as "light" intensity exercise based on % VO_2 but "moderate" intensity exercise based on %HRmax and RPE while thermo-neutral yoga would be classified as "light" intensity exercise based on % VO_{2max} , %HRmax, and RPE (according to established ACSM guidelines). **CONCLUSION:** Despite the added hemodynamic stress and perception that exercise

in a hot environment is more difficult than in a thermo-neutral room, we observed parallel responses in oxygen consumption during hot vs. thermo-neutral yoga resulting in relatively modest but equal objective measures of exercise intensity and energy expenditure.

3184 Board #89 June 2 2:00 PM - 3:30 PM
Different Types Of Stability Balls Impact On Heart Rate And VO2 Responses To Arm Ergometry
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Prior studies have demonstrated that sitting on a stability ball during arm ergometry elevates oxygen consumption about 10%; however, the influence that the characteristics of the stability ball has on this response has not been examined. **PURPOSE:** The purpose of this study was to determine if the type of material or size of a stability ball affects the heart rate or oxygen consumption levels during aerobic arm exercise. **MEHODS:** Ten apparently healthy young adults that were at least moderately active underwent two three minute stages of arm ergometry (increase heart rate by 20-40 b/min each stage) sitting on three different stability balls: 75 cm D made of stiff material (SB), 75 cm D made of elastic material (EB), and 65 cm D made of elastic material (SE) with the order randomized. VO_2 and heart rate (HR) were continuously monitored. **RESULTS:** Repeated measures ANOVA revealed that the type of stability ball did not significantly (p = .417) affect heart rate. However, VO_2 was significantly (p = .005) affected by ball type. The EB was 6 to 7% higher than the SB.

Table. Different Types of Stability Balls during Exercise				
	Stage 1 VO_2 L/min	Stage 2 VO_2 L/min	Stage 1 HR min ⁻¹	Stage 2 HR min ⁻¹
SB Mean + SD	0.613 + 0.306	0.829 + 0.406	118 + 12	143 + 12
EB Mean + SD	0.653 + 0.322	0.877 + 0.437	121 + 18	145 + 18
SE Mean + SD	0.622 + 0.286	0.851 + 0.413	117 + 18	141 + 16

CONCLUSION: It is concluded that a more elastic material making up a stability ball can elevate the metabolic response to arm exercise but might be attenuated by a smaller ball. In addition, the type of stability ball might not affect exercise training heart rates.

3185 Board #90 June 2 2:00 PM - 3:30 PM
The Effect Of Exercise On Inter-arm Systolic Blood Pressure Difference
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 (No relationships reported)

Clinically, when a difference of ≥10 mmHg in systolic blood pressure (SBP) between arms exists, it is identified as inter-arm systolic blood pressure difference (ISBPD). At rest, ISBPD is linked with hypertension, peripheral vascular disease, and increased premature mortality. It is well known that exercise reveals underlying cardiovascular pathologies absent at rest. However, there have been no investigations to examine the effect of exercise on ISBPD. **PURPOSE:** To determine if exercise may alter ISBPD when measured at rest, or reveal ISBPD when not observed in the resting condition. **METHODS:** An experienced investigator sequentially measured SBP using standard auscultation in each arm (alternating order). ISBPD was quantified at rest (REST). Participants then completed a three-stage protocol on a cycle ergometer. A cadence of 50 rpm was maintained at a workload of 3 (EX-3; light) and 6 METS (EX-6; moderate) and during an active recovery (AR). At each stage, SBP was measured upon achieving steady-state heart rate. A logistic regression analysis was used to determine the change in odds ratio of ISBPD when exposed to exercise. **RESULTS:** Eighty-five healthy individuals (18-45y) completed the study. Thirteen percent (n=11) presented with ISBPD during REST. In these individuals, the difference in SBP between arms was lower at AR than at REST (3.81 mmHg; P<0.05). In individuals who did not present with ISBPD during REST (n=74), progression from EX-3 to EX-6 significantly increased the odds of ISBPD (4.31; P<0.05). **CONCLUSIONS:** In individuals with ISBPD at rest, active recovery from exercise attenuated the difference between inter-arm SBP. Moderate-intensity exercise resulted in ISBPD not otherwise present at rest.

3186 Board #91 June 2 2:00 PM - 3:30 PM

The Relationship Between Changes In Rmssd And Rectus Femoris Cross-sectional Area Following Exercise

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PURPOSE: The natural log transformation of the root mean square of successive R-R differences (lnRMSSD) is a parasympathetic measure of heart rate variability. The extent to the relationship between lnRMSSD and localized muscle damage following exercise is unknown. The purpose of this study was to examine the relationship between lnRMSSD and Rectus femoris CSA (CSA-RF) following an exhaustive bout of exercise over 72 hours. **METHODS:** Twelve participants were measured for pre-exercise lnRMSSD for five minutes in a seated position, followed by a CSA-RF measurement with musculoskeletal ultrasound 15 cm above the superior pole of the participant's right patella. Next participants completed an exhaustive exercise protocol. Finally, participants repeated the lnRMSSD and CSA-RF measures immediately following exercise termination with follow-up testing at 24-hours, 48-hours, and 72-hours. **RESULTS:** Repeated measures ANOVA revealed significant differences in lnRMSSD between pre-exercise and post-exercise measures ($p = .002$, Table 1), but no other significant differences. Likewise, there were significant differences in CSA-RF from pre-exercise to post-exercise ($p < .001$, Table 1), but no other differences were noted. There was a large near-significant correlation between the changes in lnRMSSD and CSA-RF from pre-exercise to post-exercise ($r = -.57$, $p = .055$), and large statistically significant correlation between the changes in lnRMSSD and CSA-RF from pre-exercise measures to 24-hour follow-up ($r = -.64$, $p = .025$). **CONCLUSIONS:** In this study lnRMSSD declined as CSA-RF increased immediately following exercise up to 24 hours. This inverse relationship is likely the result of vagal tone suppression and increased sympathetic outflow in cardiac control during and immediately following exercise. Tracking lnRMSSD following exercise may give practitioners further insight to the mechanisms of recovery.

	Pre-Ex	Post-Ex	24H-Post-Ex	48H-Post-Ex	72H-Post-Ex
lnRMSSD	3.99	2.60*	3.91	3.92	3.89
CSA-RF	7.12	7.73*	7.17	7.06	7.35

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Heart Rate Variability Following a Short and Long Bout of High-Intensity Functional Training

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(No relationships reported)

Depression of Heart Rate Variability (HRV) occurs following exercise and is influenced by the intensity and duration of the activity. High-Intensity Functional Training (HIFT) is a style of training performed using various modalities and durations. **Purpose:** To examine the effect of a short (< 5-min) and a long (15-min) bout of HIFT on HRV recovery. **Methods:** Ten apparently healthy males (28 ± 5 yrs) participated in this study. Two HIFT sessions were performed in a crossover fashion. Each visit consisted of three HRV recordings: at rest (PRE; 10-min), post exercise (P; 45-min), and two-hours post (P2HR; 10-min). The short bout (SHORT) consisted of 30 power clean-and-jerks (61 kg) for time, while the long bout (LONG) was a 15-min circuit of 250m row, 20 kettlebell swings (24 kg), and 15 dumbbell squat presses (16 kg). The HRV marker used was the Root Mean Square of Successive Differences (RMSSD) and was analyzed in 5-min segments: the last 5-minutes of PRE, eight segments during P (P1-P8) starting at the 5th minute, and the last 5-mins of P2HR. **Results:** Normality was violated and data underwent a natural log transformation (lnRMSSD). Repeated Measures ANOVA did not reveal any significant differences in lnRMSSD between the SHORT and LONG trials ($p = 0.822$). A significant time effect ($p = 0.023$) was observed in both trials, with lnRMSSD depression occurring from P1-P8 ($p < 0.05$) and recovering by P2HR ($p = 0.141$). **Conclusion:** This study indicates that SHORT and LONG bouts of HIFT result in similar HRV depression and recovery. Future research is needed to better understand various bouts of HIFT and its relationship with HRV.

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Effects of Prior Aerobic Exercise and Prolonged Sitting on Postprandial Plasma Glucose and Triglyceride Responses

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(No relationships reported)

Sedentary behavior, particularly prolonged sitting, is common in modern society and is associated with numerous cardiovascular disease (CVD) risk factors, including impaired glucose metabolism and higher blood triglycerides. **PURPOSE:** The purpose of this study was to determine the effects of a single bout of aerobic exercise performed prior to a prolonged sitting challenge on postprandial plasma glucose and triglyceride responses. **METHODS:** Ten healthy men [21.2 ± 0.6 y; maximal oxygen consumption (VO_{2max}) = 49.6 ± 1.7 ml/kg/min (mean \pm SE)] participated in a randomized, cross-over study in which they completed a single bout of continuous treadmill exercise (45 min at 65% VO_{2max}) or 45 min of seated rest. A carbohydrate-rich snack [190 kcals; 29/7/3g (carb/fat/pro)] was ingested by participants 30 min before and 30 min following exercise (or seated rest). Plasma glucose and triglycerides were measured after an overnight fast (Pre), 1 hr following exercise (or seated rest) (Post), and at 1 hr intervals during a 3 hr prolonged sitting challenge. Study personnel monitored participants during the sitting challenge to ensure minimal lower extremity movement. Repeated-measures ANOVA and Bonferroni post-hoc tests were used to evaluate differences within and between trials. **RESULTS:** Treadmill exercise was completed at $65.4 \pm 1.3\%$ VO_{2max} (range = 60.9-72.6%). A main effect due to time ($P < 0.001$) was observed for plasma glucose. Relative to Pre, plasma glucose concentrations in the exercise trial increased at Post by 12.1% ($P = 0.05$) and were 8.6% and 14.5% lower ($P \leq 0.02$) at 1 and 3 hr of prolonged sitting, respectively. Plasma glucose concentrations in the seated rest trial increased at Post by 15.0% ($P < 0.01$) and returned to levels no different than Pre by 1 hr of prolonged sitting. Plasma triglycerides showed no time or treatment effects. **CONCLUSION:** These preliminary findings suggest that acute aerobic exercise performed prior to 3 hr of prolonged sitting lowers postprandial plasma glucose responses induced by a carbohydrate-rich snack in healthy men. Future studies should investigate individuals at increased CVD risk and utilize a larger postprandial challenge to further elucidate potential deleterious effects of prolonged sitting.

Supported by Miami University Undergraduate Summer Scholars Program.

3189 Board #94 June 2 2:00 PM - 3:30 PM

Effect Of Vitamin D At Rest And In Response To Maximal Exercise

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(No relationships reported)

Conflicting evidence suggests insufficient vitamin D (VitD) levels are associated with high resting blood pressure (BP). However the relationship between VitD and the peak systolic BP (SBP) response to exercise, a predictor of future hypertension, has yet to be investigated. **PURPOSE:** We sought to examine the relationship among serum 25-hydroxy VitD (25[OH]D), resting BP, and the peak SBP response to a graded exercise stress test among a large sample ($n=417$) of healthy men (49%) and women (51%) over a broad age range (20-76 yr; mean age 44.1 ± 0.8 y). We hypothesized that individuals with clinically sub-optimal VitD would have higher resting BP and a peak SBP response to a graded exercise stress test compared to individuals with optimal VitD levels. **METHODS:** Fasting serum VitD, anthropometrics, resting BP, and peak exercise SBP were obtained at the baseline visit of a larger clinical trial (STOMP; NCT01140308). **RESULTS:** Mean VitD levels were 36.1 ± 0.7 ng/mL, with 41.2% of individuals classified as sub-optimal (< 32 ng/mL). Average resting BP was $118.9 \pm 0.6/75.3 \pm 0.5$ mmHg, with 41% of individuals having high BP ($n=174$) consisting of those with pre-hypertension (32.5%) and established hypertension (8.5%). Individuals with optimal VitD had higher resting SBP (120.6 ± 13.4 mmHg vs. 116.4 ± 12.7 mmHg; $p=0.002$) and DBP (76.0 ± 9.9 mmHg vs. 74.1 ± 9.1 mmHg; $p=0.048$) than individuals with sub-optimal VitD, respectively. Similarly, individuals with optimal VitD tended to have a greater peak exercise SBP response than individuals with sub-optimal VitD ($p=0.114$). **CONCLUSION:** In contrast to our hypothesis, VitD was positively associated with resting BP levels, but was not associated with peak SBP under maximal exercise conditions. Additional studies are needed to confirm our findings and to provide insight into mechanisms underlying these associations among individuals with high BP. TRIAL REGISTRATION: NCT01140308

3190 Board #95 June 2 2:00 PM - 3:30 PM
Skeletal Muscle Force Production and Bioenergetics During All-out Exercise: Influence of Group III/IV Muscle Afferents
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PURPOSE: To investigate the influence of group III/IV muscle afferent feedback on skeletal muscle force production and bioenergetics during all-out exercise.
METHODS: Phosphorous magnetic resonance spectroscopy was performed during a 5-min all-out intermittent isometric single-leg knee-extensor exercise, consisting of 60 maximal voluntary contractions (MVC), with intrathecal fentanyl (FENT), to attenuate group III/IV leg muscle afferents, and control (CTRL) conditions in 8 healthy men (age: 28 ± 5 yrs, stature: 178 ± 4 cm, and body mass: 77 ± 8 kg). Peak, integrated, and mean forces were determined per MVC and critical force (CF) was determined as the mean force of the final 6 MVCs. The intramuscular metabolic perturbation and adenosine triphosphate (ATP) synthesis rates were determined from intramuscular concentrations of phosphocreatine (PCr), inorganic phosphate (Pi), diprotonated phosphate ($H_2PO_4^-$), ATP, and pH. **RESULTS:** Peak force (FENT: 595 ± 113 vs. CTRL: 568 ± 126 N) and end-test force (FENT: 224 ± 50 vs. CTRL: 209 ± 52) were not significantly different between conditions. The cumulative integrated force was significantly greater for FENT than CTRL over the 1st min (17557 ± 2581 vs. 16154 ± 2825 N), but not thereafter (Figure 1). End-exercise [PCr] was not significantly different between conditions, while [Pi] and [$H_2PO_4^-$] were significantly greater for FENT. The estimated total ATP synthesis rate was significantly greater for FENT than CTRL over the 1st min (66 ± 16 vs. 57 ± 13 mM), but not thereafter (Figure 1). The estimated total ATP synthesis rate at CF arose from a significantly greater oxidative ATP synthesis (FENT: 77 ± 15 vs. CTRL: 83 ± 13 %) than anaerobic ATP synthesis (FENT: 23 ± 15 vs. CTRL 17 ± 13 %). **CONCLUSION:** Attenuation of group III/IV muscle afferent feedback augmented force production during the 1st min of all-out exercise, for which the increased energy demand was met, *en masse*, by the creatine kinase reaction, glycolysis, and oxidative metabolism.

3191 Board #96 June 2 2:00 PM - 3:30 PM
Mechanisms By Which Isometric Handgrip Training May Improve Endothelial Dilator Function In Young Healthy Men.
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Isometric (IHG) handgrip training can reduce arterial blood pressure (ABP), especially in hypertensives, but the mechanisms remain unclear (1). We recently showed that IHG for 4-5weeks in healthy young White European (WE) and South Asian (SA) men augmented peak exercise hyperaemia and reactive hyperaemia in the *contralateral* arm by ~30% in WEs, but only ~15% in SAs (2,3). This suggested that IHG training of one arm improves endothelial dilator function systemically even in young men, but the effects are greater in WEs. **PURPOSE:** To determine the changes induced in forearm blood flow (FBF) in the contralateral arm (CA) during a single bout of IHG training, which might serve as a stimulus for improving endothelial function, and to test whether endothelium-dependent cyclooxygenase (COX) products contribute.
METHODS: In 10 WEs and 10 SAs (19-23 yrs), FBF was recorded by venous occlusion plethysmography in the CA during IHG contractions of the dominant arm at 30% maximum voluntary contraction (5 x 3min at 5 min intervals) on 2 different days in the absence or presence of the COX inhibitor aspirin (600mg p.o.).
RESULTS: Mean arterial pressure (MABP), recorded by finger photoplethysmography, increased similarly in WEs and SAs from 79.3±2.1 to 90.0±2.4mmHg in the 1st IHG and from 78.4±1.7 to 82.6±1.8mmHg in SAs. COX inhibition had no effect on baseline or IHG values of MABP. Concomitantly, FBF in the CA increased during each IHG in both WEs and SAs, but the changes were greater in WEs than SAs, for example by an average of 30.1±2.6 vs 18.5±2.6* ml/min/100g respectively in IHG 2 and by 37.0±2.8 vs 30.6±3.2*ml/min/100g in IHG 5 (*; RMANOVA, WEs vs SAs: P<0.05). After COX inhibition, the increases in FBF were attenuated in WEs (to 11.7±1.9 and 11.6 ± 1.9§ ml/min/100g in IHGs 2 and 5), but *augmented* in SAs (to 26.8 ± 2.9§ and 39.4 ± 3.5§ml/min/100g in IHGs 2 and 5, §; before vs after aspirin: P<0.05).
CONCLUSIONS: We propose that increased FBF and increased shear stress in the CA during IHG training may act as a stimulus to improve endothelium-dependent dilator function in young WE and SA men. Further, dilator COX products contribute to the increased FBF in WEs, whereas vasoconstrictor COX products limit the increased FBF in SAs, thereby limiting the effectiveness of IHG training on endothelial function. Supported by Alexander S. Onassis Public Foundation

3192 Board #97 June 2 2:00 PM - 3:30 PM
Blood Pressure Responses To Wearing An Abdominal Belt When Performing Differing Static Exercises
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Many people wear abdominal belts when exercising to aid in stabilization of their core. Static exercise has been shown to raise blood pressure; however minimal is known about how wearing an abdominal belt impacts blood pressure during static exercise.
PURPOSE: The purpose of this study was to investigate the impact of wearing an abdominal belt on blood pressure when subjects performed 3 static exercise positions.
METHODS: n = 16, 13 males & 3 females (age=21.5±1.3 years, ht=179.2±6.4 cm, wt=79.3±12.6 kg) served as subjects. Resting blood pressure was initially measured in a seated position. Subjects then participated in three static exercises including a Wall-Sit, Side Plank, and Static Back Extension. Subjects completed each exercise position once with an abdominal belt and once without. Test order of belt/no belt and exercise positions was randomized. Blood pressure was measured at the 45 second point for each exercise. Subjects were given recovery time between exercises for blood pressure to return to normal. A 2 x 3 Factorial ANOVA was performed on systolic (SBP) and diastolic blood pressure (DBP) data. It was determined a priori that appropriate post-hoc follow up tests would be performed as needed. **RESULTS:** Results for SBP are presented in table below. For SBP no significant interaction (p>.05) was found with the 2 x 3 ANOVA. When main results were investigated no significant difference (p>.05) was found between positions. A significant difference (p<.01) was found for the main effect of With Belt vs. No Belt. No significant (p>.05) results were found with all testing of DBP.

	Wall Sit	Side Plank	Static Back Extension	Total
No Belt	146.7 (7.0)	144.8 (5.6)	144.8 (6.1)	145.4 (6.2)
W/ Belt	151.7 (9.4)	150.3 (6.6)	151.6 (5.5)	151.2 (7.2)*
Combined	149.2 (8.5)	147.5 (6.6)	148.2 (6.7)	

*p<.01
CONCLUSIONS: The results indicate that wearing an abdominal belt when performing static exercises has minimal impact on DBP between wearing a belt and not. However, wearing an abdominal belt while performing static exercises appears to increase SBP irrelevant of body position compared to no abdominal belt. Subjects should be conscious/aware of this response when performing static exercises.

3193 Board #98 June 2 2:00 PM - 3:30 PM
Post-Exercise Blood Pressure In 8-10 Year Old Boys
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INTRODUCTION: Adults often see a period of post-exercise hypotension (PEH) following moderate intensity exercise. It is not established if children experience PEH after aerobic exercise. **PURPOSE:** To investigate the changes in blood pressure (BP) occurring after a bout of exercise in prepubescent boys ages 8-10. **METHODS:** Ten boys visited the lab on four separate occasions. The first visit was to assess anthropometric measurements (height, weight and body composition via skinfolds) as well as perform a graded exercise test to exhaustion on an electronically braked cycle ergometer in order to establish aerobic capacity and peak power output (PPO). The subsequent visits (two exercise and one control) were randomized and counterbalanced and separated by at least 48hrs. The exercise visits were identical in protocol and required participants to arrive at the lab after an overnight fast. Resting BP measurements were obtained during 30 minutes of semi-recumbent seating. After the resting period, the child then performed 20 minutes of continuous cycling at 50% of their PPO. Upon cessation of the exercise test the child resumed the semi-recumbent position and BP measurements were obtained for minutes 5, 10, 15, 20, 30, 40, 50 and 60 post-exercise. Participants remained in the semi-recumbent position for the control visit; BP measurements were taken the same as the exercise visits. **RESULTS:** Data from exercise tests were averaged. When cycling at 50% of PPO the boys averaged 62% of their VO2peak. Resting systolic BP (110.7±14.2mmHg) did not significantly (p>0.05) differ when compared to post-exercise measurements at minutes 5 (125.3±23.0mmHg), 10 (113.0±16.1mmHg), 15 (111.0±15.7mmHg), 20 (108.7±14.3mmHg), 30 (108.9±16.1mmHg), 40 (106.4±16.1mmHg), 50 (107.3±15.2mmHg), 60 (104.8±16.1mmHg) or any measurements from the control visit. Furthermore, resting diastolic BP (61.0±3.9mmHg) did not significantly (p>0.05) differ when compared to post-exercise measurements at minutes 5 (58.1±5.1mmHg), 10 (61.7±1.8), 15 (61.1±4.3), 20 (59.2±3.9), 30 (60.2±5.7), 40 (60.6±5.0), 50 (63.3±5.2), 60 (61.2±5.4) or any measurements from the control visit. **CONCLUSIONS:** PEH was not observed in 8-10 yr old boys following a 20-minute exercise at 62% of VO2peak. It is unknown if a greater exercise intensity would elicit a PEH response.

3194 Board #99 June 2 2:00 PM - 3:30 PM
The Effect of Acute Exercise on Coagulation Factors and the Mechanical Properties of Fibrin Fibers
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PURPOSE: The objective of this study was to investigate the effect of acute exercise on coagulation factors and fibrin fiber properties in both younger healthy subjects and older subjects with cardiovascular disease (CVD). In addition, it was of interest to examine relationships between coagulation factors and fibrin fiber properties during acute exercise. **METHODS:** 5 male subjects were recruited to the younger, healthy (YH) group and 5 male subjects were recruited to the older group with CVD (OD). Each participant performed a single session of an acute exercise protocol, having blood drawn pre-exercise and post-exercise. Repeated measures ANOVA and Pearson's correlations were used to analyze the results. Effect sizes (η^2) were used to combat the small sample size and avoid type II errors. **RESULTS:** 2-way repeated measures ANOVA revealed only one significant interaction: VIII ($p = .001$, $\eta^2 = .778$). Paired sample t-tests showed the YH group had a significant increase in VIII from pre-exercise to post-exercise ($p = .002$) but the OD did not. Between group differences (YH vs. OD) were seen during exercise when measuring alpha-2-antiplasmin ($p = .018$, $\eta^2 = .552$), antithrombin ($p = .026$, $\eta^2 = .481$), and fibrin fiber extensibility ($p = .003$, $\eta^2 = .691$). A significant increase in platelet levels was seen within groups from pre- to post-exercise ($p = .048$, $\eta^2 = .507$). Pearson's correlations revealed significant inverse correlations between VIII and fibrin fiber extensibility post-exercise ($r = -.804$), and between platelets and fibrin fiber extensibility post-exercise ($r = -.711$). Significant inverse relationships were also seen between pre-exercise alpha-2-antiplasmin and post-exercise fibrin extensibility ($r = -.788$), and between pre-exercise antithrombin and post-exercise fibrin extensibility ($r = -.646$). **CONCLUSION:** Coagulation factors including VIII, alpha-2-antiplasmin, and antithrombin all appear to be affected by acute exercise. Furthermore, acute exercise appears to cause an increase in fibrin fiber extensibility in the OD group but not in the YH group. The four significant inverse correlations provide evidence fibrin fiber extensibility may decrease in response to exercise, by altering levels of pre-exercise VIII and platelets, and post-exercise alpha-2-antiplasmin and antithrombin.

3195 Board #100 June 2 2:00 PM - 3:30 PM
The Age-related Decline In Vo2max: Role Of Peripheral Oxygen Transport And Utilization
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 (No relationships reported)

PURPOSE: Determine if decrements in peripheral factors, such as skeletal muscle oxygen delivery, oxygen diffusion and mitochondrial oxygen consumption, contribute to the well-established, age-related decline in aerobic capacity (*i.e.* VO_{2max}). **METHODS:** Eight young (25 ± 1 yrs) and eight old (74 ± 3 yrs) males matched for physical activity, and body mass index, performed a graded cycling exercise test to determine whole-body VO_{2max} (body VO_{2max} , Indirect Calorimetry). To determine the capacity of peripheral factors free from central constraints, participants also performed maximal single leg knee extension (KE), while single-leg VO_{2max} ($VO_{2max, KE}$), oxygen delivery ($Q_{O_{2max, KE}}$) and muscle oxygen diffusion ($D_{O_{2max, KE}}$) were determined with arterial-venous blood draws and Doppler Ultrasound (*i.e.* Direct Fick). Maximal skeletal muscle mitochondrial respiratory capacity ($VO_{2max, Mito}$) was assessed with mitochondrial respirometry of biopsied fibers from the vastus lateralis. **RESULTS:** Consistent with previous reports, during cycling exercise older individuals exhibited a 25-30% reduction in maximum power (Young: 244 ± 9 W, Old: 182 ± 16 W, $P < 0.05$) and body VO_{2max} (Young: 37 ± 2 ml/kg/min, Old: 26 ± 2 ml/kg/min, $P < 0.05$). Interestingly, during KE, which is free from central constraints, older individuals exhibited similar capacities in terms of KE power, $VO_{2max, KE}$, $Q_{O_{2max, KE}}$ and $D_{O_{2max, KE}}$ to the young (See Figure). Additionally, rather than being attenuated, $VO_{2max, Mito}$ was actually slightly greater in the old ($P < 0.05$). **CONCLUSION:** Despite exhibiting a lower VO_{2max} during whole-body exercise, the capacity for peripheral oxygen transport and utilization appears to be preserved in physical-activity matched, older adults. Thus, when physical activity is maintained the age-associated decline in aerobic capacity during whole-body exercise is likely dependent upon limited central factors, such as cardiac output, and not peripheral oxygen transport and utilization.

3196 Board #101 June 2 2:00 PM - 3:30 PM
Acute Effects of Elevation Training Mask on Heart Rate Variability in Healthy Subjects
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 (No relationships reported)

Elevation training mask (ETM) is purportedly designed for providing simulated altitude training, which claims that increasing respiratory resistance during exercise could provide benefits in respiratory functions and aerobic fitness. We assumed that this changed respiratory resistance may alter the autonomic cardiac regulation especially Heart Rate Variability (HRV). **PURPOSE:** The purpose of this study was to examine the acute effect of an elevation training mask on HRV during cycling. **METHODS:** This study was conducted with randomized and crossover design. Fifteen healthy male ($N=9$) and female ($N=6$) collegiate students (27.0 ± 4.42 yrs) completed two trials with mask (Mask) vs without mask (CON). The 40-minute protocol included (1) rest, (2) 50% and (3) 70% of VO_{2max} cycling, and (4) recovery, each 10-minute phases. HRV variables including high frequency (HF), low frequency (LF), LF/HF ratio, were collected for 5 minutes at each phase with Activwave-Cardio (CamNtech, UK). A 2x4 repeated measures (RM) MANOVA was used to analyze the data. Significant level was set at .05. **RESULTS:** A RM MANOVA result showed that there was no significant interaction effect on HRV. However, there were significant trial (Pillai's $F[3,12] = 4.488$, $p = .025$) and time (Pillai's $F[9,126] = 5.383$, $p < .001$) effects on HRV. Follow-up univariate tests revealed that HF was significantly greater in Mask than CON trial ($F[1,14] = 7.484$, $G-G p = .016$). Both HF ($F[1.05,14.74] = 24.221$, $G-G p < .001$) and LF ($F[1.29,18.05] = 28.759$, $G-G p < .001$) were decreased as cycling intensity increased. **CONCLUSIONS:** In summary, acute wearing of ETM does not alter the HRV during cycling. However, a greater HF response was observed in Mask than CON trial. Future studies are needed to confirm the effects of long-term training with ETM on HRV.

3197 Board #102 June 2 2:00 PM - 3:30 PM
Effects Of Acute Aerobic Repetition Exercise On The Vascular Endothelial Function
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PURPOSE: High-intensity interval exercise leads to greater improvements in the vascular endothelial function than continuous exercise at moderate intensity. However, few studies have been performed on the effects of repetition exercise consisting of high-intensity exercise and followed by complete rest of the arterial function. Therefore, the purpose of this study was to investigate the effects of repetition exercise on the vascular endothelial function determined by flow-mediated vasodilation (FMD). **METHODS:** Seven healthy male subjects completed two exercise sessions on a cycle ergometer in a counterbalanced order. The exercise sessions were (i) 20 min cycling at 50% VO_{2max} (CE) and (ii) 20 x 20-sec intervals at 100% VO_{2max} interspersed with 40-sec intervals at complete rest (RE). Before and after each protocol, the brachial systolic and diastolic blood pressure were measured in the supine position. The vascular endothelial function of the right brachial artery was also assessed by flow-mediated vasodilation (%FMD), and then the normalized FMD (nFMD) was calculated from the adjusted peak shear rate. **RESULTS:** In the CE trial, the nFMD (au) increased after exercise and returned to the baseline level after 60 min of recovery (0.9 ± 0.1 at baseline, 1.4 ± 0.2 at 30min after the trial, 1.2 ± 0.2 at 60 min after the trial). In the RE trial, the change in the nFMD (au) resembled those in the CE trial (0.9 ± 0.2 at baseline, 2.0 ± 0.3 at 30 min after the trial, 1.3 ± 0.3 at 60 min after the trial). The exercise-by-time interaction effect was not significant; in addition, the main effect of exercise was not significant. However, there was a significant main effect of time present ($P < 0.05$), indicating that the nFMD changed over time. **CONCLUSION:** Acute repetition exercise increases the systemic vascular endothelial function just as continuous exercises dose. These results suggest that repetition training might be useful for the prevention of cardiovascular disease.

3198 Board #103 June 2 2:00 PM - 3:30 PM

Burn Injury Reduces Cardiac Output and Stroke Volume During Submaximal Aerobic Exercise in Children

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PURPOSE: Burn trauma causes a hypermetabolic-cardiac stress response that impairs resting cardiac function. It is currently unknown how burn trauma affects cardiovascular responses to submaximal exercise in children. We tested the hypothesis that burned children have reduced cardiac output and stroke volume during submaximal exercise at 6-12 months post-burn.

METHODS: Values are expressed as means \pm SD with significance set at $P < 0.05$. Five children with 49 \pm 4% total body surface area (BSA) burned (2 female, 11.7 \pm 1y, 40.4 \pm 18kg, 141.1 \pm 9cm) and nine similar ($P > 0.05$) non-burned controls (6 female, 12.5 \pm 2y, 59.0 \pm 16kg, 150.1 \pm 12cm) with comparable exercise capacity (VO_{2peak} : 31.8 \pm 11 vs 37.7 \pm 8 mlO₂·kg⁻¹·min, $P = 0.27$) participated. Burn children had a reduced growth BMI-for-age percentile compared to non-burn (54.6 \pm 36 vs 93.2 \pm 6 %tile; $P = 0.008$) at 9.4 \pm 3 mo post-burn injury. Oxygen consumption (VO_2), heart rate (HR), cardiac output (Q, via non-rebreathing), stroke volume (SV, Q/HR), and arteriovenous O₂ difference ((a-v) O₂ diff, Q/VO₂) were measured during a submaximal exercise protocol that entailed a pre-exercise (pre-EX) rest period followed by 3-minute exercise stages at 50% and 75% of their peak VO_2 .

RESULTS: Utilizing a 2-way factorial ANOVA (group (G) x exercise (EX)), Q at 50% and 75% VO_{2peak} were reduced by ~27% in burned (5.6 \pm 1, 6.9 \pm 1.6 L·min) compared to non-burn group (7.9 \pm 2, 9.1 \pm 3 L·min) (G x EX interaction, $P = 0.012$). SV did not differ from preEX to 50-75% VO_{2peak} in burn children (preEX: 41.7 \pm 15 to 50-75%: 43.8 \pm 8ml·beat) but, increased by ~21% in non-burned group (preEX: 47.7 \pm 16 to 50-75%: 60.7 \pm 16 ml·beat; main effect for EX, $P = 0.046$). (a-v) O₂ diff and VO_2 at preEX, 50-75% VO_{2peak} was not different ($P > 0.05$) between groups but HR response to exercise was reduced (G x EX interaction, $P = 0.02$). When normalized to BSA, SV(index) was similar between groups; however, Q(index) response to exercise remained attenuated in the burned (G x EX interaction, $P = 0.007$).

CONCLUSIONS: These preliminary data indicate that burn children have an attenuated cardiovascular response to submaximal exercise compared to non-burned children due to impaired cardiac function. Further examination of hemodynamic function during exercise will offer insight for cardiovascular rehabilitation medicine in burned children.

3199 Board #104 June 2 2:00 PM - 3:30 PM

Microvascular and Nitric Oxide Responses to Acute Exercise with Resveratrol or Estradiol in Postmenopausal Women

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PURPOSE: Microvascular function measured via the reactive hyperaemic velocity time integral (VTI) has been shown to be more closely related to cardiovascular disease risk factors than macrovascular endothelial function, and is an independent predictor of cardiovascular events. Estrogen (E2)-deficient postmenopausal women have diminished endothelial adaptations to exercise training compared to age-matched men and E2-treated postmenopausal women. The polyphenol resveratrol, is an E2 receptor agonist that has been shown in animal models to enhance exercise training effects on cardiovascular function. No study has examined the effects of acute endurance exercise with E2 or resveratrol treatment on microvascular function or circulating nitric oxide (NO). Accordingly, the purpose of this study was to determine whether pre-treatment with acute E2 or resveratrol modulates microvascular function and NO responses to an acute bout of endurance exercise in postmenopausal women.

METHODS: VTI and circulating NO (via Griess assay) were examined before and following (120 minute) acute treadmill exercise (40 minutes at 60-75% of maximal heart rate) in 13 sedentary E2-deficient postmenopausal women (58 \pm 3 years; mean \pm SD) randomized, to either E2 (transdermal patch 0.05 mg/d starting 2 days before exercise visit), resveratrol (one 250 mg oral tablet 45 minutes before exercise) or placebo (inactive patch and tablet).

RESULTS: There were no significant differences in pre-exercise VTI and NO between placebo and resveratrol conditions or with E2 conditions. There were no significant differences in post exercise between group changes in VTI and NO.

	VTI (cm)			NO (µM)		
	Placebo	Resveratrol	E2	Placebo	Resveratrol	E2
Pre	81.1 \pm 25.2	94.6 \pm 21.7	91.1 \pm 23.5	123.7 \pm 60.6	142.8 \pm 65.6	119.5 \pm 51.2
120 min change	-9.5 \pm 17.4	-11.4 \pm 16.6	-4.8 \pm 22.7	-4.9 \pm 30.7	-18.5 \pm 64.1	-5.0 \pm 19.7

CONCLUSIONS: Acute E2 or resveratrol did not significantly alter basal microvascular function or circulating NO, nor did they modulate the response to an acute bout of moderate intensity treadmill exercise. Whether resveratrol would modulate vascular adaptations to chronic exercise training needs future exploration.

3200 Board #105 June 2 2:00 PM - 3:30 PM

Performance Related Hemodynamic Responses to an Aerobic Exercise Across Different Stages of the Menstrual Cycle

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(No relationships reported)

PURPOSE: To examine the physiological changes, especially body water and hemodynamic measures that occur in females across their respective menstrual cycles in response to aerobic performance. **METHODS:** Eleven females (age = 21.2 \pm 1.4 yrs) performed four sessions of aerobic activity at 75% of their calculated VO_{2max} as determined by the Bruce Protocol. The speed for each subject's aerobic activity was then calculated using the ACSM metabolic running equation. The four sessions of aerobic activity were identical in format and performed on days 1, 7, 14, and 21 of each subject's menstrual cycle. Sessions began with measurements of body weight, body fat, heart rate (HR), and blood pressure (BP). Extracellular fluid (ECF), intracellular fluid (ICF), and fat-free mass (FFM) was also recorded via single-frequency and multiple-frequency bio-electrical impedance analysis (BIA) prior to aerobic activity. Subjects then completed 30 minutes of aerobic exercise at the calculated speed to yield an intensity of 75% VO_{2max} . Following the aerobic event, all measures taken pre-exercise, as well as RPE, were measured again at three separate time points post-exercise (post-0min, post-15min, and post-30min) while HR was monitored continuously. **RESULTS:** Day one systolic BP significantly correlated with day one Δ ECF at multiple time points ($r = -0.619$ to -0.680 , $p < 0.05$). HR also had significant correlations on day one with Δ ECF and Δ ICF ($r = -0.610$, $p < 0.05$; $r = 0.609$, $p < 0.05$). Day 7 had significant correlations between BP (systolic and diastolic) and ICF ($r = -0.610$ to -0.672 , $p < 0.05$) at multiple time points. **CONCLUSIONS:** The results showed that hemodynamic variables had notable correlations throughout most performance-related measures and across the different days of the menstrual cycle. From Day 1 to 7 there is an observable shift in correlation from BP and ECF to BP and ICF. This apparent shift in fluid may be due to the physiological responses associated with progressing through one's cycle from the menstrual to luteal phase in which a significant amount of body water is lost. These results demonstrate that there may be different responses to aerobic performance throughout the different phases of the menstrual cycle, but further investigation is required to make any kind of recommendations.

3201 Board #106 June 2 2:00 PM - 3:30 PM

Sex Differences in Acute Effect of Exercise on Endothelial Function in Older Adults

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(No relationships reported)

There is growing evidence of sex differences in the chronic effect of aerobic exercise on endothelial function (flow-mediated dilation; FMD) in older adults. However, whether sex differences also exist in the acute effect of aerobic exercise on FMD in older adults is unknown. **PURPOSE:** To test the hypothesis that the FMD response to acute aerobic exercise will be different in older men compared with postmenopausal women and that exercise intensity will influence the FMD response. **METHODS:** Thirteen older men and fifteen postmenopausal women, free of major clinical disease, participated in this randomized crossover study (67 \pm 1 vs. 65 \pm 2 yrs, mean \pm SE, $P = 0.4$). Subjects completed a single bout of low-intensity continuous training (LIC; 47 min 50% peak heart rate (HRpeak)), moderate-intensity continuous training (MICT; 47 min 70% HRpeak) and high-intensity interval training (HIIT; 40 min: alternating intensities of 90% and 70% HRpeak) on the treadmill in a counterbalanced order. Brachial artery FMD was assessed at rest, at end of exercise and following 60-minute recovery. **RESULTS:** In older men, FMD was attenuated by 45% following HIIT (5.95 \pm 0.85 vs. 3.27 \pm 0.52%, $P = 0.003$) and by 37% following MICT (5.97 \pm 0.87 vs. 3.73 \pm 0.47%, $P = 0.03$; $P = 0.9$ for FMD response to HIIT vs. MICT) and was normalized following 60-min recovery ($P = 0.99$). In postmenopausal women, FMD did not

significantly change in response to HIIT (4.93 ± 0.55 vs. $6.31 \pm 0.57\%$, $P=0.14$) and MICT (5.32 ± 0.62 vs. $5.60 \pm 0.68\%$, $P=0.99$). In response to LICT, FMD did not change in postmenopausal women nor older men (5.21 ± 0.64 vs. $6.02 \pm 0.73\%$, $P=0.7$ and 5.70 ± 0.80 vs. $5.55 \pm 0.67\%$, $P=0.99$). **CONCLUSIONS:** Sex and exercise intensity significantly impact the FMD response to acute aerobic exercise in older adults. In older men, FMD is attenuated following acute HIIT and MICT but not LICT, whereas in postmenopausal women FMD is unaffected.

3202 Board #107 June 2 2:00 PM - 3:30 PM
The Acute Cardiorespiratory Responses to High versus Low Volume Interval Cycling Exercise in Healthy Adults

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PURPOSE: High intensity interval training (IT) is an increasingly popular exercise mode with possible health risks and benefits. Therefore the purpose was to compare acute responses to two volumes of IT in healthy untrained males.

METHODS: Ten males (aged 19.5 ± 1.13 years) completed two IT trials on a cycle ergometer in a counter-balanced repeated measures study, at least 48 hours apart. Low volume (LVIT) consisted of three 20 s sprints (3x20) at self-selected maximal cadence with 7% of body mass as resistance and 160 s active rest. High volume (HVIT) consisted of ten 60 s sprints (10x60) at self-selected maximal cadence with 3.5% of body mass as resistance and 60 s active rest. Oxygen uptake (VO_2), heart rate (HR) and power (W) were recorded continuously. In addition to these measures blood lactate [La] and systolic blood pressure (SBP) were recorded pre, post and every ten minutes post-exercise for 30 minutes. Oxygen pulse (O_2 pulse), % predicted peak heart rate (%HR_{peak}), elevated post-exercise oxygen consumption (EPOC), energy expenditure (EE), fatigue index and rate-pressure product (RPP) were calculated. Repeated measures ANOVA and effect sizes were applied.

RESULTS: 10x60 caused a significantly greater VO_2 (1548 ± 708 mL·kg⁻¹·min⁻¹ vs 1155 ± 476 mL·kg⁻¹·min⁻¹; $p < 0.001$), O_2 pulse (9.6 ± 5.5 mL·beat⁻¹ vs 7.5 ± 3.3 mL·beat⁻¹; $p < 0.001$), %HR_{peak} ($95 \pm 4\%$ vs $91 \pm 5\%$; $p = 0.010$), EPOC magnitude (35.3 ± 5.8 L vs 28.3 ± 7.1 L; $p = 0.018$) and EE (500 ± 53 kcal vs 235 ± 29 kcal; $p < 0.001$) than 3x20. EPOC duration was not significantly different (10x60: 16.51 ± 12.32 minutes vs 3x20: 10.84 ± 6.19 minutes; $p = 0.140$). There were no significant differences in mean SBP (10x60: 136.3 ± 2.6 mmHg vs 3x20: 134.6 ± 2.4 mmHg; $p > 0.050$) or RPP (10x60: 16179 ± 462 vs 3x20: 15957 ± 481 ; $p = 0.668$) between trials, however there was a clinically significant reduction in SBP 30 minutes following 3x20 (122 ± 15 mmHg) compared to pre-exercise (135 ± 8 mmHg) ($p = 0.053$, $d = 1.10$), but not following 10x60 (pre 131 ± 12 mmHg; post 126 ± 9 mmHg; $p = 0.303$). 3x20 caused significantly greater fatigue index ($36.5 \pm 11.3\%$ vs $23.0 \pm 10.1\%$; $p = 0.009$) and [La] (11.56 ± 2.13 mmol·L⁻¹ vs 7.79 ± 2.47 mmol·L⁻¹; $p = 0.010$; $d = 1.63$) 10 minutes post exercise.

CONCLUSIONS: 10x60 elicited significantly greater cardiorespiratory responses, whereas 3x20 produced a greater [La] and fatigue index.

3203 Board #108 June 2 2:00 PM - 3:30 PM
Acute Effects of Heated Water Based Exercise on Ambulatory Blood Pressure and Heart Rate Variability in Long Term Treated Elderly Hypertensive Patients

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PURPOSE: Although heated water-based exercise (HEX) training has shown to largely reduce blood pressure (BP) in patients with resistant hypertension, the effect of a single exercise bout on ambulatory BP (ABP) in elderly subjects is unknown. Our purpose was to evaluate the acute effect of HEX versus land-based exercise (LEX) on ABP and heart rate variability (HRV) in long-term treated elderly hypertensive patients.

METHODS: Twelve sedentary elderly hypertensive patients (6 women) aged 60 ± 10 yr, under drug therapy for 15±3 yr, underwent a 30 min of HEX (walking inside the pool), LEX (walking on a treadmill) and nonexercise control session (CON) in random order (2-5 days between interventions). HEX and LEX intensity was set at 11-13 in the 6-20 RPE scale. HRV was analyzed before and after each intervention, and twenty-four hour (24-h) ABP monitoring was performed after each intervention.

RESULTS: There was a tendency toward ($P = 0.06$) increase in low-frequency (pre = 43 ± 7.3 n.u.; post = 57.9 ± 5.5 n.u.) and decrease in high-frequency (pre = 56.7 ± 7.3 n.u.; post = 42 ± 5.5 n.u.) HRV after LEX, but no changes were observed after HEX and CON. However, 24-h (-6 mmHg), daytime (-6 mmHg) and nighttime (-6 mmHg) systolic ABP were significant lower ($P < 0.05$) after HEX than after LEX and CON. Although daytime (-3 mmHg) and nighttime (-4 mmHg) diastolic ABP was lower after HEX than after LEX and CON, this reduction was not statistically significant.

CONCLUSIONS: Although there was an improvement in HRV after LEX, 24-h, daytime and nighttime systolic ABP reduced only after HEX. This result suggest that HEX may be superior than LEX to manage BP hypertension in long-term treated elderly hypertensive patients.

3204 Board #109 June 2 2:00 PM - 3:30 PM
Effect of Acute Antioxidant Therapy on Cardiac Baroreflex Sensitivity in Young Healthy Men

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 (No relationships reported)

There is an emerging body of evidence in animals indicating that elevated oxidative stress impairs baroreflex sensitivity (BRS) function, however studies in healthy humans have yielded equivocal results. One potential reason for this discrepancy is that previous studies have used individual antioxidant treatments (e.g., Vitamin C only) to investigate the effect of oxidative stress on BRS. Recent studies in healthy humans have demonstrated significant reductions in reactive oxygen species using an antioxidant cocktail (AOC; Vitamin C, Vitamin E, and Co-enzyme Q10) suggesting the effectiveness of this treatment. Whether this AOC induced reduction in oxidative species affects BRS in young, healthy adults remains unknown. **PURPOSE:** We tested the hypothesis that AOC will improve cardiac BRS in young healthy adults. **METHODS:** Five young men were studied on two separate days: placebo (sugar pills) and AOC (2000 mg Vitamin C, 150 IU Vitamin E and 100 mg Co-enzyme Q10) performed in random order. Resting heart rate (ECG) and arterial blood pressure (automated sphygmomanometer and finger photoplethysmography) were measured 90 minutes after AOC or placebo (a time period this AOC has been shown to have peak effects on oxidative stress). Spontaneous cardiac BRS was determined for all sequences combined (overall BRS), and also separately for up (increase systolic blood pressure: increase R-R interval) and down (decrease systolic blood pressure: decrease R-R interval) sequences. **RESULTS:** Systolic blood pressure on AOC day tended to be lower relative to the placebo day (127 ± 4 vs. 131 ± 5 ; $p = 0.098$). However, no differences in overall cardiac BRS were found between placebo and AOC (18.0 ± 2.7 vs. 17.3 ± 2.6 ms/mmHg; $p = 0.59$). Likewise, up sequences (17.02 ± 2.9 vs 14.04 ± 4.0 ms/mmHg; $p = 0.51$) and down sequences (18.0 ± 2.7 placebo vs. 18.0 ± 2.6 ms/mmHg AOC; $p = 0.98$) were not different between conditions. Equal number of sequences were found between the placebo and AOC days. **CONCLUSION:** These preliminary data suggest that antioxidant treatment does not affect resting cardiac BRS in young, healthy men. Supported by UTA College of Nursing and Health Innovation

F-55 Free Communication/Poster - Clinically-related Exercise Responses

Friday, June 2, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

3205 Board #110 June 2 3:30 PM - 5:00 PM
The Effect of Acute Aerobic Exercise on Hemostasis in Obstructive Sleep Apnea

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Obstructive Sleep Apnea (OSA) is a prevalent sleep disorder affecting 2 – 4% of the middle-aged population. Individuals with OSA have an altered hemostatic balance favoring coagulation that may predispose them to cardiovascular disease and/or myocardial events. Although the resting hemostatic balance is well understood, the exercise response is less described.

Purpose: To determine the hemostatic response after acute aerobic exercise in Obstructive Sleep Apnea.

Methods: Eighteen males (nine OSA vs. nine Controls) aged 41 ± 13 yrs. and 28.4 ± 3.5 BMI were recruited from the university and local community without evidence of cardiovascular, pulmonary, or metabolic disease. Apnea-Hypopnea Index (AHI) > 5 was criteria for OSA. Subjects performed a treadmill exercise test at 35% and 70% predicted VO_2 reserve during the morning hours. Pre exercise blood samples were obtained after 15 minutes supine rest and within 2 minutes following exercise. Repeated Measures ANOVA were performed for Factor VIII antigen, tPA antigen, tPA activity, and PAI-1 activity. Correlational analysis compared resting and post exercise hemostatic factors with age, BMI, and AHI.

Results: Mean AHI was 13.00 ± 12.6 . No exercise x condition interactions were observed for hemostatic markers. There was a main effect for exercise in Factor VIII,

tPA antigen, and tPA activity in both groups. PAI-1 activity tended to be elevated in OSA (145%) compared to controls which remained after exercise (205%) ($P = 0.05$). Post exercise FVIII:Ag correlated with BMI ($r = 0.52$), while resting tPA:Ag correlated with AHI ($r = 0.49$), and age ($r = 0.50$).

Conclusion: The hemostatic response after acute aerobic exercise is unaffected in mild OSA although PAI-1 activity seems to be elevated. BMI is correlated with FVIII:Ag, while tPA:Ag is associated with AHI and age.

3206 Board #111 June 2 3:30 PM - 5:00 PM

Reliability of Pulse Waveform Separation Analysis Responses to an Orthostatic Challenge

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Purpose: Cardiovascular autonomic nervous system function can be assessed by recording arterial wave reflection responses to an orthostatic challenge. Using pulse wave analysis, arterial wave reflection can be estimated using pulse wave separation analysis, whereby a triangular or a physiologic flow waveform is assumed and the aortic wave is separated into its *forward* and timing-independent *reflected* (Pb) components. This study sought to determine the measurement precision (between-day reliability) of Pb responses to a modified tilt-table test. **Methods:** Twenty healthy adults (26.4 y (SD 5.2), 55% F, 24.7 kg/m² (SD 3.8)) were tested on three different mornings in the fasted state, separated by a maximum of seven days. Oscillometric pressure waveforms were recorded on the left upper arm, and aortic waveforms were generated using a generalized transfer function. The criterion for acceptable reliability was an intra-class correlation coefficient (ICC) of 0.75. To express the percentage change that must occur at a group and individual level, the standard error of measurement (%SEM) and smallest detectable change (%SDC) were calculated. **Results:** The criterion ICC (0.75) was exceeded at baseline (0.79), following 5 min tilt (0.75), and following 5 min recovery from tilt (0.75). The %SEM and %SDC for the 5 min tilt response were 7% and 19%, respectively. **Conclusion:** Arterial wave reflection responses to an orthostatic challenge can be assessed with acceptable between-day reliability using oscillometric pulse wave analysis.

3207 Board #112 June 2 3:30 PM - 5:00 PM

Effect of Moderate Versus High Intensity Interval Exercise Training on Heart Rate Variability Parameters in Inactive Latin-American Adults: A Randomized Clinical Trial

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(No relationships reported)

PURPOSE: Decreased heart rate variability (HRV) is associated with a higher risk of mortality and exercise training is effective to its increase in inactive adults. We investigated the effect of moderate versus high intensity interval exercise training on HRV indices in physically inactive adults. **METHODS:** Twenty inactive adults were randomly allocated to receive either moderate intensity training (MCT group) or high intensity interval training (HIT group). The MCT group performed aerobic training at an intensity of 55-75% of the walking on a treadmill at 60-80% heart rate max (HRmax) until expenditure of 300 kcal until the end of training. The HIT group performed running on a treadmill during 4 minutes at 85-95% peak HRmax and had a recovery of 4 minutes at 65% peak HRmax until expenditure of 300 kcal until the end of training. Supine resting HRV indices (time domain: SDNN, standard deviation of normal-to-normal intervals; rMSSD, Root mean square successive difference of RR intervals and frequency domain: HF_{Ln}, high frequency spectral power; LF, low frequency spectral power; and HF/LF ratio) and were measured at baseline and 12-weeks thereafter.

RESULTS: SDNN changes were 3.4 (8.9) ms in the MCT group, 29.1 (7.6) ms in the HIT group (difference between groups 32.6 [95% CI, 24.9 to 40.4 ($P = 0.01$)]). LF/HF_{Ln} ratio change in the MCT group 0.19 (0.03) ms and in HIT group 0.13 (0.01) ms (P between groups = 0.016). No significant group differences were observed in rMSSD, HF, and LF parameters. Finally, we observed stronger correlation between Ln rMSSD and to-R-R interval in HIT group ($r_s = 0.834$; $p < 0.001$) Figure 1A, and not significant correlation between Ln rMSSD and to-R-R interval in MCT group ($r_s = 0.396$; $p = 0.290$), Figure 1B. **CONCLUSIONS:** In inactive adults, this study showed that a 12-week HIT training program can increase short-term HRV, mostly in vagal mediated indices such as SDNN and HF/LF_{Ln} ratio power. **Trial registration.** ClinicalTrials.gov NCT02738385

3208 Board #113 June 2 3:30 PM - 5:00 PM

Blood Pressure Cuff Selection: Does One Size Fit All?

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Blood pressure (BP) is one of the most commonly measured vital signs. Historically, tremendous focus has been dedicated to increasing the reliability of BP measurement by standardizing protocols and reducing error to the smallest possible increment. Errors in BP measurement may result in misdiagnosis, cardiovascular complications during exercise, and improper prescription of antihypertensives. 'Miscuffing' is a common and significant source of error in BP measurement. The '80% rule' (i.e. cuff $\geq 80\%$ of an individual's arm circumference) is the gold standard method for BP cuff size selection as recommended by the American Heart Association. Interestingly, BP cuff manufacturers routinely print their own cuff size recommendation, based on an arm circumference range, on their products and this method often differs in the suggested cuff size from the '80% rule'. **PURPOSE:** The current study examined the occurrence of 'miscuffing' and the outcome of BP measurement using the '80% rule' cuff selection method versus the manufacturer's recommendations. **METHODS:** Forty-four individuals had their upper arm circumference measured, and appropriate cuff(s) selected using the two sizing methods. An automated oscillometric device was used to measure BP in duplicate with a 1-minute interval in between measurements, and 2-minute interval between cuffs if necessary. If different cuffs were selected, the order of measurement was randomized. A dependent t-test was used to ascertain potential BP measurement differences between sizing methods. **RESULTS:** 'Miscuffing' as the result of method discrepancies between the '80% rule' and the manufacturer's recommendation, occurred in over two-thirds (70%, $n=31$) of the sample. In these individuals, there was a significant difference in systolic BP between recommended cuffs (7.9 mmHg; $p < 0.05$). Approximately 1 in 3 individuals, with two cuffs recommended (35%, $n=11$), had a smaller cuff suggested by the manufacturer, and were misclassified with a significantly elevated systolic BP (average increase 12.5 mmHg; $p < 0.05$). **CONCLUSIONS:** BP cuff-selection methods are not universal and contribute to reliability concerns. 'Miscuffing' was a common observation when utilizing the manufacturer's method for cuff selection and resulted in BP measurement error and misclassification.

3209 Board #114 June 2 3:30 PM - 5:00 PM

Whole Body Vibration Training To Prevent Weight Gain In College Students: Early Findings From A Randomized Controlled Trial.

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At least 44 percent of adult Americans will be obese by 2030. When young adults go off to college and leave the structured environment of a household, they often adopt unhealthy behaviors, such as unhealthy eating and getting less exercise, leading to the risk of weight gain, popularly referred to as the "Freshman Fifteen". Unless interrupted, this pattern of weight gain in early adulthood can lead to obesity in later adulthood. Whole-body vibration training (WBVT) is a novel alternative approach to structured exercise for improving body composition for physically limited, time constrained, and/or unmotivated persons, but has not been studied yet in college students. **PURPOSE:** To determine if WBVT is a feasible and effective method of preventing weight gain in physically inactive students enrolled in undergraduate nursing or other 4-year programs. **METHODS:** Male ($n=5$) and female ($n=28$) undergraduate students were randomized to control ($n=14$, age=28.1 + 7.1, BMI=28.1 + 5.3) or WBVT groups ($n=19$, age= 28.5 + 9.0, BMI=27.5 + 3.8). The WBVT group completed three training sessions per week, progressing from low to high frequencies (30-50 Hz) and amplitudes (2-4mm), for six months. Control subjects were asked to maintain their usual diet and exercise habits. A 2 x 3 RM-ANOVA was used to detect

significant group x time interactions for weight and waist circumference measured at baseline, 3 and 6 months. **RESULTS:** Retention in the study was 75% and adherence to training was 60%. Weight differed significantly over time between groups at 6-months ($p < 0.02$, mean difference = 4.48 lbs, SE = 1.79), but not so for WC ($P = 0.131$, mean difference = -2.71 cm, SE = 1.75). **CONCLUSION:** Our preliminary findings suggest that WBVT may be both a feasible and effective method for preventing weight gain among inactive undergraduate students. Future studies should assess the effectiveness of self-monitored WBVT in the college recreation center setting.

3210 Board #115 June 2 3:30 PM - 5:00 PM
Iron Homeostasis In Elite Athletes and Ultramarathon Runners
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PURPOSE: The present study was aimed at determining the effect of two different types of exercise (elite athletes (EA) playing football and ultramarathon runners (UR)) on iron metabolism, and especially the role of hepcidin in iron homeostasis. **METHODS:** In our study two different groups of athletes were investigated. The first group consisted of 19 male elite football athletes and the second group of 41 ultramarathon runners. In both cases, blood samples were taken pre-race (t1), immediately post-race (t2), and 24 hours post-race for EA athletes and 36-48 hours post-race for UR athletes (t3). **RESULTS:** The iron levels in time t3 were found to have statistically significant decreases compared with the iron levels in pre-race and post-race period. Moreover, in both cases, ferritin levels were increased significantly in time t2 and t3. Hepcidin levels increased in time t2 after the race, in football players (from 27.45 ± 12.98 to 37.42 ± 13.74 ng/mL) and in time t3 decreased again. However, in ultramarathon runners, hepcidin levels significantly increased in time t2 (from 29.16 ± 10.92 to 58.81 ± 16.97 ng/mL) and remained increased in time t3 as well (37.69 ± 16.38 ng/mL), despite a trend for its decrease. In football players, sTfR levels did not change, contrary to ultramarathon runners where sTfR levels were found decreased after the race and in time t3. **CONCLUSIONS:** Iron metabolism in athletes can be impacted by the type of exercise. Ferritin is not a reliable marker for iron balance, because in the present study, it is more likely an acute phase protein. The main regulator of iron homeostasis, hepcidin increases, showing the body's response to inflammation, by trapping iron in the macrophages and by altering iron absorption. Finally, a strenuous and prolonged exercise can lead to sports' anaemia.

3211 Board #116 June 2 3:30 PM - 5:00 PM
Comparison Of Progressive High-intensity Aerobic Exercise And High-intensity Interval Training (HIIT) In Older HIV+ Adults
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 (No relationships reported)

HIV+ adults have 40% lower $VO_{2\text{peak}}$ (VO_2) than age-matched healthy adults. High intensity aerobic exercise (AEX) increases VO_2 in older adults. A growing body of evidence demonstrates that HIIT can serve as an effective alternative to AEX. However, data in older HIV+ adults for both modalities is very limited even though a quarter of HIV+ Americans are over 50 years old. **PURPOSE:** To examine the effects of progressive AEX+RT and HIIT+RT on VO_2 and strength in HIV+ older adults vs. sedentary controls.

METHODS: Sedentary HIV+ men 50+ years of age were randomized to AEX+RT or delayed entry control groups. AEX+RT group received 16-weeks (48 sessions) of supervised center-based training with progression to a target of 45 minutes of continuous exercise at 70-80% HR_{reserve} . The RT protocol consisted of 6 exercises progressed to 80% of baseline 1-RM. Control participants remained sedentary. Both groups were tested at baseline and 16-weeks. The control group participants then started 16 weeks of HIIT in a cross over design. The HIIT group received the same duration of supervised training and identical RT protocol with repeated testing at 32 weeks. The HIIT protocol was performed using 4 intervals of 4 minutes of work ($90-95\% HR_{\text{max}}$) separated by 3 minutes of active rest ($50-60\% HR_{\text{max}}$) for a total time of 28 minutes. Paired t-test or Wilcoxon signed rank sum were used to test pre/post differences. Results are presented as mean \pm SE or median (range).

RESULTS: To date 8 patients have been enrolled and randomized to AEX+RT or Control with 16 week testing complete in all 8 and post-HIIT testing completed in 3. AEX+RT increased $VO_{2\text{peak}}$ (0.29 ± 0.03 L/min, $p = 0.03$) and lower body strength ($+37\%$ 1-RM, $p = 0.05$). Post-hoc comparison showed that HIIT+RT training had comparable increases in $VO_{2\text{peak}}$ (0.32 ± 0.09 L/min, $p = 0.07$) and lower body strength ($+31\%$ 1-RM, $p = 0.05$). There was a trend for increased lean mass (LM) measured

by DXA after AEX+RT (1.2 kg (-1.8 to 6.1)) and HIIT+RT (1.5 kg (1.2 to 6.1)) and decreased LM after the sedentary control period (-1.7kg (-4.1 to 1.6)). Changes in cross-sectional area of the thigh support these findings. **CONCLUSIONS:** Progressive high-intensity AEX+RT was well tolerated and effective in older HIV+ men. HIIT may be a more time efficient option that can equally improve VO_2 and strength in the growing population of older adults with HIV.

3212 Board #117 June 2 3:30 PM - 5:00 PM
Resting And Post Exercise Autonomic Function In Active And Insufficiently Active People Living With HIV
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 (No relationships reported)

Autonomic dysfunction has been associated with cardiovascular disease (CVD) morbidity and mortality, and may be prevalent in people living with HIV/AIDS (PLWHA). Physical activity (PA) is associated with better autonomic function in healthy and cardiometabolic disease populations. However, there are few data on the resting and autonomic responses to exercise in PLWHA. **PURPOSE:** To determine whether physically active (Act) PLWHA have better autonomic responses compared with insufficiently active (IA) PLWHA.

METHODS: 23 participants (13 Active PLWHA and 10 age and gender matched IA PLWHA) were recruited. Active PLWHA performed ≥ 150 of moderate to vigorous aerobic PA, while IA PLWHA performed ≤ 30 minutes on ≤ 2 days per week of aerobic PA. Resting heart rate variability (HRV) was measured for 10 minutes before exercise from which high frequency power in normalized units (HF_{n.u.}), low frequency power in normalized units (LF_{n.u.}) and low frequency/high frequency (LF/HF) ratio were determined. Participants performed a maximal cardiopulmonary exercise test on a cycle ergometer. Heart rate recovery (HRR) was measured at 30, 60 and 120 seconds (sec.) after exercise. Parasympathetic reactivation was measured as Root Mean Square of Successive Differences (RMSSD) at 30 sec. and 10 minutes (min.) after the test. **RESULTS:** Active PLWHA showed significant parasympathetic reactivation (RMSSD) from 30 sec. to 10 min. after peak exercise while this did not occur in IA PLWHA. HRR over 120 sec. after exercise was not different between the study groups. Measures of parasympathetic modulation (HF_{n.u.} and LF/HF ratio) and sympathetic modulation (LF_{n.u.}) were enhanced in Active PLWHA, compared with IA PLWHA. **CONCLUSIONS:** Regular aerobic exercise is associated with enhanced autonomic function at rest and during the 10 minutes of recovery after exercise in PLWHA. These findings suggest a possible mechanism to support lower risk of CVD with exercise in PLWHA.

	HIV+ Act	HIV+ IA
Resting HRV Measure		
HF (n.u.)	41.0 \pm 15.6*	25.2 \pm 9.7
LF (n.u.)	55.6 \pm 15.8*	79.3 \pm 17.5
LF/HF ratio	1.6 \pm 0.9*	3.4 \pm 1.8
Post Exercise HRV		
RMSSD (ms) 30sec.	4.38 \pm 1.92**	9.08 \pm 3.8
RMSSD (ms) 10min.	11.7 \pm 2.96	13.13 \pm 2.1
Heart Rate Recovery		
HRR 30 sec. (bpm)	20.22 \pm 6.29	23.22 \pm 6.9
HRR 60 sec. (bpm)	33.9 \pm 11.95	35.33 \pm 9.26
HRR 120 sec. (bpm)	44.89 \pm 13.06	44.89 \pm 14.08
*Significant ($p < 0.05$) differences between HIV+ IA and HIV+Act groups. ** Significant ($p < 0.05$) differences from 30 sec to 10 min.		

3213 Board #118 June 2 3:30 PM - 5:00 PM
Alterations In Intraocular Pressure And Corneal Thickness Immediately Following A 161-km Foot Race
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 (No relationships reported)

Introduction: Significant visual impairment is estimated to occur in 3% of participants in 161-km ultramarathons. Initial research indicates this is most often due to a transient corneal edema. The normal physiological changes of the eye in response to prolonged exercise have not been previously reported.

Purpose: To determine the effect of prolonged exercise (14 to 30 hours) on intraocular pressure and corneal thickness.

Methods: Entries of the 2013 161-km Western States Endurance Run were invited to participate in our study via pre-race email. During the 2 days prior to the race, informed consent was obtained and pre-race testing was performed. Pre- and immediate post-race, binocular and monocular visual acuity was measured using an illuminated Snellen eye chart and intraocular pressure was measured in both eyes with Tonopen XL (Reichert Technologies, Depew, NY). Pre- and immediate post-race corneal thickness was measured three times in rapid succession using an ultrasonic pachymeter (Corneo-Gage Plus, Sonogage, Cleveland, OH) after corneal anesthesia with 0.5% proparacaine hydrochloride.

Results: Eight entrants completed the study among which, six reported a prior history of ultramarathon-associated visual impairment. Three had a history of bilateral refractive surgery. One participant reported a period of "tunnel vision" during the race. Beyond this, there were no reports of visual impairment during this race which had a temperature range of 5.0 to 39.0°C. Pre- and post-race visual acuity measurements were essentially unchanged. Pre- and post-race corneal thickness did not change ($p=.3$) with a mean (\pm SD) of 661 (\pm 82) mm pre-race and 667 (\pm 84) mm post-race. Post-race intraocular pressure decreased from pre-race values in 10 of 16 eyes, was unchanged in 2 and higher in 4, with mean (\pm SD) pressure being 12.3 (\pm 3.6) and 11.4 (\pm 3.5) pre-race and post-race, respectively ($p=0.5$).

Conclusions: Within this small sample, visual acuity, corneal thickness and intraocular pressure were not significantly altered by completion of a 161-km foot race. These findings offer some reassurance to athletes who might have concern about elevating intraocular pressure from ultramarathon running.

3214 Board #119 June 2 3:30 PM - 5:00 PM

Strength Testing In Athletes Post ACL (Anterior Cruciate Ligament) Reconstruction: Does Graft Type Matter?

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(No relationships reported)

PURPOSE:

To evaluate hamstring and quadriceps strength after ACL (Anterior Cruciate Ligament) reconstructive surgery depending on type of graft used by determining if there is any deficit in knee extension with the use of a patellar tendon graft and knee flexion deficit with the use of a hamstring graft.

METHODS:

Chart review of athletes from 2010-2016 who met the following inclusion criteria's: age of subjects 15-50 yrs., isokinetic testing (CYBEX) performed \leq 1 yr. after surgery, completion of a structured rehabilitation program before the CYBEX test, no clinical signs of instability on evaluation, and having full painless knee range of motion. Graft type (Patellar Tendon and Hamstring) and CYBEX results (extension and flexion at 60°/sec and 180°/sec at peak torque) were compared for each athlete.

RESULTS:

A total of 40 subjects met inclusion criteria's, of which 31 had hamstring graft and 9 had patellar tendon graft. 35% of subjects with hamstring graft had weakness in the extensor mechanism of the knee, 13 had weakness in flexors and extensors (29% greater in extensors and 13% greater in flexors), 13% presented weakness in flexors and 10% had weakness in the extensors of the non-surgical knee. 9 subjects had a patellar tendon graft, of which 56% had weakness in extensors and 44% demonstrated weakness in both extensors and flexors (greater in extensors).

CONCLUSIONS:

Overall, our subject's demonstrated increased weakness in the extensor mechanism of the knee in both patellar tendon and hamstring graft groups.

3215 Board #120 June 2 3:30 PM - 5:00 PM

Diminished Ventilatory Responses During Post-Exertional Malaise Contributes to Exercise Intolerance in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome

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(No relationships reported)

Reduced functional capacity and post-exertional malaise following physical activity are hallmark symptoms of Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). The mechanisms producing exercise intolerance in the post-exertional state have not been adequately described. **PURPOSE:** To compare the ventilatory response

to repeated exercise stress in control and ME/CFS subjects. **METHODS:** 40 female subjects were recruited for the study, 20 ME/CFS patients and 20 age and weight matched controls. All underwent two maximal exercise tests 24 hours apart. Oxygen consumption, minute ventilation (V_E), tidal volume (TV), respiratory rate (RR), end-tidal oxygen and carbon dioxide (ET_{O_2}/ET_{CO_2}) were measured at rest, at the anaerobic threshold, and at maximal exercise. Multivariate analyses were performed for group (ME/CFS vs control), test (exercise test 1 vs test 2), and condition (rest vs anaerobic threshold vs maximal exertion) with univariate follow up. **RESULTS:** 15 ME/CFS subjects and 18 control subject reached criteria for maximal effort. The overall multivariate analysis was significant for group and condition. Follow-up univariate and post-hoc showed VO_{2E} , V_E and TV were lower in the ME/CFS group only on exercise test 2. Post hoc for condition was significant for ventilation at maximal exercise only. Respiratory rate, ET_{O_2} , and ET_{CO_2} were not different between tests or groups. **CONCLUSION:** In the absence of a second exercise test, the lack of any significant differences for the first test would appear to suggest no exercise intolerance in ME/CFS patients. However, the results from the second test indicate the presence of exercise intolerance and post-exertional malaise. Diminished ventilatory responses accompany reductions in work output and oxygen consumption during post exertional malaise in ME/CFS patients.

3216 Board #121 June 2 3:30 PM - 5:00 PM

Leg Blood Flow and Fatigability In People With Type 2 Diabetes

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(No relationships reported)

We have previously demonstrated that people with type 2 diabetes mellitus (T2D) have greater fatigability of the knee extensor muscles during a dynamic fatiguing contraction due to impairments within the skeletal muscle; however, the precise mechanism(s) are unknown. **PURPOSE:** To determine if impairments in leg blood flow are associated with greater fatigability of the knee extensor muscles during a dynamic fatiguing contraction in men and women with T2D.

METHODS: 5 individuals with non-insulin dependent T2D (60 - 70 years; 3 women) with no signs of diabetic neuropathy were matched based on age, BMI and physical activity with four non-diabetic controls (CON) (60 - 68 years; 2 women). Physical activity was assessed over four days with a tri-axial accelerometer. To assess fatigability, participants performed a 6-minute single-limb dynamic fatiguing contractions with the knee extensors while seated at 90° of hip and knee flexion. 120 maximal voluntary concentric contractions (MVCCs) were performed with a load equivalent to 20% maximal voluntary isometric contraction torque through a 90° range of motion. Doppler ultrasonography was used to assess femoral artery diameter and pulse wave blood velocity before and immediately after the dynamic fatiguing contraction.

RESULTS: The reduction in MVCC power was greater for T2D ($40.5 \pm 17.6\%$) compared with CON ($31.3 \pm 20.8\%$, $P < 0.05$) as assessed at the end of exercise. T2D and CON both demonstrated similar increases in leg blood flow after the dynamic fatiguing contraction ($71.7 \pm 41.1\%$ vs. $69.0 \pm 37.3\%$, respectively; $p > 0.05$).

However, greater reductions in MVCC power (i.e. greater fatigability) was associated with lower blood flow following dynamic fatiguing contractions ($p = 0.034$, $r = 0.633$).

CONCLUSIONS: Greater fatigability of the knee extensor muscles during dynamic fatiguing contractions was associated with lower blood flow. Impaired blood flow responses to exercise may limit exercise performance among T2D, and this work highlights the need for future studies that examine skeletal muscle perfusion during dynamic exercise in people with T2D.

Supported by Marquette University Way Klingler Research Fellowship to SKH

3217 Board #122 June 2 3:30 PM - 5:00 PM

Prolonged Bouts Of Sedentary Behavior Are Associated With Cardiometabolic Disease Risk Factors In Young Adults

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(No relationships reported)

Research indicates sedentary behavior is associated with obesity and cardiometabolic disease (CMD) risk factors. Less understood is the effect of prolonged bouts of sedentary time on CMD risk factors, particularly in young adults. **PURPOSE:** To determine the associations among prolonged bouts of sedentary behavior and CMD risk factors in young adults. **METHODS:** 125 men ($n=29$) and women ($n=96$) participated in the study (mean \pm SD: age 22.8 ± 4.8 y; BMI 26.4 ± 4.7 kg/m²; body fat $29.1 \pm 9.4\%$; and VO_{2peak} 40.9 ± 8.3 mL/kg/min). Sedentary behavior (<150 counts/min) and moderate-to-vigorous physical activity (MVPA, >2689 counts/min) were measured by an accelerometer worn during waking hours for 7 consecutive days.

Sedentary bouts were defined as greater than or equal to 20, 30 and 60 min. Body composition, waist circumference, blood pressure, glucose, insulin, triglycerides (TG), high-density lipoprotein, and low density lipoprotein (LDL) cholesterol were measured. Multiple regression analyses were used to assess associations among variables, while controlling for age, sex, race/ethnicity, accelerometer wear time and MVPA. RESULTS: Total time spent in sedentary behaviors averaged 8.7 ± 1.5 h/day. Sedentary bouts greater than or equal to 20, 30 and 60 min accounted for 36%, 23%, and 6% of total sedentary time, respectively. The average length for bouts of greater than or equal to 20, 30, and 60 min was 33.7 ± 4.1 min, 45.6 ± 6.6 min and 63.7 ± 40.5 min, respectively. Sedentary bouts of 20 min or more had the strongest relationships with CMD risk factors, compared to bouts of 30 and 60 min or more. Time spent in sedentary bouts of 20 min or more was independently associated with BMI ($R^2=0.13$, $\beta=0.24$, $p=0.01$), waist circumference ($R^2=0.15$, $\beta=0.25$, $p=0.01$), LDL ($R^2=0.28$, $\beta=0.27$, $p<0.01$), TG ($R^2=0.11$, $\beta=0.25$, $p=0.02$), insulin ($R^2=0.55$, $\beta=0.25$, $p<0.01$), and fat mass ($R^2=0.23$, $\beta=0.27$, $p<0.01$), after adjusting for all covariates. CONCLUSIONS: Our novel findings suggest that sedentary behavior, in bouts of 20 min or more, is significantly and independently associated with markers of CMD in young adults. These findings have important implications for CVD prevention programs for young adults and suggest that public health guidelines with regards to minimizing prolonged sedentary behaviors are warranted. Funded by NIH 1U54GM104944

3218 Board #123 June 2 3:30 PM - 5:00 PM

Superior Acute Effects of High-Intensity Interval Exercise in Type 2 Diabetes Patients: A Pilot Study

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(No relationships reported)

PURPOSE: High-intensity interval training (HIIT) is a time-efficient intervention for preventing and treating type 2 diabetes (T2D). Rate of perceived exertion scale (RPE) is a simple and inexpensive tool for prescribing and self-regulating exercise. Our purpose was to analyze the hemodynamic and metabolic response to a HIIT session prescribed and self-regulated by RPE (HIIT_{RPE}) in T2D patients.

METHODS: Ten (two males) T2D patients (time since diagnosis = 9.1 ± 1.7 yr) aged 50.7 ± 2.8 yr underwent a symptom-limited CPX on a treadmill to determine their heart rate (HR) response to exercise. Patients were then assigned to perform of HIIT_{RPE} (4 min of warm-up and 21 min of jogging/running at 15-17 (1 min) alternating with walking at 9-11 (2 min) on the 6-20 RPE scale), HIIT prescribed and regulated by HR response to CPX (HIIT_{HR}, 4 min of warm-up and 21 min of jogging/running at 85% (1 min) alternating with walking at 50% (2 min) of reserve HR), continuous moderate exercise (CME) prescribed and self-regulated by RPE (30 min of walking at 11-13 on the 6-20 RPE scale), and control session (CON, sitting in a quiet environment) in a random order (3 to 7 days between intervention). Capillary glucose, endothelial function and carotid-femoral pulse wave velocity (PWV) were assessed before, immediately after and 45 min after each intervention. 24-h ambulatory blood pressure (ABP) after each intervention.

RESULTS: Exercise distance was not different between all interventions. Exercise HR and speed were also not different between HIIT_{RPE} and HIIT_{HR}. T2D patients showed similar reductions in capillary glucose after HIIT_{RPE} ($21.9 \pm 4.0\%$) and HIIT_{HR} ($25.2 \pm 4.8\%$), which were greater ($P < 0.05$) than the observed after CME ($16.4 \pm 6.2\%$). T2D patients also showed similar nighttime ABP reductions after HIIT_{RPE} and HIIT_{HR} when compared to CON; but the reduction was statistically significant ($P < 0.05$) only after HIIT_{RPE}. No ABP reductions was found after CME. No significant differences on endothelial function and PWV were observed during all interventions.

CONCLUSION: HIIT was superior to CME to acutely reduce capillary glucose and ABP, independently if it was prescribed and regulated by RPE or the HR response to CPX. This result suggest that the 6–20 RPE scale may be an efficient tool for prescribing and self-regulating HIIT in T2D patients.

3219 Board #124 June 2 3:30 PM - 5:00 PM

Energy Expenditure in Yoga versus Other Forms of Physical Activity

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It is currently not clear whether yoga is an activity that meets the requirements for moderate-to-vigorous physical activity and how yoga compares in intensity to other forms of physical activity.

PURPOSE: This study compared energy expenditure during acute bouts of Vinyasa yoga (YOGA) and two treadmill walking protocols. **METHODS:** Data from were available on 28 participants (15 males, 13 females) who performed three 60-minute activity bouts on separate days that included: 1) YOGA, 2) treadmill walking at a self-selected brisk pace (SELF), 3) treadmill walking at a pace that matched their HR to that of their yoga session (HR-MATCH). Energy expenditure (kcal and metabolic equivalent of task [MET]) was measured with indirect calorimetry. **RESULTS:** When examining the entire 60 minute period of activity, energy expenditure was significantly lower in YOGA (285.1 ± 71.6 kcal, 3.7 ± 0.6 MET/min) compared to both HR-MATCH (367.3 ± 93.7 kcal, $p < 0.001$; 4.9 ± 0.8 MET/min, $p < 0.001$) and SELF (329.2 ± 82.1 kcal, $p = 0.003$; 4.4 ± 0.7 MET/min, $p < 0.002$), and in HR-MATCH compared to SELF (p -value for kcal = 0.012; p -value for MET/min = 0.016). Because the final 15 minutes of the YOGA session was restorative in nature, data analysis was repeated using only the initial 45 minutes of each activity session. For these analyses, energy expenditure was significantly lower in YOGA (234.0 ± 57.8 kcal, 4.1 ± 0.6 MET/min) compared to HR-MATCH (306.0 ± 77.6 kcal, $p < 0.001$; 5.4 ± 0.9 MET/min, $p < 0.001$) but not SELF (242.8 ± 60.7 kcal, $p = 0.393$; 4.3 ± 0.7 MET/min, $p = 0.650$), and in HR-MATCH compared to SELF (p -value for kcal < 0.001 ; p -value for MET/min < 0.001). Gender did not significantly influence the pattern of the results observed.

CONCLUSIONS: Across a 60-minute period, energy expenditure in YOGA is significantly lower than both SELF and HR-Match. When the restorative component of YOGA was removed from the analysis, energy expenditure in YOGA was comparable to SELF. Moreover, YOGA met the energy expenditure requirement (> 3 METs) for moderate-intensity physical activity, and therefore is likely to elicit health benefits similar to walking performed at a self-selected brisk walking pace. Interventions to directly compare YOGA to other forms of physical activity are warranted.

3220 Board #125 June 2 3:30 PM - 5:00 PM

Physical Activity and Physical Functioning in Persons with Down Syndrome

Benjamin J. Carlson¹, Jasmine S. Curtis¹, Fabio Bertapelli¹, Ben Abadie¹, Marquell Johnson², Stamatis Agiovlasis, FACSM¹. ¹Mississippi State, Mississippi, MS. ²University of Wisconsin-Eau Claire, Eau Claire, WI. (Sponsor: Stamatis Agiovlasis, FACSM)

(No relationships reported)

Persons with Down syndrome (DS) are generally considered to be less active than the general population. However, limited objective accelerometer data exist on their levels of physical activity (PA) and sedentariness. Furthermore, PA and sedentariness may be associated with low levels of physical functioning in persons with DS. **PURPOSE:** To examine the levels of PA and sedentariness in persons with DS, and whether these are associated with measures of physical functioning. **METHODS:** Seventeen persons with DS (9 women and 8 men; age 28 ± 14 y) participated in this study. They wore for 7 days on their right wrist an accelerometer (GT3X+, Actigraph). PA variables, time spent sedentary, and the percent of participants meeting the PA Guidelines for Americans were determined with the Freedson cut-points. Physical functioning variables included performance during the timed-up-and-go (TUG) test, as well as the distance covered and the energetic cost (oxygen uptake per meter measured with portable spirometry) during the 6 min walk (6MW) test. **RESULTS:** Participants accumulated an average of 83 ± 164 min per week of moderate-to-vigorous PA in bouts at least 10 min in duration. Only two participants with DS (12% of the sample) met the recommended amount of 150 min of weekly moderate-to-vigorous PA, and 15 participants (88%) did not. Participants performed light PA for 1427 ± 241 min per week (~ 3.5 h per day). Mean sedentary time was 3210 ± 210 min per week (~ 7.5 h per day). Mean performance on the TUG was 9.82 ± 3.22 s. Mean distance covered during the 6MW test was 284.7 ± 113.7 m and mean walking speed was 0.79 ± 0.32 m \cdot s⁻¹. The energetic cost during the 6MW was 0.34 ± 0.12 ml \cdot kg⁻¹ \cdot m⁻¹. Light PA had moderate and significant associations with TUG performance, 6MW distance, and 6MW energetic cost ($r = 0.61$, 0.61 , and 0.66 , respectively; $p < 0.03$). In addition, 6MW distance was associated with time spent sedentary ($r = 0.55$; $p = 0.02$). Low and

non-significant correlations were found between measures of physical functioning and other PA variables. **CONCLUSION:** Persons with DS have low levels of PA and high levels of sedentariness. Most persons with DS do not meet the PA Guidelines for Americans. They also have low levels of physical functioning. Lower levels of physical functioning are associated with greater participation in light PA among persons with DS.

F-56 Free Communication/Poster - Descriptive Epidemiology and Surveillance

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3221 Board #126 June 2 2:00 PM - 3:30 PM Screen Time, Physical Activity, And Bmi Among Hispanic Children In Puerto Rico

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Screen time (ScT) represents a behavior usually, but not always, associated with reduced physical activity, and increased sedentary time and BMI among children. Childhood obesity is a major health problem, particularly among Hispanic children in Puerto Rico (PR). Little information is available regarding ScT and its association with BMI and moderate to vigorous physical activity (MVPA) in this population. **PURPOSE:** To evaluate ScT, including the use of passive vs. active video games (PVG and AVG), MVPA, and BMI among 6-8-year-old Hispanic children in PR. **METHODS:** A convenience sample of 100 children (54 boys and 46 girls) wore an accelerometer attached to an elastic band over the right hip area for 7-days, and their parents completed a physical activity questionnaire including information regarding their children's screen time. T-tests were conducted to detect sex differences, and correlation analyses to detect associations between variables. **RESULTS:** Total screen time (2.1 ± 1.5 hrs/day), including PVG (0.4 ± 0.6 hrs/day) and AVG (0.1 ± 0.4 hrs/day), and MVPA (4.1 ± 0.9 hrs/day) were not significantly different between boys and girls. An inverse correlation was observed between MVPA and AVG ($\rho = -0.20$, $P = 0.04$). No other significant correlations were detected between ST, MVPA, and BMI. **CONCLUSION:** ScT in the group of Hispanic children evaluated was in the recommended limit, and appear not to affect their level of MVPA, which exceeded current recommendations. They appear to spend more time using PVG than AVG, and those that spent more time in AVG also spent less time in MVPA. These results support other studies suggesting that ScT does not influence MVPA or BMI in young children.

3222 Board #127 June 2 2:00 PM - 3:30 PM Comparison Of Step Count During A Bout Of Pokémon Go Vs Traditional Aerobic Exercise

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Traditional video game use employs sedentary behavior but exergames allow for such games to involve physical activity (PA). Pokémon Go is a live, real-time version of a popular video game involving the use of a mobile device's GPS capability to locate, capture, battle, and evolve virtual characters. Users transport to physical locations to advance in the game, meanwhile potentially using a mode of PA during play. **Purpose:** To compare the number of steps taken when playing Pokémon Go to a traditional bout of aerobic exercise, walking at a self-selected pace. **Methods:** Seventeen regular Pokémon Go users ages 18-65 years old wore a pedometer on their waist while playing the popular reality game for 30-minutes and walking for 30-minutes at a self-selected pace. The order of events were randomized and the game was played either as an individual or in a group depending upon the participant's normal type of play. Regular PA patterns and distance traveled (km) during habitual play were self-reported. A paired-sample t-test compared the number of steps taken during each activity; Pearson's correlations evaluated potential relationships between step count, type of play, distance traveled, and regular PA patterns. **Results:** Users were primarily intermediate or advanced players of the game (94%) and average level of play was 21 ± 5 (range 8-30). Mean step count while playing Pokémon Go was 2992 ± 548 vs 3379 ± 206 when walking at a self-selected pace for an equivocal amount of time ($P = 0.009$). Users accumulated an average of 388 fewer steps during 30-minutes of Pokémon Go than with traditional walking outdoors. Steps taken during the 30-min walk were significantly associated with regular PA patterns ($r = 0.594$, $p = 0.012$). No associations were noted between type of play and distance traveled in habitual play or step count of the study session. **Conclusion:** Significantly less steps were taken during

a 30-minute bout of Pokémon Go than participating in a traditional walk. However, the practical implications of the data imply a relatively small difference in overall PA in 388 steps. Playing the exergame as an individual or in a group did not influence steps taken during the study or km traveled during habitual play.

3223 Board #128 June 2 2:00 PM - 3:30 PM Patterns of Objectively-assessed Sedentary Behavior in Community-dwelling Japanese Older Adults

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(No relationships reported)

Accumulated evidence suggests greater time spent in sitting is associated with adverse health outcomes. However, limited data on how sedentary behavior (SB) is patterned in older adults. **PURPOSE:** To examine patterns of objectively-assessed SB classified by duration of bout in community-dwelling Japanese older men and women.

METHODS: This cross-sectional study included 450 Japanese older adults (255 men, 70-79 years) who were randomly selected from resident registries and provided valid data (wearing at least four days of ≥ 10 hours/day) of accelerometer (HJA-350IT, Omron Healthcare, Japan). Descriptive analyses of the duration (min/day) and number of bouts (times/day) of SB (≤ 1.5 METs) were conducted, stratified by gender. Total SB time was further divided into five types according to the duration of SB: 1-9 min, 10-19 min, 20-29 min, 30-59 min, and ≥ 60 min. Gender differences in patterns of SB were assessed using analysis of covariance (ANCOVA) after adjusting for age and wear time.

RESULTS: The adjusted mean SB time (min/day) in men and women was 561.8 and 469.3, respectively ($P < 0.001$), and number of SB bouts (times/day) was 57.0 in men and 61.3 in women ($P < 0.001$). The number of SB bouts of less than 10 min was 42.9 in men and 49.4 in women ($P < 0.001$). On the other hand, the number of SB bouts of lasting 20-29 min was 2.9 and 2.3 in women, that of 30-59 min was 3.5 in men and 2.5 in women, and that of at least 60 min was 1.6 in men and 1.1 in women (all $P < 0.001$). Time accumulated by short-bout (1-9 min) SB in women was significantly longer than men (men:114.7, women:128.3), whereas time accumulated by long-bout SB in women was significantly shorter than men (20-29 min SB; men:70.4, women:55.6, 30-59 min SB; men:143.4, women:103.1, and ≥ 60 min SB; men:148.4, women:100.2).

CONCLUSIONS: Older women were less likely to be prolonged sedentary with more frequent interruption compared to older men. Effect of patterns of SB on health outcomes may differ by gender.

3224 Board #129 June 2 2:00 PM - 3:30 PM Exploring Associations Between Greenspace, Physical Activity, And Health Outcomes: Results From The 2011-2015 Illinois BRFS

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PURPOSES: 1) To examine spatial effects of green space on health outcomes at various levels of geography; 2) To examine the potential mediating effect of physical activity on the relationship between green space and health outcomes.

METHODS: Socio-demographic (e.g., sex, race, poverty, age) and health outcome variables (e.g., obesity, diabetes, heart disease, and mental health) were derived from the 2010-2015 Illinois Behavioral Risk Factor Surveillance System (BRFSS). Measures of green-space were created using tree canopy data from the 2011 National Land Cover Dataset (NLCD). Residential area was defined using measures of urban density by counting dwellings per 10 hectares. Green space was calculated for three levels of buffers, specifically 300m, 500m, 1km for each residential unit and the entire county where the residential unit was located. ArcGIS 10.3 (ESRI, CA), was used to geoprocessing all data. Residential green space was used as the primary independent variable while accounting for socio-demographic variables in regression analysis.

RESULTS: Due to missing data, only 78 of 102 Illinois counties (76.47 %) were included in the analysis. The amount of green space, regardless of buffer level, has no association with health outcomes. Physical activity explained a significant proportion of variance only for diabetes all measures of green space: 300m, 500m, and 1000m for residential units ($\beta = -.12$, $p < .03$; $R^2 = .30$, $p < 0.001$); county level ($\beta = -.14$, $p < .02$; $R^2 = .31$, $p < .001$).

CONCLUSIONS: Although county level green space was negatively associated with physical activity, residential green space showed no association. This difference supports the importance of appropriately defining geographical units used for large-scale population-based. Further studies clarifying geographic units of analysis are required.

3225 Board #130 June 2 2:00 PM - 3:30 PM
The Impact of Public Transportation on Daily Walking Level

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Background: Only 21% of the U.S. adults meet the recommended level of physical activity: 150 minutes of moderate intensity of physical activity per week, or 75 minutes of vigorous intensity of physical activity per week. Transportation is recognized as one of the most influential domains determining people's daily physical activity level. There are a few studies looked at the walking level of public transit users as well as socio-demographic traits. This study examined walking time difference between public transit users and non-public transit users to articulate how much walking time is derived from transit related walking more clearly, and how demographic characteristics differ among the two groups. Purpose: To investigate and articulate the impact of public transit on the walking activity level within the U.S. population in order to advocate the ongoing public transit improvement projects and policy changes toward walkable communities. Methods: The National Household Travel Survey conducted from March 2008 to May 2009 by the U.S. Department of Transportation was used to examine the association between public transit use and walking trip time for an assigned travel day. Multivariate linear regression model was applied to estimate the difference of walking time in minutes per day between public transit users (n=2,835) and non-public transit users (n=165,969). Results: People who used any forms of public transit walked 35.2 minutes more than people who did not use public transit during one travel day (p<0.01). 27.0 minutes of the 35.2 minutes difference was gained exclusively from transit related walking which includes access from or to public transit. In addition, people in low income group, minority population groups such as African American and Hispanic, people residing in bigger cities, and people perceiving the lack of access or availability of public transit as a big issue had longer daily walking time compared to the other groups (p<0.01). Conclusion: There is a significant association between public transit use and daily walking time. The results of this study will add on an evidence to the positive impact of public transit on physical activity level, and support ongoing project of public transit improvement, such as railway extension, as well as policy enactments with respect to public transit system.

3226 Board #131 June 2 2:00 PM - 3:30 PM
Social Network Engagement and Adherence with Physical Activity Recommendations; The American Time Use Survey

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Physical activity has numerous benefits in both primary and secondary prevention of chronic diseases. Current estimates suggest that most adults are not meeting the minimum recommended levels (PA-R) of leisure time physical activity (LT-PA) and these levels of adherence can vary by sociodemographic factors. Individuals' social networks may impact their health behavior choices through interpersonal support mechanisms. Many LT-PA intervention studies have utilized "buddy systems" or social network engagement (SNE), as a method of promoting adherence. Thus far, there have been no large-scale, population based examinations of the relationship between SNE and adherence to PA-R. PURPOSE: The current study used nationally representative data from the American Time Use Survey dataset to test the relationship between Social Network Engagement (SNE) and participants' adherence to minimum recommendations (PA-R) during leisure-time physical activity (LT-PA), and the impact of socio-demographic factors.

METHODS: Data were collected from each cross sectional year (2003-2014) of the American Time Use Survey dataset. Leisure Time-Social Network Engagement (SNE) was conceptualized as the participation of LT-PA with a member of an individual's social network. Adherence to PA Recommendations (PA-R) was calculated using an estimation of physical activity intensity through the PA compendium MET values and corresponding activity codes. MET-weighted minutes of LT-PA were dichotomized into a PA-R adherence estimation.

RESULTS: The data were stratified by gender for the analysis. Age group, the only significant covariate, was controlled for in the models presented here. Men (OR = 1.53; 95% CI: 1.11 to 2.11) and women (OR = 2.52; 95% CI: 1.90 to 3.34) engaging their social network during reported LT-PA were more likely to meet PA-R compared to participating alone. Men engaging a friend (OR = 2.80; 95% CI: 1.84 to 4.25) and women engaging a family member (OR = 4.39; 95% CI: 2.37 to 8.12) or a friend (OR: 3.08; 95% CI: 2.10 to 4.51) during LT-PA were more likely to meet PA-R compared to participating alone, and when controlling for age and other forms of SNE.

CONCLUSIONS: Social Network Engagement is associated with meeting PA-R. This relationship varies by gender and the type of SNE, but not other common sociodemographic factors.

3227 Board #132 June 2 2:00 PM - 3:30 PM
Reported Walkable Destinations Across Age Groups Among US Adults — 2015

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The Guide to Community Preventive Services recommends community-scale design strategies as a way to increase physical activity. One example of this strategy is locating residences within walking distance of other destinations. Physical activity participation declines with increasing age. It is unclear if the prevalence of near-home walkable destinations also declines with age.

PURPOSE: To describe the prevalence of four types of walkable destinations across age groups in a representative sample of US adults aged ≥18 years. METHODS: Respondents to the 2015 National Health Interview Survey reported the presence of four walkable destination types near their home: shops, stores, or markets; bus or transit stops; movies, libraries, or churches; and places that help one relax, clear one's mind, and reduce stress. The proportion reporting each was calculated and stratified by age group. Differences between age groups were assessed with Wald tests corrected for multiple comparisons; trends were tested with orthogonal contrasts.

RESULTS: Overall, 71.8% reported walkable relaxing destinations, followed by shops (58.0%); transit (53.2%); and movies, libraries, or churches (47.5%). For shops; transit; and movies, libraries, or churches, adults aged 18–34 years reported similar values, beyond which the prevalence was progressively lower with increasing age (all p<0.05 for trend, Table). For relaxing destinations, the prevalence was similar among adults aged 18–44 years, and lower among those aged 45–64 and ≥65 years.

CONCLUSIONS: In general, the prevalence of walkable destinations among adults was lower with increasing age, and most consistently among adults aged ≥45 years. Community-scale design, including locating residences and other destinations within walking distance, can help promote physical activity across all ages. Addressing differences in the presence of walkable destinations between older and younger adults may be a community design priority.

% Reporting Walkable Destinations								
Age (years)	Shops, stores, markets		Bus or transit stops		Movies, libraries, churches		Places to relax, reduce stress	
	%	95% CI	%	95% CI	%	95% IC	%	95% CI
18-24	71.5a	68.8-74.1	62.7a	59.7-65.6	58.9a	56.0-61.7	75.8a	73.3-78.2
25-34	67.8a	65.6-69.9	62.1a	59.7-64.5	55.8a	53.5-58.1	76.4a	74.7-78.1
34-44	60.5	58.3-62.6	56.0	53.6-58.3	49.6	47.6-51.7	74.7a	72.7-76.6
45-64	54.3	52.5-56.0	49.6	47.9-51.3	44.8	43.3-46.3	71.3	69.9-72.7
≥65	44.7	42.8-46.6	42.8	40.8-44.7	35.2	33.5-36.9	63.3	61.5-65.0

Within columns, values with the same letter are not significantly different (p>0.05)

3228 Board #133 June 2 2:00 PM - 3:30 PM
The Effect of Ramadan Month on Changes in Objectively Assessed Physical Activity in Adults

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Ramadan is the Islamic month, when Muslims around the world participate in an intermittent fast for 29 to 30 days as a part of their religious obligation. During this period, Muslims abstain from eating and drinking during daylight hours. Studies have shown that Ramadan fasting has negative influence on sleep, physical performance and attention. However, the effects of Ramadan fasting on physical activity are not clear.

PURPOSE: To determine the impact of Ramadan month on objectively assessed physical activity among Muslim adults.

METHODS: Around 802 Muslim adults (Males 51.7%) ages ranging from 18 to 60 years, were sampled from a national community health program in Qatar representing two consecutive years. Physical activity was assessed daily using a pedometer (Omron HJ-720 ITC). Daily average step count and aerobic step count during the days of Ramadan month was compared during non-Ramadan months (one month prior and one month after Ramadan). For this longitudinal study design, a linear mixed model statistical procedure was adopted to adjust for demographic and environmental factors to test the study hypothesis.

RESULTS: Objectively assessed physical activity, i.e. daily average step counts per day, declined during the month of Ramadan compared to non-Ramadan months in this population. The average daily steps per day during Ramadan month was 7,267 (95% CI 7,180 to 7354) steps. When compared to one month prior Ramadan there was an average reduction of 619 steps (95% CI 483 to 755) per day $p < 0.001$. The decline in physical activity during Ramadan was higher men (-729±74) steps compared to women (-490±81). However, one month post Ramadan the physical activity levels defined by daily average step counts increased by average 548 steps (95% CI 407 to 688) compared to Ramadan ($P < 0.001$) and were similar to pre-Ramadan month ($P = 0.692$).

CONCLUSIONS: This study confirmed that in this population, due to the shift in time of activity as well as calorie intake from daylight to evening hours during Ramadan there was substantial decline in objectively assessed daily physical activity among Muslim adults. Interventions are needed to promote physical activity during this period.

3229 Board #134 June 2 2:00 PM - 3:30 PM
Changes in Body Height And Weight Of Children And Adolescents In China During 1943-2014
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PURPOSE: To compare body height and weight of 5-19 years old children and adolescents between 1943 and 2014 in China, and to determine the change in morphological development in Chinese children and adolescents over 71 years. **METHODS:** Based on the Student Physical Standard (made by the Physical Education Committee of the Ministry of Education of China, with unknown sample size) in 1943 and the National Physical Fitness Surveillance Report (from the General Administration of Sport of China, with sample size of 358725.) in 2014, the data in body height and weight of 5-19yr boys and 5-17yr girls were compared. The difference of height and weight average of children and adolescents in each age, and the growth of each age were calculated. And contrast chart were generated. Due to the sample size data could not be obtained when the Student Physique Standard is established, in this study we couldn't test the mean difference. Therefore this study used simple statistical description to reflect the growth trend of children and adolescents. **RESULTS:** The average height in each age for boys between 5-19yr and girls between 5-17yr in 2014 was significantly higher than that in 1943, the differences were 4.6(19yr)-20.4(13yr) cm for boys and 3.4(17yr)-14.7(11yr)cm for girls. The average weight in each age for boys between 5-19yr and girls between 5-17yr in 2014 was significantly higher than in 1943, and the differences were 2.4(5yr)-14.8(13yr)kg for boys and 1.2(5yr)-11.6(11yr) kg for girls. In 1943, boys between 5-14yr were at a lower physical development level than girls, but boys after 14yr were at a higher physical development level than girls. However, in 2104, boys between 10-11yr were at a similar physical development level compared to girls, in each of the other ages boys were at a higher level than girls. In 1943, the height growth spurt periods were from 12-13yr in girls and from 15yr in boys, and the weight growth spurt periods were from 12-15yr in girls, and from 14-15yr in boys. In 2014, the growth spurt periods for both height and weight were 11yr in girls and 13yr in boys. **CONCLUSION:** Compared to the data collected in 1943, Chinese children in 2014 were higher and heavier. Moreover, a 1-2 years gap was also observed in terms of the growth spurt age. Supported by the Sports Medicine key laboratory of General Administration of Sport of China(A2015C06).

3230 Board #135 June 2 2:00 PM - 3:30 PM
Physical Literacy of 8-12 Year Old Children in Prince Edward Island, Canada
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 (No relationships reported)

PURPOSE: Physical literacy is defined as the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engaging in physical activities for life. The purpose of the present study was to assess the physical literacy of children and youth living in Prince Edward Island, Canada, using preliminary results from the RBC Canadian Assessment of Physical Literacy (CAPL).

METHODS: The CAPL includes tests in 4 domains: Motivation and Confidence (CSAPPA Questionnaire), Knowledge and Understanding (CAPL Physical Activity Questionnaire), Physical Competence (BMI, waist circumference, grip strength, PACER test, plank, sit and reach, and obstacle course), and Daily Behaviour (objectively measured steps/day and self-reported physical activity and sedentary behaviour). The scoring categories for each domain were: Beginning, Progressing, Achieving, or Excelling, with Achieving considered the minimum recommended score. **RESULTS:** Data were collected on 205 boys and 202 girls aged 8-12 years (mean: 10.7±1.1 years). The proportion of participants identified as Achieving or Excelling

in each domain was as follows: Motivation and Confidence: 40%; Knowledge and Understanding: 66%; Daily Behaviour: 64%; Physical Competence: 39%; Overall Physical Literacy: 63%.

CONCLUSIONS: Although two-thirds of participants were considered to have met the minimum recommended level of Knowledge, Daily Behaviour, and overall Physical Literacy, only a minority of children met the minimum recommended levels of Physical Competence and Motivation and Confidence.

FUNDING: Research funding was provided by the Children's Hospital of Eastern Ontario Research Institute through the RBC Learn to Play project, delivered in partnership with ParticipACTION and the Public Health Agency of Canada.

3231 Board #136 June 2 2:00 PM - 3:30 PM
Geographical Distribution, Socioeconomic Status And Health-related Physical Fitness In Adolescents From A Large Population-based Sample From Bogotá, Colombia: The Ser Study

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PURPOSE: The negative gradient between socio-economic status and prevalence of non-communicable disease in adulthood has prompted investigation of potential foundations based in childhood. The objective of the present study is to examine the influence of socio-geographical variations and socioeconomic status on health-related physical fitness in adolescents from a large population-based sample of Colombian ninth graders.

METHODS: During the 2014-2015 school years, we examined a cross-sectional component of the SER Study is a cross-sectional Body mass, height, muscular fitness (standing broad jump and handgrip tests) and cardiorespiratory fitness (20 m shuttle-run) were measured in n=52,204 14-16-year-olds. Area-level socioeconomic status was categorized from 1 to 6. A model was built by means of a step-by-step process and gradient maps were created to show physical fitness in the quartiles and the trend of physical fitness across disaggregated in Zonal Planning Units (in Spanish UPZ) in Bogotá, for each of the five health-related physical fitness variables.

RESULTS: Socioeconomic status was used as the only group-level variable and this had a significant effect on the models for all health-related physical fitness parameters except for handgrip. Cardiorespiratory fitness, standing broad jump, and body mass index increased 6.31, 2.69, and 1.45 times, respectively, on average with the maximum increase in socioeconomic status categories, when we compared two random individuals in each stratum.

CONCLUSIONS: Our results suggest a significant association between health-related physical fitness variables and socio-geographical location in ninth grade adolescents from Bogotá, using a multilevel methodological approach.

3232 Board #137 June 2 2:00 PM - 3:30 PM
Trends in Walking for Transportation or Leisure Among U.S. Adults — National Health Interview Survey, 2005-2015

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BACKGROUND: Physical activity confers considerable health benefits, but only half of U.S. adults report achieving levels of aerobic physical activity consistent with current guidelines. Walking is an excellent way for most people to increase their physical activity. The prevalence of walking among adults increased by 6 percentage points from 2005 to 2010, but it is unknown whether this increase has been sustained. **PURPOSE:** To evaluate trends in the prevalence of walking for transportation or leisure among U.S. adults between 2005 and 2015.

METHODS: Nationally representative data from the 2005, 2010 and 2015 National Health Interview Survey (NHIS) cancer control supplements (n=78,741) were analyzed

to estimate the age-adjusted prevalence of self-reported walking among adults ≥ 18 years. Walking was defined as engaging in at least one 10-minute bout of transportation or leisure walking in the past seven days. Estimates are reported for the total sample and stratified by sex. Linear and quadratic trends in walking prevalence from 2005 to 2015 were tested using logistic regression.

RESULTS: The overall prevalence of self-reported walking increased significantly from 2005 to 2015, although a leveling off was observed between 2010 and 2015 (2005: 55.7%, 2010: 62.1%, 2015: 63.9%; p-value for linear and quadratic trends ≤ 0.05). A similar trend was observed among men, with no significant difference in prevalence between 2010 and 2015 (2005: 54.3%, 2010: 61.8%, 2015: 62.8%; p-value for linear and quadratic trends ≤ 0.05). Among women, the prevalence of walking demonstrated a significant linear increase from 2005 to 2015 with no significant quadratic trend; the increase in prevalence between 2010 and 2015 was significant (2005: 57.5%, 2010: 62.5%, 2015: 65.1%; p-value for linear trend only ≤ 0.05).

CONCLUSION: Overall, the proportion of U.S. adults who reported walking significantly increased from 2005 to 2015; however, the results suggest that this increase has slowed in recent years, especially among men. This finding highlights the importance of implementing effective programs and policies that promote walking and improve the walkability of communities, as described in *Step it Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities*.

3233 Board #138 June 2 2:00 PM - 3:30 PM
Findings from the 2016 Active Healthy Kids Scotland Report Card

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The Active Healthy Kids Scotland Report Card provides a comprehensive assessment on the physical activity and health of Scottish children and adolescents. **PURPOSE:** To summarize the report card grades; to identify changes in report card grades since the previous report card published in 2013; to critique Scottish surveillance of physical activity and health in children and young people.

METHODS: Report card grades were assigned to 10 indicators related to physical activity and health (7 behavioral indicators and 3 policy and environment indicators). Grades were based on Scottish data which were: recent (published after the 2013 card), derived from nationally representative samples and affected by minimal bias, and determined by the percentage of Scottish children and adolescents meeting an evidence-based benchmark: A is 81% to 100%; B is 61% to 80%; C is 41% to 60%, D is 21% to 40%; F is 0% to 20%; INC is Incomplete data combined with lack of an evidence-based recommendation. Grades were assigned a '+' if trends had improved since the last report card and a '-' if there was a marked socio-economic inequality in the indicator. **RESULTS:** Overall Physical Activity, Sedentary Behavior and Obesity received F or F- grades. Active Outdoor Play and Organised Sport Participation were graded as INC. Active Transportation to School/Nursery was graded C, and Diet D-. Family and Peer Influence was graded as D-. Community and the Built Environment, and National Policy were both graded B. Issues with measurement and reporting of several physical activity indicators were identified: no surveillance of moderate to vigorous physical activity in children, no surveillance of active outdoor play and sports participation in children or adolescents, and summary surveillance data not reported in line with evidence-based recommendations.

CONCLUSIONS: Grades were similar to those in 2013. Scotland has a favorable environment for physical activity, but children and adolescents have low physical activity and high screen-based sedentary behavior. Better surveillance of physical activity and health in Scottish children and adolescents is required and would encourage more evidence-informed physical activity and health policy in Scotland in future.

3234 Board #139 June 2 2:00 PM - 3:30 PM
Running Profiles And Their Associated Behaviors: A Proposal For Chilean Runners

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Purpose: Identifying different runner profiles may improve running-related injuries (RRIs) prevention, education, and management. The aim of this study was to determine Chilean runner's profiles according to socio-demographic characteristics, motivations, training factors and behaviors associated with running during 2015-2016.

Methods: An email and web-based online cross-sectional survey were conducted. Runners from six different competitions and other running circuits were recruited. The survey collected information on 6 dimensions: (1)socio-demographics; (2)health; (3)motivations; (4)training factors; (5)behaviors associated with running; and (6) beliefs and perceptions. Profiles' construction was performed through a two-step cluster analysis using Bayesian Information Criterion and linear discriminant analysis to correctly assess subject classification. All statistical analyses were performed using SPSS22 with a significance level set at 5%. **Results:** A total of 821 runners (46% females), aged 36.6 (± 10.0) years were analyzed. Cluster analysis allowed the generation of 4 groups (n=752) according to years-of-running-experience, volume (km/week) and hours of training (hrs/week). Main variable for runners' classification was years-of-running-experience: "Beginner"(n=163); "Basic"(n=164); "Intermediate"(n=160); and "Advanced"(n=265). Statistically significant (p<0.05) and clinically relevant variables among the 4 groups were: sex, age, years-of-running-experience, training factors, previous injury(PI) and technological implements used for running practice. Beginners were mainly females (63.2%), aged 28.5 (± 8.4) years, having less than 1 year-of-running-experience, 32.5% reported PI, and accumulated a training volume of 18.3 (± 12.7) km/week. Advanced runners were mainly males (65.3%), aged 37.4 (± 10.9) years, 63.4% with more than 7 years-of-running-experience, 44.2% reported to have PI and accumulated a training volume of 38.2 (± 20.8) km/week. **Conclusion:** Advanced runners accumulate greater training load per week, were older, and with higher PI proportions when compared with Beginners. Future work should include a differentiated classification of runners, in order to identify clinically specific risk factors related to running injuries.

3235 Board #140 June 2 2:00 PM - 3:30 PM
< The Relationship Among The Built Environment, Transportation Behavior, And Population Health: Comparison Of Two Cities >

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PURPOSE: Active commuting and transportation behavior impacts obesity rates, wellbeing, and environmental health and quality. This study was designed to assess the relationship between active transportation, the built environment, and population perceived health in two comparable cities in the southeastern U.S.A.

METHODS: From 2006-2010, Charlotte, NC (city1) improved the built environment (e.g., shifting a motor vehicle lane to designated bicycle lane) and transportation policies (e.g., bicycle safety) to facilitate active commuting in the downtown area. Jacksonville, FL (city2) did not implement any changes to the built environment to foster active commuting. Data from the Behavioral Risk Factor Surveillance System [BRFSS] from 2006 (pre intervention) to 2012 (post intervention) were analyzed for both cities.

RESULTS: There were no significant differences between city1 and city2 in sample size and demographic make-up (age, race, gender, sex). Over the period 2006 to 2012, the annual difference between the percentage of Charlotte respondents rating physical health as good and those in Jacksonville rating physical health good increased at a rate of 13% per year based on an exponential growth regression model (p = 0.0213). That is, over time the difference between the two cities grew in favor of Charlotte.

CONCLUSIONS: Supportive urban and transportation policies aimed at facilitating healthy behaviors are associated with healthier communities in this convenience sample of two cities This study's findings were consistent with past findings that highlight the importance of the built environment and transportation policies on population health. Future research is needed to assess rates of active commuting and examine the populations and outcomes longitudinally.

3236 Board #141 June 2 2:00 PM - 3:30 PM

Physical Activity Among U.S. Adults With Mobility Disability, Brfss, 2015

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The 2008 *Physical Activity Guidelines* recommends that all adults avoid inactivity and engage in activities based on their abilities. Mobility disability is the most prevalent disability type among US working-age adults and is related to poor health outcomes. Understanding physical activity (PA) patterns among this group can aid development of inclusive interventions to increase PA participation in ways that meet their needs and abilities. **PURPOSE:** To assess prevalence of PA levels among adults aged 18-64 years with mobility disability and determine the most common PA types by activity level. **METHODS:** Using the 2015 Behavioral Risk Factor Surveillance System (n=269,486), we classified respondents reporting serious difficulty walking or climbing stairs as having mobility disability (n=35,140). We calculated moderate-intensity-equivalent minutes/week (2*vigorous min/wk + moderate min/wk) from self-reported type, frequency, and duration of PA in the past month. Three PA levels were: active (≥150 min/wk), insufficiently active (10 - 149 min/wk), and inactive (no PA for ≥10 min/wk). Weighted prevalence estimates and 95% confidence intervals (CI) were calculated for PA levels and for activity types. **RESULTS:** Overall, 10.5% of 18-64 year old adults reported mobility disability. Among these adults, a significantly higher percentage were inactive [51.0% (95% CI: 50.0, 52.0)] than insufficiently active [19.1% (95% CI: 18.3, 20.0)] or active [29.9% (95% CI: 29.0, 30.9)]. Among those who were insufficiently active, walking was the most commonly reported activity (78.1%), followed by gardening/yard work (3.8%), and bicycling (3.3%). Among active adults, walking was the most commonly reported activity (61.3%) followed by gardening/yard work (9.4%) and bicycling (6.2%). **CONCLUSION:** Nearly 5 in 10 working-age adults with mobility disability avoid inactivity, primarily through walking. However, the other half of this group are inactive and missing the opportunity to protect or improve their health by regularly engaging in PA. These results highlight the need for PA promotion strategies in which all adults have opportunities to participate according to their abilities and the need to evaluate how specific activities, such as walking or wheelchair rolling, may increase PA among adults with mobility disabilities.

3237 Board #142 June 2 2:00 PM - 3:30 PM

Assessing Street-scale Supports For Walking In The U.S. Virgin Islands — 2016

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PURPOSE: Streets can be designed to provide safe and easy places that encourage walking by providing street-scale supports such as destinations, sidewalks, lighting, and traffic calming features. The prevalence of street-scale supports for walking across the US Virgin Islands (USVI) was assessed and differences determined by residential or commercial land use type.

METHODS: A two-stage sampling method was used to select representative street segments: (1) Estates (census subdivisions in the USVI) were selected using stratified random sampling (n=46 selected of 336) and (2) street segments were then randomly selected from within Estates (n=1550). The Microscale Audit of Pedestrian Streetscape Abbreviated Tool was locally adapted and used by trained auditors to conduct objective assessments of several key elements of street-scale design, including destinations, traffic calming features, street lighting, and sidewalks. Descriptive statistics were weighted to be representative of the total street length within the sampling frame. Audits were conducted on 1114 street segments (unweighted: 94.6 km of street length; weighted: 1456 km).

RESULTS: Overall, 22.1% of street length had at least one destination, 27.9% had at least one traffic calming feature, 53.0% had at least some street lighting, and 11.2% had sidewalks (TABLE). Significant differences were found by type of land use for the presence of several features, including number of destinations, the degree of street lighting, and sidewalks (Pearson's chi-square test, p<0.001).

CONCLUSION: Across the USVI, street-scale features that support walking were uncommon and were less prevalent on residential streets than on commercial streets. Implementing policies and projects relating to street-scale design in the USVI could improve walkability, particularly those that focus on residential areas.

TABLE. Prevalence of built environment features among audited street length, US Virgin Islands, 2016

Features	Overall (N=1456 Km)		Residential land use		Commercial land use		Pa
	%	95% CI	%	95% CI	%	95% CI	
Total	--	--	85.3	(76.0-91.4)	14.7	(8.6-24.0)	
Number of destinations							
0	78.0	(70.9-83.7)	87.3	(82.6-90.8)	20.3	(10.2-36.3)	<0.001
1-2	13.1	(9.5-17.7)	10.4	(7.0-15.2)	29.6	(21.7-39.0)	
>2	9.0	(5.9-13.4)	2.3	(0.6-8.1)	50.1	(38.4-61.7)	
Traffic calming features							
None	72.1	(60.4-81.4)	72.4	(58.8-82.8)	70.4	(47.3-86.2)	0.866
Any	27.9	(18.6-39.6)	27.6	(17.2-41.2)	29.6	(13.8-52.7)	
Street lighting							
None	47.0	(39.0-55.1)	50.4	(42.3-58.5)	26.9	(19.2-36.3)	<0.001
Some	50.7	(42.3-59.1)	47.2	(38.9-55.6)	71.1	(61.2-79.4)	
Ample	2.3	(0.6-8.1)	2.4	(0.6-9.7)	2.0	(0.7-5.4)	
Sidewalks							
Not present or continuous	88.8	(81.7-93.4)	93.9	(87.0-97.2)	60.3	(46.5-72.7)	<0.001
Present	11.2	(6.6-18.3)	6.1	(2.8-13.0)	39.7	(27.3-53.5)	

a. Pearson's chi-square test for differences in distributions by type of land use.

Note: Percentages may not add to 100% due to rounding.

3238 Board #143 June 2 2:00 PM - 3:30 PM

Fitness And BMI Levels In Children Of The City Of Barcelona Related To Their Socio-economical Level (POIBA Project)

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(No relationships reported)

PURPOSE: To study the fitness and the BMI levels of children from Barcelona (Spain), related to their socio-economical level.

METHODS: 3279 children (1634 boys) of 7-10 yr. were recruited from schools of three different socio-economical levels: low (n=343), medium (n=850) and high (n=1808), and participated in the study after the approval of the Clinical Ethics Committee research CEIC- Parc Salut Mar. The participants' families gave informed consent for their children to participate. Height, weight and BMI of all of them were obtained. A battery of fitness tests was performed: vertical jump, ball throwing, long jump, zig-zag running test, 20 m running velocity test and 20m shuttle run test (EUROFIT, 1993; Welk & Meredith, 2008). Descriptive for all variables were obtained, ANOVA and Bonferroni were applied to compare the three groups.

RESULTS: Significant differences appeared between the three groups, with worse values in the low socio-economic level for all the fitness tests, except for vertical jump test.

CONCLUSIONS: As a low socio-economical group showed worse fitness levels than medium and high groups. Moreover, their overweight/obesity levels could have conditioned the fitness levels. The study was partially funded by the "Fondo de Investigación Sanitaria (FIS)" (PI09/02259), of the Carlos III Health Institute (Ministry of Economy and Competitiveness, Spanish Government. Authors declare no conflict of interest.

Characteristics and Fitness test values compared between socio-economical levels							
Variables	Socio-economic level	HighMean (SD)	MediumMean (SD)	LowMean (SD)	P1	P2	P3
Descriptive							
Weight (kg)		31.7 (6.4)	32.0 (6.7)	32.6 (7.7)	1.0	.390	.075
Height (cm)		134.3 (6.0)	134.1 (5.9)	134.0 (6.5)	.781	1.0	.940
BMI		17.4 (2.6)	17.6 (2.9)	18.0 (3.2)	.276	.181	.004
Fitness test							
Ball throwing (cm)		415.7 (102.7)	407.7 (109.7)	390.4 (104.1)	.242	.042	.000
Long jump (cm)		129.4 (23.6)	126.2 (25.4)	122.7 (23.1)	.008	.098	.000
Vertical jump (cm)		22.3 (7.1)	22.17 (7.1)	21.9 (6.5)	1.0	1.0	1.0
Zig-zag running (sec)		12.0 (5.3)	12.7 (5.3)	12.8 (4.2)	.008	1.0	.262
20 m running velocity (sec)		4.6 (0.6)	4.7 (0.7)	4.8 (0.8)	.024	.010	.000
20m shuttle run		12.3 (3.7)	11.8 (3.9)	11.3 (3.9)	.052	.077	.000
Abbreviations: P1: group differences between High and Medium level P2: group differences between Medium and Low level P3: group differences between High and Low level							

3239 Board #144 June 2 2:00 PM - 3:30 PM
Objective And Subjective Measures Of Walkability And Bikability At Westfield State University
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(No relationships reported)

PURPOSE: Walking and bicycling are popular forms of active transportation that help an individual engage in physical activity. College campuses present unique opportunities for all of its members to engage in physical activity as they are moving on and around campus and these forms of active transport should be encouraged for all campus members. This study aims to compare objective walkability measurements of Westfield State University's (WSU) pathways and roadways and how they support walking and biking versus student and faculty/staff perceptions of infrastructure support for walking and biking. **METHODS:** Mixed methods were used to obtain data: selected segments of WSU campus were objectively measured using a modified CDC Walkability Audit tool; the results of the audits were compared to results of an online survey distributed to WSU students and faculty/staff about their perceptions of ease of walking and biking on and around the campus. Two open-ended response questions were given to each group to propose recommendations to facilitate walking and biking. **RESULTS:** Selected path segments (n=26) on and connecting the WSU campus were audited for their objective walkability/bikability. The segments received a mean score of 62.9±18.4, giving WSU a grade C. Only 31% of audited segments received a grade A or B while the remaining 68% received a grade C or F, indicating fair or poor conditions for walking and biking. Students (n=389) and faculty/staff members (n=78) responded to the survey. Student age was 20.4±1.7 years and 48.72% self-reported their daily physical activity level as a mix of both sedentary and activity. Faculty age was 48.2±13.2 years and 46.75% self-reported their daily physical activity level as mostly sedentary with some activity. For the open-ended questions, the top answers for both students and faculty/staff were posting more motivational signage about walking and installing bike racks and outdoor bike storage. **CONCLUSIONS:** The objective audit supports current student and faculty/staff perceptions of campus walkability and bikability. Both subjective and objective measures can be used when designing a long-term campus master plan as well as physical activity interventions.

3240 Board #145 June 2 2:00 PM - 3:30 PM
A National Survey of Popular Physical Activities among U.S. Children and Youth
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PURPOSE: Understanding what children and youth enjoy to play is beneficial in helping design intervention and other physical activity (PA) related programs to help improve children's fitness levels. The aim of this study was to determine the popularity of different PA among children and youth aged from 3 to 15 yr. old. **METHODS:** The national representative data (N = 53,669,505; 51.12% male; 3-15 yr.) from the 2012 NHANES National Youth Fitness Survey were employed for the analysis. Descriptive analysis was applied to examine the popularity of different type of PA and t-tests were used to determine the sex difference and ANOVAs were applied to examine the age difference on total PA participation. **RESULTS:** Among the 30 types of PA listed, including running, football, basketball, soccer, swimming, dance, and walking, etc., the most popular PA for children and youth in all age groups is running (33.30%), followed by bike riding (27.86%), and backyard games (21.71%). The 3 most popular PA for boys are running (35.18%), basketball (30.31%), and bike riding (29.90%), and for girls are running (31.33%), bike riding (25.73%), and walking (21.55%). About 16.9% of children/youth participated in no activity, but about 18.7% took part in at least one activity and about 64.4% took part in more than one activities; on average, children/youth took part in 2.59 ± 2.18 (M±SD) activities and boys (2.81±2.31) participated in more activities than girls (2.36±2.02; t=758.544, p<0.00, effect size = .10). From 3 to 11 yr., as the children got older, they participated in more PA, but the PA participation decreased after 12yr. **CONCLUSIONS:** Running is the most popular PA for the US children and youth, and some gender and age impact on PA participation was found.

Physical activity participation in age and gender difference among U.S. children and youth					
	3-7 yr.	8-11 yr.	12-15 yr.	F	p-value
Boys	2.92±2.42	2.98±2.29	2.56±2.15	552152.12	.00
Girls	2.56±2.04	2.82±2.21	1.71±1.57	692984.56	.00
Total	2.75±2.26	2.90±2.25	2.14±1.94	81088.51	.00

3241 Board #146 June 2 2:00 PM - 3:30 PM
Do New Zealand Women's Age and Ethnicity Contribute to Achieving Physical Activity Guidelines?
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Regular participation in physical activity (PA) has overwhelming positive implications on long-term health and on disease prevention. Despite established government guidelines to improve health through PA, over half of New Zealand women reportedly fail to meet these criteria. Barriers to achieving minimum physical activity levels may include demographic characteristics (i.e. age, ethnicity), but the contribution of each factor is unclear. **PURPOSE:** To understand how age and ethnicity affect a New Zealand woman's ability to meet PA guidelines. **METHODS:** Healthy New Zealand women (n = 350) of three ethnicities (Māori, Pacific, European) aged 16-45y (stratified as 16-25y, 26-35y, 36-45y) wore triaxial accelerometers for 7 days. Levels of moderate-vigorous PA (MVPA; ≥2020 counts.min⁻¹) were assessed. Participants were categorized as achieving or not achieving PA guidelines. PA guidelines are commonly reported as either ≥150 min.wk⁻¹ MVPA (Basic) or ≥150 min.wk⁻¹ MVPA in bouts of 10+ min (Basic10+), therefore both of these classifications were considered. **RESULTS:** Basic10+ guidelines were met by only 32% of New Zealand women; a further 34% of women (66% in total) met Basic guidelines. There were no significant differences between the three age groups when ethnicity was not also considered. Achievement of Basic guidelines was lower in Pacific women (37%) than Maori (65%; p=0.001) or European (75%; p<0.001) women. Specifically, fewer Pacific women in the 16-25y and 36-45y age groups achieved Basic PA guidelines than women of the same age but different ethnicity. More European women (38%) met Basic10+ guidelines than Maori (22%; p=0.011) or Pacific (22%; p=0.012) women. These differences between ethnicity were not specific to any age group. **CONCLUSION:** Although only two-thirds of New Zealand women achieved Basic PA guidelines, the prevalence was substantially higher than overall national statistics (48%). Given the extremely low rates of PA for periods of 10 or more minutes, a strategy is needed to increase the length of time women spend in bouts of MVPA. The findings further suggest that ethnicity, more so than age, is a contributing factor to achieving PA guidelines.

Funding Sources: Nutricia Research Foundation

3242 Board #147 June 2 2:00 PM - 3:30 PM

Comparison Of Weekend And Weekdays Physical Activity Levels In Korean Professional Golfers.

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The dominance of the U.S based LPGA/PGA tour by Korean-born golfers over the past decade has been well recognized. The sheer volume of quality golfers being produced by this relatively small golfing nation has certainly caught the attention of the field of golf. However, the level of physical activity in Korean professional golfers has never been systematically examined. **PURPOSE:** The present study was to describe the baseline characteristics of the participant and to compare the physical activity level between weekdays and weekends in Korean professional golfers using objective physical assessment tools (i.e., Accelerometer). **METHODS:** Fourteen (male=7; female=8) young Korean professional golfers (23 ± 2.4 yrs; height = 171±7.5 cm; weight = 73.7±7.5 kg, experience = 6.6 yrs) consented to participate in the study. Participants were asked to wear the accelerometer (i.e., Actigraph) on their right wrist for 24 hours/day, 7 consecutive days to provide data on time in moderate and vigorous physical activity (MVPA). ActiLife software (version 6.11.2) was used to download all data. Raw data were processed with the R package GGIR and associated Hilderband milling (mg) cut points. Descriptive for all variables was calculated and Pearson product moment correlations were used to test for relationships between weekdays and weekends. A paired sample t-test was used to evaluate differences between weekday and weekend physical activity level. **RESULTS:** The accelerometer wear compliance was excellent 6.8 days, 98% of the time. Time in MVPA was 99.5 ± 35.79 mins/day and 136.4 ± 35.2 mins/day for weekends, weekdays, respectively. There is no significant difference on physical activity levels on weekdays ($t(12) = .379, p = .329$) and weekends ($t(12) = -.004, p = .997$) between male and female golfers. No correlation was observed between weekdays MVPA and years of experience. However, weekends MVPA were inversely correlated with years of experience ($r = -.215, p = .48$). Similar correlations were found between weekdays MVPA ($r = -.432, p = .141$) and weekends MVPA ($r = -.438, p = .134$) with golfers' age. **DISCUSSIONS:** Our data demonstrates that Korean professional golfers were highly active during weekdays compared to weekends. Experienced golfers were associated with little time spent in MVPA regardless of the days of the week.

F-57 Free Communication/Poster - Energetics

Friday, June 2, 2017, 1:00 PM - 6:00 PM

Room: Hall F

3243 Board #148 June 2 3:30 PM - 5:00 PM

Effect Of Work Intensity On The Kinetics Of W'

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(No relationships reported)

PURPOSE:To assess the effect of work intensity on the W'_{BAL} model during intermittent exercise**METHODS:**

After determining VO_{2max} , critical power (CP), and W' , 10 untrained subjects completed three separate exercise tests on a cycle ergometer on different days, and in random order. In each case, subjects were asked to perform severe-intensity work intervals lasting 60s, followed by 30s of recovery at 20W. The intervals were repeated until volitional exhaustion. The work interval power was different during each visit, and was set using the 2-parameter CP model. Subjects were exercised at either the power predicted to result in exhaustion at 1.5, 3, or 4 min (P1.5, P3, P4). All subjects completed all trials. These data were entered into a continuous integrating equation predicting balance of W' remaining, assuming exponential reconstitution of the W' (W'_{BAL} model; Skiba 2012). The time constant ($\tau W'$) was varied by iterative process until the remaining modeled $W' = 0$ at the time of athlete exhaustion. $\tau W'$ was compared across trials, and predicted $\tau W'$ was compared to calculated $\tau W'$, using ANOVA. Results are reported as group means ± SD.

RESULTS:

Calculated $\tau W'$ was not significantly different between trials (mean P1.5 = 507 ± 547s, P3 = 436 ± 266s, P4 = 463 ± 268s, $p = 0.91$). Model predicted $\tau W'$ (mean = 443 ± 45) was not significantly different from the calculated $\tau W'$ in any of the experimental trials ($p = 0.96$). However, considerable inter-individual variability was noted, resulting in high SD. In particular, three subjects showed unexpectedly slow recovery of the W' during the experimental trials.

CONCLUSIONS:

These data suggest that the recovery of the W' is insensitive to work intensity within the power ranges studied. These data provide further support for the utility of the W'_{BAL} model over a variety of work intensities, but also suggest the possible need to develop athlete specific models with a customized $\tau W'$.

3244 Board #149 June 2 3:30 PM - 5:00 PM

Energy Expenditure In Low-load Resistance Exercise With Slow Movement Using Body Mass Alone As Load

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(No relationships reported)

PURPOSE: Energy expenditure (EE) and MET values have been reported for many different physical activities and exercises. Resistance exercise using free weights and training machines at 3.5-6.0 METs has been defined as conditioning exercise. However, little research has been conducted on low-load resistance exercise with slow movement, such as squats and push-ups, using body mass alone as load. This study aimed to determine the EE and MET values in low-load resistance exercise using body mass alone as load. **METHODS:** Sixteen men aged 20-26 years performed 6 resistance exercises in random order, using body mass alone as load. The exercises consisted of squats, single-leg lunges, sit-ups, push-ups, heel raises, and hip lifts. The eccentric and concentric phases of the exercises were completed with 3-second slow movements, performed in 2 sets of 10 repetitions of each exercise. Oxygen consumption (VO_2) was continuously measured during exercise, and EE was calculated by applying the VO_2 and VCO_2 to the Weir equation. We measured resting EE for 30 min before exercise, and 1 MET was calculated by dividing gross oxygen consumption (ml/kg/min) by individual resting EE. **RESULTS:** The mean EE and MET values for low-load resistance exercise using body mass alone as load were 3.2 0.8 kcal/min and 2.6 0.7 METs, respectively. Squats involved multiple major muscle groups, with the quadriceps showing the highest EE and MET values for 6 exercises, at 4.1 1.0 kcal/min and 3.4 0.4 METs, respectively. Heel raises showed the lowest values of 2.2 0.6 kcal/min and 1.8 0.3 METs, respectively. **CONCLUSIONS:** The EE and MET values for low-load resistance exercise using body mass alone as load were lower than the values observed during the use of free weights and training machines, and were equivalent to those for low-to-moderate-intensity exercises such as walking in daily life.

3245 Board #150 June 2 3:30 PM - 5:00 PM

Energy Expenditure of Collegiate Golfers in a Competitive Setting

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Tracking daily energy expenditure via wearable devices has become very popular. However, few in-lab and field studies validating these devices have been published. **PURPOSE:** To determine the accuracy of a wrist-based activity tracking device in a lab setting and during a NCAA style golf tournament. **METHODS:** Eight NCAA golfers [4 males; 4 females; Age: 19.3±2.0 yrs; WT: 149.5±13.4 lbs; Bag WT: 22.3±2.0 lbs; Bag Wt./Body Wt.: 15.0±1.8%; HT: 67.7±3.6 in; % BF: 20.0±7.3%] were tested. In-lab testing consisted of a VO_{2max} test with golf bag wt. simulation and two 6-min run/walk steady-steady (SS) tests (one with bag wt., one without). The golf tournament consisted of completing two, 18-hole rounds while carrying their own golf clubs. Variables collected during tournament play were HR, distance, time, speed, device kcals, kcals from the metabolic cart (MET kcals), pace, and score. Unpaired, paired t-test, and a repeated measures ANOVA were used to determine significant differences. Correlation and step-wise multiple regression were used to determine which variables had the largest influence on determining kcals expended. **RESULTS:** During the in-lab testing, the device overestimated kcals expended compared to the actual MET kcals (+22.4%; $p = 0.01$) for the 6-min SS tests. Step-wise regression showed that HR had the largest impact on kcal expenditure ($p = 0.04$) during the SS tests. During the golf tournament, males had lower mean HRs (males: 111.00 ± 4.31 bpm; females: 121.99 ± 15.26 bpm). The device showed females burned more tournament kcals (1,642.33 ± 442.98 kcals), but less kcals per hour (348.59 ± 78.09 cal/hour) than males (1,583.13 ± 145.80 kcals; 357.13 ± 30.21 cal/hour). Comparing MET kcals and device kcals, the device underestimated females by 6.22% (not significant, NS) and overestimated males by 5.3% (NS). Looking at the device kcals for all golfers across all rounds, step-wise regression showed that calories/hour and playing duration time ($p \leq 0.01, p \leq 0.01, r\text{-squared} = 0.99$) were the primary independent device kcal determinants. **CONCLUSION:** The in-lab tests showed the device overestimated kcals expended.

During the golf tournament, the device overestimated males and underestimated the female kcals expended showing a possible golf tournament wearable kcal gender measurement tracking bias.

3246 Board #151 June 2 3:30 PM - 5:00 PM

Muscle Oxygen Extraction is a Key Performance Adaptation in Sprint Canoe-Kayak

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Background The aerobic contribution to sprint canoe-kayak performance ranges from ~37% to ~85% of total energy expenditure from shortest (200m) to longest (1000m) events. While systemic $\dot{V}O_{2\max}$ is a strong predictor of performance in 500m and 1000m races, the respective role of central and peripheral adaptations is poorly understood.

Purpose The purpose of this study was therefore to characterize the changes in oxygenation derived from portable near-infrared spectroscopy (NIRS) in various muscles during a $\dot{V}O_{2\max}$ test and two on-water time trials (TT: 200m and 500m or 1000m), and to examine the link between muscle oxygenation, cardiac output and performance.

Methods Twenty one well-trained sprint canoe-kayak athletes (12 men: 8 kayakers (MK) and 4 canoeists (MC); 9 women: 4 kayakers (WK) and 5 canoeists (WC)) participated in three testing sessions: 1) an incremental $\dot{V}O_{2\max}$ test on a canoe or kayak ergometer; 2) a 200-m TT; and 3) a 500-m (WK and WC) or 1000-m (MK and MC) TT. NIRS monitors were placed on the *latissimus dorsi* (LD), *biceps brachii* (BB), and *vastus lateralis* (VL) during the 3 testing sessions to assess changes in muscle O_2 saturation (SmO_2 , % from baseline). Cardiac output was measured by impedance during the $\dot{V}O_{2\max}$ test in a subset of 9 athletes.

Results Performance in the 200m time trial correlated with both LD final SmO_2 ($R=0.700$, $p=0.01$) and VL final SmO_2 ($R=0.568$, $p=0.02$). Performance during the 500-1000m time trials correlated with BB final SmO_2 obtained during the $\dot{V}O_{2\max}$ test ($R=0.519$, $p=0.033$) and with $\dot{V}O_{2\max}$ (L/min: $R=-0.560$, $p=0.03$). Maximal cardiac output was low (men: 26.2 ± 4.7 L/min, women: 24.0 ± 2.6 L/min) and did not correlate with 200m ($R=0.253$) or 500-1000m ($R=0.028$) performance.

Conclusion These results confirm that systemic $\dot{V}O_{2\max}$ is related to performance in the longer canoe-kayak events, and suggest that peripheral adaptations (i.e., the muscle ability to extract oxygen during the effort) rather than central factors better contribute to success in this sport. The ability to extract oxygen during the effort appears to be a predictor of performance for both short and long events. These results indicate that training for sprint canoe-kayak athletes should emphasize the development of the peripheral component of oxygen consumption.

3247 Board #152 June 2 3:30 PM - 5:00 PM

Gender Differences In Resting Energy Expenditure In Athletic Populations

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Gender differences in energy expenditure and fuel utilization have been observed during exercise. However, less is known about whether or not these differences are also evident at rest, particularly in athletic populations, and it is currently unknown whether these differences remain when adjusted for body mass (BM) and fat-free mass (FFM). **PURPOSE:** The purpose of this study was to determine the differences in resting metabolism between men and women athletes when adjusted for body mass and fat-free mass. **METHODS:** Twenty-one men (20.1 y; 180.8 6.3 cm; 97.7 17.3 kg; 17.2 8.5% BF) and nineteen women (20.1 y; 166.1 5.2 cm; 64.5 7.2 kg; 23.4% 4.4% BF) athletes were recruited to participate in a single testing session. Resting metabolism was estimated using Resting Energy Expenditure (REE) measurements through indirect calorimetry (TrueOne® 2400 Metabolic Measurement system, ParvoMedics, Sandy, UT) and body composition analyses via air displacement plethysmography (BODPOD, Cosmed, USA) to determine fat mass (FM) and FFM. Athletes reported to the lab in a rested (>48 hrs. from strenuous exercise) and fasted (>8 hrs.) state. During REE assessment, athletes remained in a supine position, motionless for 15-20 minutes while maintaining conscious awareness. Data recordings were then obtained when criterion variables (i.e., $\dot{V}O_2$ L/min) experienced less than a 5% alteration during the final five minutes of data collection. A one-way analysis of variance was used to compare differences in REE and body composition. **RESULTS:** Body mass and FFM were significantly greater in men ($p<0.001$). Women had higher body fat percentages (M: 17.2 ± 8.5 vs. W: 23.4 ± 4.4 %; $p=0.007$) however no differences between groups

were observed for FM ($p=0.361$). Absolute REE was significantly higher in men athletes (M: $2,480.8 \pm 208.6$ vs. W: $1,583.1 \pm 192.8$ kcals; $p<0.001$). When expressed relative to BM and FFM there were no differences in REE observed between men and women athletes (M: 25.8 ± 3.5 vs. W: 24.6 ± 1.9 kcals/kg of BM; $p=0.183$), (M: 31.2 ± 3.1 vs. W: 32.1 ± 3.1 kcals/kg of FFM; $p=0.357$) respectively. **CONCLUSIONS:** Based upon the results of the current study it appears as though the greater REE observed in men athletes are likely attributable to their increased BM and FFM.

3248 Board #153 June 2 3:30 PM - 5:00 PM

Exercise-induced Changes In Plasma Adenosine Triphosphate Concentration In Highly-trained Sprinters And Triathletes

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PURPOSE: It is known that plasma adenosine triphosphate (ATP) concentration increases during exercise and depends on its intensity. There are no reports about the effect of specific long-term training adaptation on plasma ATP levels during exercise. The aim of our study was to compare the exercise-induced plasma ATP release in athletes specialized in speed-power vs endurance disciplines. **METHODS:** Nine sprinters, 9 triathletes at national/international level, and 9 amateur runners (controls), aged 23.8 ± 2.8 y, 23.1 ± 4.3 y, and 25.2 ± 2.7 y, respectively, were studied. They underwent an incremental exercise test until exhaustion on a motorized treadmill. Venous blood samples were drawn at rest, at exhaustion (maximum intensity), and after 10 and 30 min of recovery. Blood samples were immediately centrifuged for 30 s at 14,000 rpm and 4°C, frozen in liquid nitrogen, stored at -86°C, and then analyzed using high-performance liquid chromatography. Comparisons between groups and exercise phases were made using two-way ANOVA with repeated measures and Scheffe post-hoc test. **RESULTS:** In all three groups, a significant increase in plasma ATP was observed between rest and exhaustion, as well as after 30 min of recovery (see: Figure). A significantly greater plasma ATP concentration was observed in sprinters than in triathletes and controls at exhaustion and after 10 min of recovery. No significant between-group differences were observed at rest and 30 min after exercise. **CONCLUSION:** Plasma ATP response to incremental exercise until exhaustion is different depending on specific training adaptation. Training based on speed-power exercise brings about much greater plasma ATP release than endurance training. Underlying mechanisms, connected with exercise-induced vasodilation and its mediators, erythrocyte function, skeletal muscle activity, and other factors, need further research. Supported by National Science Center Poland Grant 2013/09/B/NZ7/02556

3249 Board #154 June 2 3:30 PM - 5:00 PM

Energetics of Semi-contact Karate in Trained Young Athletes

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PURPOSE: Karate will have its debut in the 2020 Olympic Games. Understanding the energetics in karate as a contact sport event may provide information for performance training. However, the existing studies on karate have limited mainly on non-contact fighting. The aim of this study is to determine the energetics of semi-contact karate in trained young athletes.

METHODS: Nine females (18.3 ± 1.7 yrs, 166 ± 4.7 cm, 57.2 ± 4.5 kg, 2.1 ± 1.7 yrs training experience) and nine males (16.7 ± 2.0 yrs, 176 ± 8.2 cm, 61.1 ± 9.4 kg, 2.4 ± 1.7 yrs training experience) from the Chinese national youth team participated in one round of semi-contact karate, with the duration of 2 min and 3 min, respectively. A portable spirometric system (MetaMax 3B, Cortex, Germany) was utilized to measure the inspired oxygen uptake. Capillary blood was taken from the earlobe prior to and post the karate, and analyzed with blood lactate analyzer (Biosen C-line, EKF, Germany). Athletes were encouraged to fight as in real matches, but without touching the spirometric machine. The energy contributions were calculated based on the accumulated oxygen uptake and blood lactate during karate, as well as the fast component of oxygen debt during the recovery.

RESULTS: The peak blood lactate values after karate were 3.36 ± 1.15 and 5.14 ± 1.70 mM for females and males. The averaged oxygen uptakes during karate were 30.6 ± 4.6 and 40.5 ± 5.0 ml/min/kg for females and males. The energy contribution from anaerobic alactic, anaerobic lactic, and aerobic pathways were 27.3 ± 11.8 (27.7 ± 8.1 %), 7.5 ± 4.4 (7.4 ± 3.3 %), and 61.6 ± 10.7 (64.9 ± 9.3 %) kJ for females, and 31.1 ± 10.8 (17.7 ± 5.3 %), 13.0 ± 5.9 (7.1 ± 2.7 %), and 132.7 ± 22.2 (75.2 ± 5.3 %) kJ for males.

CONCLUSIONS: Karate is an aerobic-dominant sport event, while the anaerobic energy system may play an important role in high-intensity fighting. These findings are consistent with existing studies on non-contact karate.

3250 Board #155 June 2 3:30 PM - 5:00 PM

A Comparison of Energy Expenditure Between Motorized and Non-Motorized Treadmills

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Non-motorized, arced treadmills are becoming more popular in fitness settings and are thought to require greater effort than walking or running on a traditional motorized treadmill. However, little research has been conducted to evaluate this type of exercise equipment.

PURPOSE: The purpose of this study was to compare the energy expenditure (EE) required to complete one mile on a non-motorized, arced treadmill (AT) and a motorized treadmill (TM).

METHODS: Nine recreationally trained healthy participants (4 male, 5 female) ages 26.1±9.6 years walked or ran 1-mile at a self-selected speed on a motorized treadmill (TM) and a non-motorized arced treadmill (AT) while VO₂, EE, and heart rate (HR) were measured. The EE in kcal•min⁻¹ and kcal•mile⁻¹ was calculated from VO₂ measured after subjects achieved steady-state. The tests were counterbalanced so half of the subjects completed the TM trial first and half completed the AT trial first.

RESULTS: Nine participants completed the 1-mile effort at an average speed was 125.1±32.6 m•min⁻¹ (range: 88.4–160.8 m•min⁻¹). The mean VO₂, EE, and HR were significantly higher during the TF trial compared to the TM trial:

	TM	AT	p
VO ₂ (L•min ⁻¹)	1.6±0.9	2.2±1.1	0.0006
EE (kcal•min ⁻¹)	7.9±4.6	10.9±5.4	0.0005
EE (kcal•mile ⁻¹)	98.4±35.4	144.8±32.2	0.0001
HR (beats•min ⁻¹)	152.0±29.3	164.9±23.3	0.005

Values expressed as mean±SD

CONCLUSION: Use of a non-motorized arced treadmill resulted in a significantly higher VO₂, EE, and HR compared to a traditional treadmill at the same speed. This could be due to the unique design of the arced treadmill that requires a different movement pattern and additional effort to propel the non-motorized belt. This may have implications for fitness applications in which EE is of interest.

3251 Board #156 June 2 3:30 PM - 5:00 PM

Energy Expenditure Characteristics of Overweight Women at the Same Speed of Jogging and Walking

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(No relationships reported)

PURPOSE: Jogging and walking are two common exercises in overweight people. However, the relationship between energy expenditure of jogging and walking in overweight people is still not clear. This paper probes into characteristics of energy expenditure and physiology of overweight adult women at the same speed of jogging and walking.

METHODS: Twenty six overweight and twenty five normal weight adult women (age: 22.0±1.6 years) participated in the study. The resting energy expenditure and the energy expenditure of overground walking and jogging were measured by Cortex portable gas metabolism system. The overground walking speed from low to high were 4.0km/h, 4.5km/h, 5.0km/h, 5.5km/h, 6.0km/h, 6.5km/h and 7.0km/h. The overground jogging speed were 6.0km/h, 7.0km/h and 8.0km/h. The duration of each speed was 6 minutes. Net energy expenditure of each speed was calculated as energy expenditure minus resting energy expenditure.

RESULTS: When the jogging speed over 7.0km/h (including 7.0km/h) and walking speed over 5.5km/h (including 5.5km/h), the net energy expenditure, energy expenditure and heart rate of overweight women were significantly higher than normal weight women (P<0.05). When walking speed was 6.0km/h, net energy expenditure (5.44±0.95 vs 6.51±1.65 kcal/min) and energy expenditure (6.49±0.91 vs 7.55±1.64 kcal/min) of overweight women were significantly lower than jogging at the speed of 6.0km/h (P<0.01). However, when walking speed was 7.0km/h, net energy expenditure (9.60±1.48 vs 8.69±1.57 kcal/min), energy expenditure (10.64±1.50 vs 9.73±1.56 kcal/min), heart rate (170±10 vs 158±14 BPM) and RPE (17±1 vs 13±2) of overweight women were significantly higher than jogging at the speed of 7.0km/h (P<0.05).

CONCLUSIONS: The differences of BMI will result in differentiations of energy consumption and physiological indexes of women when walking and jogging at a

certain speed. When speed reach and exceed 7.0km/h, walking will consume more energy than jogging. As far as the weight control of overweight people is concerned, the effect of walking at this speed is better than that of jogging.

3252 Board #157 June 2 3:30 PM - 5:00 PM

Comparisons Of Caloric Expenditure During- And Post- Treadmill Activity Vs. Racquetball In Apparently Healthy College-aged Adults

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PURPOSE: The purpose of this study was to examine the possibility that alternative modes of exercise, specifically racquetball, may provide similar caloric benefits as traditional aerobic physical activity guidelines defined by the American College of Sports Medicine. Alternative modes of physical activity can be used to counteract many common physical activity barriers. This study examined the caloric expenditure (Kcal) differences during and post treadmill activity in comparison to racquetball.

METHODS: Twenty-six university students, aged 18-22 years, participated in this study. All participants completed a 30-minute racquetball session and a 30-minute treadmill running session (at 40-60% heart rate reserve), each session followed by a 30-minute of post-exercise monitoring of oxygen consumption (VO₂) using a metabolic cart. Minute-by-minute VO₂ and respiratory exchange ratio were utilized to calculate the total Kcal over the 30-minute recovery period, during which participants were laying supine. To obtain Kcal during exercise, accelerometer connected to heart rate monitor was utilized. **RESULTS:** Out of 26 participants, 4 were excluded from the analyses due to equipment malfunctioning during testing, resulting in N = 22 (Male n=11, Female n = 11). A two-way (sex x modality) repeated measures ANOVA, using an alpha level of .05, indicated that there was a significant modality (treadmill vs. racquetball) effect on Kcal post activity, F(1,20) = 5.61, p = .028, meaning that Kcal was significantly higher post treadmill activity vs. post racquetball session. A two-way repeated measures ANOVA indicated that there was a significant modality (racquetball vs. treadmill) effect on Kcal during activity, F(1,20) = 5.08, p = .036. More specifically, Kcal expended during racquetball activity was significantly higher than Kcal expended during treadmill activity. Ultimately, a two-way repeated measures ANOVA indicated that modality was not a significant predictor of total (during- and post-exercise) Kcal expenditure, F(1,20) = 1.33, p = .262. **CONCLUSION:** These findings suggest that participating in a recreational activity, such as racquetball, will yield similar total energy expenditure benefits compared to simple aerobic running exercise among apparently healthy college-aged males and females.

3253 Board #158 June 2 3:30 PM - 5:00 PM

Acute Metabolic Responses of Exercise with a Sauna Suit

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Purpose: The purpose of this study was to examine acute metabolic responses of exercise with a sauna suit (SS) under different exercise intensity and duration conditions. **Methods:** Twelve physically active men (age = 27.1±7.5 yrs, height = 175.4±6.3 cm, weight = 75.6±7.9 kg, maximal oxygen uptake - VO_{2max} = 38.6±7.8 mL•kg⁻¹•min⁻¹) completed four experimental trials on a cycle ergometer: 1) 30min moderate-intensity (MI) exercise (55-60% heart rate reserve-HRR) with SS, 2) 20min vigorous-intensity (VI) exercise (75-80% HRR) with SS, 3) 30min MI exercise (55-60% HRR) without a sauna suit (CON), and 4) 20min VI exercise (75-80% HRR) CON. Trials were separated by 24-96 hours and performed in randomized order. Exercise energy expenditure (EE), one hour excess post-exercise oxygen consumption (EPOC), and one hour post-exercise weight loss (PEWL) were measured for each trial. **Results:** There were significant differences (p<0.05) in exercise EE, one hour EPOC and one hour PEWL between SS and CON under both MI and VI conditions. MI results: exercise EE was greater with SS vs. CON (282.6±34.7 kcal vs. 247.8±40.2 kcal), one hour EPOC was greater with SS vs. CON (69.9±4.3 kcal vs. 45.2±3.0 kcal), and the SS condition resulted in greater change in one hour PEWL (0.52±0.14 kg vs. 0.37±0.15 kg). VI results: exercise EE was greater with SS vs. CON (204.7±24.2 kcal vs. 184.6±21.3 kcal), one hour EPOC was greater with SS vs. CON (87.7±7.0 kcal vs. 72.1±3.4 kcal), and the SS condition resulted in greater change in one hour PEWL (0.63±0.15 kg vs. 0.39±0.12 kg). **Conclusion:** Our findings support the feasibility of exercise training with a sauna suit—and the amplified exercise EE and EPOC—to contribute to long-term energy balance and thus improve cardiovascular health.

FRIDAY, JUNE 2, 2017

3254 Board #159 June 2 3:30 PM - 5:00 PM

Impact of Alternative Footwear on Human Energy Expenditure

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PURPOSE: Use of alternative footwear options such as flip-flop style sandals and minimalist athletic shoes are becoming increasingly popular footwear choices. The purpose of the investigation was to analyze the energy expenditure and oxygen consumption requirements of walking at preferred pace while wearing flip-flops, slip-on style shoes, and minimalist athletic shoes.

METHODS: Eighteen healthy male adults participated in this study. In addition to an initial familiarization session, participants were tested in three different footwear conditions [thong-style flip-flops (FF), slip on shoes (CROC), and minimalist shoes (MIN)]. Then after a brief warm-up, participants walked a one-mile distance at their preferred pace. Immediately following completion of the one-mile walk, participants stood quietly on the treadmill for an additional period to assess excess post-exercise oxygen consumption (EPOC).

RESULTS: A repeated-measures ANOVA showed that the following variables did not show evidence of a significant differently value between conditions: preferred pace ($p = 0.392$), average oxygen consumption ($p = 0.804$), energy expenditure per mile ($p = 0.306$), or EPOC ($p = 0.088$). There was shown to be a significantly higher RER during exercise in CROC compared to MIN ($p = 0.031$) with no significant differences observed when comparing CROC to FF ($p = 0.106$) or FF to MIN ($p = 0.827$).

CONCLUSIONS: Based on the results of the current study, it appears that the alternative footwear selected for evaluation do not lead to a substantial alteration of walking pace or overall EE. However, the significant difference in RER suggesting a slightly elevated exercise intensity while wearing the CROC could perhaps be related to the softer sole, influencing overall mechanical efficiency.

3255 Board #160 June 2 3:30 PM - 5:00 PM

Energy Expenditure of College Students

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A great deal of research has made it evident that an increase in physical activity (PA) leads to a decrease in risk for developing health issues such as cardiovascular disease (CVD). While persons of all ages and skill levels can increase their PA, young adults often have the ability to focus on decreasing their risk of CVD early in life through avoiding sedentary lifestyles and meeting PA guidelines (PAG). The 2008 PAG suggest that a 70 kg person expends approximately 1198.75 kcals/week, which equates to 0.12 kcals/min, at 50% HR_{max} intensity to elicit health benefits. **PURPOSE:** To determine the PA level of college students as compared to PAG through monitoring their level of energy expenditure (EE) as kilocalories per minute (kcals/min) burned. **METHODS:** Twenty-three college students (20 y.o.; 69.93 kg) wore an Actigraph accelerometer on the waist during daily activities to determine EE. The following measurements were also collected: 1) medical history, 2) demographic info, 3) BP, 4) HR, 5) height, 6) weight. **RESULTS:** The average EE for one week was approximately 0.1641 kcals/min±0.11988. **CONCLUSION:** Our data indicate that college students met and exceeded the PAG of 0.12 kcals/min (1198.75 kcals/week) by 0.0441 kcals/min. This PAG is based off recommendations that one should exercise 150 min/week at moderate intensity. However, through calculating PAG as 0.12 kcals/min, we were able to apply recommendations that are based off activity level throughout an entire week at various intensities. Further research is warranted to better understand whether one should focus on intensity of exercise or expending the recommended number of kcals to elicit/maintain health benefits.

3256 Board #161 June 2 3:30 PM - 5:00 PM

Metabolic Demands of Stationary ElliptiGO Cycling Compared to Treadmill Running

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Trained runners often face injury due to the high impact nature of the sport and lower limb strain. When injury occurs, runners commonly substitute alternative low-impact exercises modes like cycling and swimming. While these modes promote cardiovascular fitness they do not mimic the biomechanical patterns of running. An alternate form of training, ElliptiGO cycling, combines the low-impact of elliptical training with the mechanical patterns of running. However, the metabolic demands of ElliptiGO cycling have not been investigated.

PURPOSE: To compare the metabolic demands of stationary ElliptiGO cycling with treadmill running. **METHODS:** In a randomized cross-over design, 17 trained runners (9 males; 8 females, age 21.4 ± 1.1 yr, body mass 60.8 ± 9.2 kg, height 1.70 ± 0.07 m, body fat 12.6 ± 5.9%) completed 5×3 min stages while either cycling on a stationary ElliptiGO bike or running on a treadmill during which heart (HR), rating of perceived exertion (RPE), and expired gases were collected using a metabolic analyzer during each exercise bout. Subjects increased one gear or 1 mph every 3 min during cycling or running respectively. Pedaling cadence was fixed at ~70 rpm using a metronome. Linear regression analyses were performed for each physiological variable and speed. Metabolic demand data for running and ElliptiGO were matched to determine equivalent running and cycling speeds. The other physiological measures were then matched with the corresponding running and ElliptiGO cycling speeds. **RESULTS:** For each testing intensity, metabolic demand (VO₂), HR, and V_E were significantly higher during running ($p < 0.05$), however the RPE for each intensity was similar ($p > 0.05$). The relationship between speed and VO₂ during running had a steeper slope compared to ElliptiGO. As a result, the ElliptiGO speed that was equivalent to the VO₂ of each running speed increased at a greater rate (4 mph run = 10.2 mph ElliptiGO, 7 mph = 17.1 mph, 10 mph = 24.1 mph). When matched for VO₂, the HR, V_E, and RPE were significantly higher for ElliptiGO compared to running. **CONCLUSION:** ElliptiGO cycling is a practical training device that will elicit a similar metabolic demand, but higher HR, V_E, and RPE compared to running at faster cycling speeds. Supported by the Student Summer Scholars program at Grand Valley State University.

F-58 Free Communication/Poster - Ergogenic Aids III

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3257 Board #162 June 2 2:00 PM - 3:30 PM

Accounting For The 'Dehydration Factor' In The Athlete Biological Passport

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(No relationships reported)

The Athlete Biological Passport (ABP) was implemented by the World Anti-Doping Agency in 2008 to monitor elite athletes for banned substances. The potential for dehydration to bias the ABP by elevating parameters such as hemoglobin (Hb) and hematocrit (Hct) deserves careful attention before integration into detection models. **PURPOSE:** To examine biological variation in euhydrated Hb and Hct for comparison against changes observed in response to a standardized loss of total body water (~3-4% body mass) achieved using two distinct types of dehydration. **METHODS:** Ten participants (7M, 3F; 23 ± 4 years) completed three days of controlled euhydration (EUH) from which the within-subject biological variation (CVw) and analytical variation (CVa) were used to estimate a meaningful change (unidirectional 95% level). Two trials of controlled dehydration via sweating (HYP) and diuretic administration (DIUR) followed. **RESULTS:** The CVw and CVa for Hb and Hct were both ~2% and 0.5%, respectively. When properly summed [$RVCV = 2^{1.5} \times 1.65 \times (CVa^2 + CVw^2)^{0.5}$] they explain a relative increase of ~5% (0.7 Hb units and 2.0 Hct units) between any two successive values measured 24 hours apart. Participants achieved body mass losses of 3.13 ± 0.44% (HYP) and 3.70 ± 0.54% (DIUR). The change in Hb was 0.6 units (HYP) and 1.4 units (DIUR) ($P < 0.05$) vs EUH. The change in Hct was 2.1 units (HYP) and 4.2 units (DIUR) ($P < 0.05$) vs EUH. Only with the diuretic was the change in Hb and Hct (1.4, 4.2) well beyond expected values due to biological variation (0.7, 2.0). **CONCLUSION:** Dehydration by ~3-4% of body mass produced changes in Hb and Hct beyond day-to-day variation (> unidirectional 95% level) only when achieved using a diuretic. These findings have important implications for claims made against dehydration as a bias factor in the ABP and also provide important insight related to hydration testing in general. Funded by USAMRMC; author views not official US Army or DOD policy.

3258 Board #163 June 2 2:00 PM - 3:30 PM

Nrf-2 Activation by Palm Fruit BioactivesShawn M. Talbott, FACSM¹, Cory Grand², Kevin L. Ohashi³, Joseph De Angelo³. ¹*EQQIL, Draper, UT*. ²*Wasatch Scientific Services, Salt Lake City, UT*. ³*Phenolaeis, Cambridge, MA*.**Reported Relationships:** S.M. Talbott: Consulting Fee; Scientific advisor to Phenolaeis.

PURPOSE: Overexposure to reactive oxygen species has been implicated in the pathogenesis of a wide range of chronic conditions, including cardiovascular disease, cancer, and the aging process (e.g. "free radical theory of aging"). While some early studies have shown the benefits of "direct" antioxidants (e.g. vitamins A, C, E) in reducing oxidative cellular damage, more recent evidence suggests that mega-doses of antioxidants (e.g. E, beta-carotene, resveratrol) may interfere with internal cellular protection pathways, disrupt redox balance, and suppress several important exercise-induced adaptations. In contrast, up-regulation of endogenous "indirect" antioxidant pathways has been proposed as a mechanism for optimizing redox balance. Activation of nuclear factor (erythroid-derived 2)-like 2 (Nrf2), a transcriptional regulator of phase II antioxidant enzymes, has been suggested as an important step in attenuating oxidative stress. A number of natural phytonutrients have been shown to activate Nrf2, including turmeric and green tea. Palm Fruit Bioactives (PFB), a standardized 5-polyphenol blend, has been shown to exhibit anti-hypertensive, anti-atherogenic, anti-diabetic, and chemo-preventive effects in animal models. The purpose of this study was to evaluate the effect of palm fruit bioactives (PFB) on activation of the Nrf2 pathway in cell culture as one potential mechanism of action for PFB's health effects. **METHODS:** AREc32 cells (MCF-7 cell line stably transfected with a vector containing firefly luciferase under the control of the Antioxidant Response Element, ARE) were cultured in RPMI 1640 culture medium with L-glutamine and supplemented with 10% fetal bovine serum and antibiotic/antimycotic. AREc32 cells were seeded at a density of 500 cells/well and exposed to PFB at varying concentrations from 0.125% to 20% for 6-24h. **RESULTS:** PFB increased cell viability at 6h (0.125% and 3.3%) and 24h (2% and 3.3%). At both time points, PFB increased Nrf2-activation expression over untreated controls by a factor of 9-20 fold (0.25% and 7.5% at 6h; 0.125% and 5% at 24h). **CONCLUSIONS:** These data demonstrate potent Nrf2-activation by PFB which may provide a potential mechanism of attenuating oxidative stress and explaining previously observed cardiovascular, metabolic, and cell-protection effects.

3259 Board #164 June 2 2:00 PM - 3:30 PM

Effects Of Seaweed Supplementation On Oxidative Stress And Blood Glucose Regulation After Resistance Training In RatsChun-Tai Chen¹, Chi-Hong Lu¹, Chi Yang¹, Yu-You Wu¹, Ching-Hung Lin², Chien-Wen Hou¹. ¹*University of Taipei, Taipei, Taiwan*. ²*Yuan Ze University, Taoyuan, Taiwan*.

(No relationships reported)

PURPOSE: To investigate the effects of resistance training and supplement seaweed on oxidative stress and blood glucose regulation in rats.

METHODS: The five-week-old SD rats were randomly divided into four groups: C group (control group), S group (seaweed group), E group (exercise group) and ES group (exercise plus seaweed group). The rats in E group and ES group were trained with climbing resistance every two days, S group and ES group were given seaweed immediately after exercise. C group and E group were given placebo at the same time. After 10 weeks training, the ability of blood glucose regulation and oxidative stress of muscle would be test.

RESULTS: HOMA-IR of ES group were significantly higher than C group (C group $2.3 \pm 0.2 < ES$ group 3.8 ± 0.8). TBARS of E group were significantly higher than C group (E group $1.3 \pm 0.2 \text{ umole/g} > C$ group $1.0 \pm 0.05 \text{ umole/g}$), but ES group were significantly lower than E group (ES group $1.0 \pm 0.05 \text{ umole/g} < E$ group $1.3 \pm 0.2 \text{ umole/g}$). SOD of ES group and S group were significantly higher than C group (ES group $0.61 \pm 0.04 \text{ U/mg} > C$ group $0.47 \pm 0.05 \text{ U/mg}$, S group $0.60 \pm 0.04 \text{ U/mg} > C$ group $0.47 \pm 0.05 \text{ U/mg}$). Resistance training was significantly increased for GSH, but supplemental seaweed had no effect. While in the GSSG, supplementation of seaweed was significantly reduced.

CONCLUSIONS: Ten weeks of resistance training and supplementation of seaweed immediately after exercise may reduce oxidative stress, but reduce insulin sensitivity.

3260 Board #165 June 2 2:00 PM - 3:30 PM

Flavanol-Rich Lychee Fruit Extract Prevents Diabetes-Induced Muscle Loss And Palmitate-Induced Myotube LossHung-Wen Liu¹, Sue-Joan Chang². ¹*National Taiwan Normal University, Taipei, Taiwan*. ²*National Cheng Kung University, Tainan, Taiwan*.

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Diabetes-induced muscle loss is associated with stimulated the muscle RING-finger protein 1 (MuRF1), a muscle specific E3 ubiquitin ligase. Elevated lipid metabolites impair myogenesis. Flavanol-rich lychee fruit extract (FRLFE) exhibited anti-diabetic and -obesity properties which would be an alternative approach for maintaining muscle homeostasis. **PURPOSE:** The underlying mechanisms of FRLFE on maintaining muscle homeostasis was studied *in vivo* and *in vitro*. **METHODS:** Dietary (10 wk) FRLFE supplementation (200 mg/kg diet) on the skeletal muscle size and transcription factors such as NF- κ B and Foxo3a involved in regulation of MuRF1 were investigated in diabetic db/db mice (n=10/per group). The roles of FRLFE on cell cycle and senescent phenotype were investigated in palmitate-induced insulin resistance in C2C12 muscle cells. The statistical significance of the differences among the groups ($P < 0.05$) was determined by one-way ANOVA and following post hoc assessment by Student-Newman-Keuls Method. **RESULTS:** The average cross-sectional area was significantly increased by 1.6-fold after administration of FRLFE compared with non-treated db/db mice ($420 \mu\text{m}^2$). Prevention of muscle loss by FRLFE was associated with down regulation of MuRF1 mRNA expression (410% vs. 100%, $p < 0.05$). Decreased NF- κ B expression in the nuclear fraction was observed in FRLFE treated db/db mice compared with untreated mice (260% vs. 60%, $p < 0.05$). At transcriptional level, FRLFE abated ceramide-induced MuRF1 promoter activity (200% vs. 100%, $p < 0.05$). Restoration of SIRT1 expression (30% vs. 150%, $p < 0.05$) prevented Foxo3a nuclear localization in FRLFE treated db/db mice. A strong β -galactosidase staining positive signal was observed in the palmitate-treated myoblasts. For cell cycle analysis, significantly increased proportion of cells in G2-phase by palmitate was observed compared with group without palmitate treatment (28.9% vs. 18.3%). Weak β -galactosidase staining positive signals in accordance with decreased proportion of cells in G2-phase (21.7%) were observed in FRLFE-treated myoblasts. **CONCLUSION:** The efficacy of FRLFE on preserving skeletal muscle mass and myogenic process indicates that FRLFE acts as an effective supplement for diabetes and/or obesity-induced muscle atrophy.

3261 Board #166 June 2 2:00 PM - 3:30 PM

No Adverse Effects of Matcha Green Tea Powder on Metabolic and Physiological Responses during RunningMark E. Willems, Julianne Doherty, Sam D. Blacker. *University of Chichester, Chichester, United Kingdom*.

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(No relationships reported)

Matcha is powder made from green tea leaves that had restricted light exposure to enhance composition. Consumption of the powder in Matcha green tea drinks ensures substantially higher intake of catechins and caffeine than normally brewed green tea. Green tea effects are commonly examined with epigallocatechin gallate (EGCG) or green tea extract with evidence to support enhanced fat oxidation and increased endurance performance. The metabolic and physiologic responses of short-duration intake of Matcha green tea powder during exercise are not known.

PURPOSE: To examine the metabolic and physiological responses of Matcha green tea powder during submaximal treadmill running. **METHODS:** Twelve male recreational runners (mean \pm SD, age: 31 ± 9 years, height: 185 ± 9 cm, body mass: 79 ± 11 kg, maximum oxygen uptake ($\dot{V}O_{2\text{max}}$): $55 \pm 6 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) completed a 40-minute treadmill run at 55% of the running speed at $\dot{V}O_{2\text{max}}$, i.e. running at $10.0 \pm 0.8 \text{ km} \cdot \text{h}^{-1}$. In the Matcha condition, participants were supplemented with 3x3 capsules on the day before and 3 capsules one hour before exercise in a fasted state. Each capsule contains 77 mg total catechins of which 37.5 mg EGCG and 12 mg caffeine. Expired air, heart rate and rating of perceived exertion (RPE) were collected at 10-minute intervals and analysed with two-way repeated measures and Bonferroni *post hoc* testing. Significance was accepted at $p < 0.05$. **RESULTS:** There was no condition effect of Matcha green tea powder at any time point on minute ventilation, oxygen consumption, fat oxidation, carbohydrate oxidation, heart rate and RPE. For example, fat oxidation values and heart rates during 9-10 min, 19-20 min, 29-30 min and 39-40 min were 0.63 ± 0.18 , 0.65 ± 0.24 , 0.71 ± 0.17 , $0.80 \pm 0.24 \text{ g} \cdot \text{min}^{-1}$ and 0.63 ± 0.22 , 0.67 ± 0.26 , 0.67 ± 0.22 , $0.73 \pm 0.24 \text{ g} \cdot \text{min}^{-1}$, and 139 ± 13 , 145 ± 14 , 148 ± 14 , $150 \pm 14 \text{ beats} \cdot \text{min}^{-1}$ and 140 ± 13 , 144 ± 13 , 147 ± 13 , $150 \pm 13 \text{ beats} \cdot \text{min}^{-1}$, for the control and Matcha condition, respectively. **CONCLUSION:** Short-duration intake of Matcha green tea powder had no adverse effects on metabolic and physiological responses during submaximal

intensity running. Future studies should address whether there is an effect of long-duration intake of Matcha green tea on metabolic and physiological responses and exercise performance.

Matcha capsules were provided by OMGTEA Ltd, United Kingdom.

3262 Board #167 June 2 2:00 PM - 3:30 PM
Beyond Ginseng And Echinacea: A Meta-analysis Of Herbal Supplement Use By Athletes

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(No relationships reported)

Herbal supplements are noteworthy components of athletes' nutritional supplement regimens. Recent reviews have characterized use of herbal supplements vaguely, or ginseng and echinacea specifically, but neglected less common supplements such as ginkgo, spirulina, St. John's Wort, and others. **PURPOSE:** To determine the frequency of athletes' use of specific herbal supplements beyond ginseng and echinacea through a meta-analysis of previously published surveys. **METHODS:** Thirty-two studies (published between 1985 and 2016) that reported specific herbal supplement data were identified through a combination of systematic database searching and citations from previous works. Usage rates for specific herbs were tabulated and overall prevalence calculated. When available, demographic information including age, sex, sport, and athlete country-of-origin were also tabulated. **RESULTS:** 11,855 athletes were in the final data set. All-supplement usage averaged 58.7%. Average individual herbal supplement usages were: ginseng (9.6%), echinacea (9.6%), ephedra (3.8%), ginkgo (3.0%), garlic (2.8%), St. John's Wort (0.6%), and spirulina or blue-green algae (0.4%); others ($\leq 0.3\%$) included chamomile, ciwujia, yohimbe, flaxseed, green tea, arnica, evening primrose, guarana, kava kava, tribulus, goldenseal, kola nut, and peppermint. Several additional studies reported that athletes consumed various lesser-known herbal supplements including these and others (such as tea tree oil), but did not provide usage statistics. Multi- or poly-herbal supplements (2.0%) and "other" unspecified herbal supplements (4.9%) usage averages were also reported. Surveyed athletes were predominantly male (61.6%), from North America (40.3%), and college-aged (38.9%); most surveys sampled athletes from multiple sports. **CONCLUSION:** While ginseng and echinacea are (unsurprisingly) the herbal supplements most frequently consumed by athletes, over a dozen other herbal supplements are also consumed and warrant better attention in both athlete nutrition surveys and research. Certain athlete populations are underrepresented in the current literature, including females, those hailing from the southern hemisphere, non-college-aged athletes, and athletes with impairments.

3263 Board #168 June 2 2:00 PM - 3:30 PM
Seaweed Supplement Harmed The Exercise Effect In Ovariectomy Rats

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Purpose

This study aimed to find out the effect on blood glucose regulation after 10 weeks resistance exercise of ovariectomized rats with seaweed supplementation.

Method

12-month-old Sprague Dawley female rats were subjected to bilateral ovariectomy and then were randomly divided into 3 groups: Control (C), Exercise (E), Exercise-Seaweed (ES). Resistance exercise started 2 weeks after the surgery and operated 5 days/week in E and ES group. In ES group, 50 mg/kg of seaweed gavage was given immediately after exercise. In C and E group, rats also receive the same volume of water gavage after exercise. Oral glucose tolerance test (OGTT) and serum insulin level was evaluated after 10 weeks of resistance training

Result

After 10 weeks of resistance training, ES had higher fasting and 60 min blood glucose compared to E. (Fasting glucose: $E 96.9 \pm 3.12 < ES 105.0 \pm 3.32$ mg/dl; 60min glucose: $E 141.4 \pm 6.39 < ES 161.7 \pm 9.51$ mg/dl. $p < 0.05$). E had lower fasting blood insulin level than C and ES. ($E 0.4 \pm 0.1 < C 0.8 \pm 0.2$; $ES 0.9 \pm 0.2$ ug/dl $p < 0.05$)

Conclusion

10 weeks of resistance exercise significantly improve the ability of blood sugar regulation on ovariectomized rats. However, if combined with seaweed supplementation, the benefits of exercise were eliminated.

3264 Board #169 June 2 2:00 PM - 3:30 PM

Capsaicin Induces Metabolic Gene Expression in C2C12 Myotubes

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(No relationships reported)

PURPOSE: Capsaicinoids may possess thermic effects resulting in increased energy expenditure, leading some to consume concentrated capsaicin supplements for weight loss. Capsaicin has been shown to activate select molecular targets contributing to increased metabolism, however the effects of capsaicin on many molecular targets have yet to be determined. This study investigated the effects of capsaicin on metabolic gene expression in cultured skeletal muscle. **METHODS:** C2C12 myotubes were treated with either DMSO control or capsaicin at 0.25 μ M, 0.5 μ M, 1.0 μ M, or 2 μ M for 24 hours. Gene expression of several regulators of mitochondrial biogenesis and oxidative metabolism including peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1 α), nuclear respiratory factor 1 (NRF1), and mitochondrial transcription factor A (TFAM) were measured via qRT-PCR. Mitochondrial content was quantified via fluorescence which was confirmed visually using fluorescent microscopy. Cellular lipid content was determined by oil red o colorimetric staining. **RESULTS:** Gene expression experiments identified capsaicin at 0.5 μ M to be the most optimal concentration for inducing myotube mitochondrial biogenesis. Specifically, capsaicin at 0.5 μ M significantly elevated PGC-1 α (18.6 fold ± 14.5), NRF1 (4.6 fold ± 1.7), and TFAM (5.0 fold ± 2.3) gene expression following 24-hour treatment. Cells treated with capsaicin at 0.5 μ M also exhibited significantly greater mitochondrial staining (7.5% $\pm 4.5\%$). Moreover, capsaicin induced the expression of several related metabolic genes such as Forkhead Box O1 (Foxo1) and Sirtuin 3 (Sirt3). Lastly, despite unaltered peroxisome proliferator-activated receptor gamma (PPAR γ) expression, capsaicin-treated cells exhibited significantly reduced lipid content suggesting lipid oxidation may be enhanced following capsaicin treatment. **CONCLUSION:** Capsaicin appears to stimulate several genes which govern mitochondrial biogenesis and cellular energetics. These findings suggest capsaicin may provide metabolic benefits, however, these data require verification at the protein and functional level.

3265 Board #170 June 2 2:00 PM - 3:30 PM

The Effect Of Chlorella Supplementation On Exercise Performance And Inflammation-related Blood Cells After Dehydration.

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(No relationships reported)

PURPOSE: The purpose of this present study was to investigate the effect of chlorella supplementation on aerobic performance and complete blood count (CBC) after dehydration.

METHODS: Twelve male college students with exercise habit were recruited in this double-blind, crossover designed study. All subjects were divided into control and Chlorella groups. All subjects performed an acute treadmill exercise at 40% VO₂max in 35°C and 70% relative humidity environment until reaching dehydration to 3% body weight. Subjects of Control and Chlorella were given 130 ml of placebo or chlorella drink respectively immediately after dehydration, and then all subjects were rehydrated with sports drink (6% sucrose and 0.04% NaCl), 1.5 times amount of weight loss within 2 hours after dehydration. Blood samples were obtained before, 1h to 4h, 24h, and 48h after dehydration. The maximal aerobic exercise capacity was determined before, 4h, 24h and 48h after dehydration. White blood cells, neutrophils, lymphocytes and blood glucose levels were measured from blood samples.

RESULTS: The results showed that dehydration caused a significant reduction in exercise time and a significant increase in white blood cells and neutrophils numbers. The exercise time of Chlorella group was significantly higher than that of control group 4 hours after dehydration. White blood cells and neutrophils numbers in Chlorella group were significantly lower than that of the control group within 2 to 4 hours after dehydration. However, blood glucose level and the lymphocytes number showed no significant differences between control and Chlorella groups.

CONCLUSIONS: Our results concluded that Chlorella supplementation can improve aerobic exercise capacity and reduce Inflammation after dehydration.

3266 Board #171 June 2 2:00 PM - 3:30 PM

High Intensity Intermittent Training And Chlorella Intake Enhance Muscle Glycolytic And Oxidative Metabolism In Rats.

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(No relationships reported)

Chronic chlorella intake enhances aerobic exercise capacities, i.e. exercise tolerance. High intensity intermittent exercise (HIIE) training enhances aerobic and anaerobic exercise capacities via elevation of muscle glycolytic and oxidative metabolism. However, the additive effects of combination of HIIE training and chlorella intake on exercise performance and muscle glycolytic and oxidative metabolism remain unclear. **PURPOSE:** The purpose of this study was to investigate the effect of chronic chlorella intake alone or in combination with HIIE training on exercise performance and muscle glycolytic and oxidative metabolism in rats. **METHODS:** Male 12-week-old Sprague-Dawley rats were randomly assigned to the four groups; sedentary control, chlorella intake (0.5% chlorella powder in normal feed), HIIE training, and combination of HIIE training and chlorella intake for 6 weeks (n = 10 each group). HIIE training comprised 14 repeats of a 20-s swimming session with a 10-s pause between sessions, while bearing a weight equivalent to 16% of body weight, 4 days/week. Exercise performance was tested after the interventions by measuring the maximal number of HIIE sessions that could be completed. **RESULTS:** Chlorella intake and HIIE training significantly increased the maximal number of HIIE, and enhanced the expression of monocarboxylate transporter (MCT)1, MCT4, and peroxisome proliferator activated receptor γ coactivator-1 α concomitantly with the activities of lactate dehydrogenase (LDH), phosphofructokinase, citrate synthase (CS), and cytochrome oxidase (COX) in the red region of the gastrocnemius muscle (p<0.05). Furthermore, the combination further augmented the increased exercise performance and the enhanced expressions and activities (p<0.05). By contrast, in the white region of the gastrocnemius muscle, MCT1 expression and LDH, CS, and COX activities did not change. **CONCLUSIONS:** These results showed that compared to only chlorella intake and only HIIE training, chlorella intake combined with HIIE training has a more pronounced effect on exercise performance and muscle glycolytic and oxidative metabolism, in particular lactate metabolism.

Supported by Grants-in-Aid for Scientific Research (#26282199, M. Iemitsu)

3267 Board #172 June 2 2:00 PM - 3:30 PM

Effects of Energy Drink on Metabolic Parameters and Exercise Performance Following Basketball Game Simulation

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PURPOSE: Intermittent sports are characterized by intermittent bursts of high-intensity exercise and are dependent upon a combination of anaerobic and aerobic energy systems, both of which rely on carbohydrate as an important fuel source. A potential reason for athletes to use energy drinks is due to the conception the energy drinks would promote improvement of performance and this practice has been common among athletes in recent history. This study examined the effects of energy drink on metabolic parameters and exercise performance following basketball game simulation (BGS).

METHODS: Six female college basketball players, aged 21.5 \pm 1.9 yrs, volunteered for this study which was designed by a randomized counterbalanced experimental design with repeated measures under two different trials: energy drink (ED, extrication glucose 20 g from corn, citrus juice 2% from pure Calamansi fruit, branched chain amino acid 600 mg and taurine 600 mg) and placebo (PO, aspartame) with a double-blind experiment. The drink, either ED or PO is provided for the participants right after BGS, and the participants has a 20 min recovery period (POST). The BGS consisted of major basketball movements such as walking, jogging, running, low and high shuffles, dribble, jump, sprint, and pass which are all performed during 20 min. Height, body weight, blood pressure, and heart rate, blood glucose (BG), blood lactate (BL) were measured at a baseline (BASE). Vertical jump, 10 m \times 5 shuttle run and Wingate tests were performed prior to BGS and POST to evaluate muscular power, agility, and anaerobic power, respectively. BG and BL were measured at right after SBC (PRE) and POST. Data were analyzed by two-way ANOVA with repeated measures.

RESULTS: BG decreased significantly in PO (PRE: 106.5 \pm 13.2 mg \cdot dL⁻¹, POST: 91 \pm 5.1 mg \cdot dL⁻¹, p=.018) and BL decreased significantly in the both ED (PRE: 5.5 \pm 1.8 mmol \cdot L⁻¹, POST: 3.1 \pm 1.4 mmol \cdot L⁻¹, p=.0001) and PO (PRE: 5.0 \pm 0.9 mmol \cdot L⁻¹,

POST: 3.5 \pm 0.8 mmol \cdot L⁻¹, p=.000). Vertical jump (BASE: 58.0 \pm 7.3 cm, POST: 55.5 \pm 8.2 cm, p=.012) and anaerobic work (BASE: 12.3 \pm 1.3 KJ, POST: 11.4 \pm 1.5 KJ, p=.035) decreased significantly in PO.

CONCLUSIONS: The results indicate that energy drink may replenish a deficiency of fuel source and promote improvement of muscular and anaerobic power during recovery period.

3268 Board #173 June 2 2:00 PM - 3:30 PM

Seven Days Of Mushroom Blend Supplementation Improve Measures Of Aerobic And Anaerobic Performance

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(No relationships reported)

PURPOSE: The purpose of this study was to determine the effects of one week of mushroom blend supplementation (PeakO2, Compound Solutions, USA) on maximal oxygen uptake, peak power output, time to fatigue, and submaximal aerobic economy in apparently healthy young adults.

METHODS: Forty recreationally active men and women volunteered to participate, were randomized into one of two groups, and completed the testing protocol. At baseline each participant completed a maximal oxygen consumption (VO₂max) test, which included a 5 minute economy state from minutes 3-8 along with a Wingate cycle ergometer test (peak power) at least 24 hrs later. The treatment group (T, n=23, mean \pm standard deviation, Age = 23.5 \pm 5.2 yrs, Height = 172.9 \pm 8.8 cm, Body Mass = 72.4 \pm 12.1 kg) consumed 12.0 g /day of mushroom blend (PeakO2) along with 12.0 g of Gatorade powder for one week. The control group (C, n=17, Age = 22.5 \pm 4.6 yrs, Height = 172.4 \pm 8.4 cm, Body Mass = 72.3 \pm 11.8 kg) consumed placebo (whole wheat flour) and Gatorade powder in identical fashion.

RESULTS: There were no differences between groups in any variables at baseline. Analysis was conducted stratifying each group by VO₂max at baseline, in which the top 50% of each group was compared to the bottom 50% (Treatment top, TT, Treatment bottom, TB, Control top, CT, Control bottom, CB). TB increased VO₂max significantly (1.95 \pm 2.76 ml \cdot kg⁻¹ \cdot min⁻¹, p = 0.02) while TT, CT, and CB did not change significantly. PPO did not change significantly in any group, however; a trend (p = 0.059) for increased PPO in TB by was observed. Submaximal HR was lower (3.5 \pm 18.5 bpm, p=.0167) in TT, but these changes were not different from changes in TB, CT, CB. TTF increased significantly (p < 0.05) in both TT and CT but changes between groups were not significant.

CONCLUSIONS: Seven days of supplementation with 12.0 g/day of PeakO2 may improve aerobic and anaerobic power output in less aerobically fit, healthy individuals. Those higher fit, apparently healthy individuals may see an improvement (e.g. lower HR) in economy during submaximal aerobic exercise.

3269 Board #174 June 2 2:00 PM - 3:30 PM

Increased Time to Fatigue Following Twenty-Eight Days of Mushroom Blend Supplementation

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(No relationships reported)

PURPOSE: There is evidence to suggest a commercially available, Cordyceps militaris-containing mushroom blend supplement (Peak O2, Compound Solutions, USA) improves tolerance to high-intensity exercise. However, the optimal dosing strategy remains unclear. Therefore, the purpose of the present study was to determine the effects of Peak O2 on indices of maximal and submaximal aerobic performance following 28 days of low-dose (1.0 g/day) supplementation in apparently healthy young adults.

METHODS: Twenty-one individuals (Mean \pm standard deviation, Age = 23.0 \pm 3.2 yrs, Height = 169.7 \pm 6.4 cm, Body Mass = 70.3 \pm 12.9 kg) participated in this randomized, blinded, placebo-controlled study. The treatment group (T, n=11) was given 1.0 g/day mushroom blend while the control group (C, n=11) received 1.0 g/day of color-matched wheat flour as placebo for 28 days. A graded maximal cycle ergometer test was used to evaluate maximal oxygen consumption (VO₂max), time to fatigue (TTF), two-minute heart rate recovery following exhaustion (HRR), submaximal oxygen consumption (VO₂) and blood lactate (BL) following 28 days of supplementation.

RESULTS: Dependent measures t-tests were used to evaluate changes within groups. TTF increased by 56.7 \pm 80.4 sec (p = 0.04) in T while there was no change in C (-2.1 \pm 31.3 sec, p = 0.42). VO₂max increased in both groups (M, 1.9 \pm 2.6 ml \cdot kg⁻¹ \cdot min⁻¹, p < 0.05; C, 1.0 \pm 1.6 ml \cdot kg⁻¹ \cdot min⁻¹, p < 0.05). HRR, VO₂ and BL at submaximal workload showed no change in either group from pre to post.

CONCLUSIONS: Twenty-eight days of supplementation with a mushroom blend (1.0 g/day) may increase TTF in young, recreationally active adults.

3270 Board #175 June 2 2:00 PM - 3:30 PM
The Effect Of Blackcurrant Polyphenols On Recovery And Performance In Elite Endurance Athletes In Preparation For The World Championships

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(No relationships reported)

Strategies that enable athletes to tolerate a higher training load may be advantageous for athlete health and performance.

PURPOSE: To examine the effects of New Zealand blackcurrants polyphenols (NZBK) on recovery and physical performance in elite athletes during a period of intensified training.

METHODS: Nine male modern pentathletes were tested at baseline (T1), after 7 days of receiving a placebo (P; T2) and after 7 days of receiving a blackcurrant supplement (NZBK; T3). Training volume was 30% higher during the second week. The test battery included a counter movement jump (CMJ) a running test (4 x 800 m), a mood state questionnaire (Recovery-Cue), and an extensive panel of blood tests including haematology and biochemistry. CMJ, lactate, a biomarker of oxidative damage (FORT) and anti-oxidant defense (FORD) were measured at rest and immediately before and after the 4 x 800 m run. A general linear model, with Tukey's post-hoc test for pairwise comparisons was used to determine differences between conditions, with Cohen's effect sizes (*d*) to calculate the magnitude of the standardised difference in means where significant; reported as 0.2 (small), 0.5 (moderate), 0.8 (large), and 1.3 (very large). Data are presented as mean ± SD. **RESULTS:** No effects were seen for P or NZBK on hormonal, haematological biochemistry markers, mood state, or running performance (*p*>0.05). NZBK reduced inflammation in comparison to P (HS-CRP 0.8±0.3 mg·L⁻¹ at T3 vs. 1.3±0.4 mg·L⁻¹ at T2, *p*=0.024, *d*=1.41), despite the increased training volume. There was a trend and effect for NZBK on reducing FORT (1.7±0.31 mmol·L⁻¹ at T1 vs. 1.62±0.31 mmol·L⁻¹ at T2 vs. 1.50±0.25 mmol·L⁻¹ at T3; *p*=0.063) and FORD (1.53±0.1 mmol·L⁻¹ at T1 vs. 1.54±0.16 mmol·L⁻¹ at T2 vs. 1.34±0.18 mmol·L⁻¹ at T3; *p*=0.015, *d*=1.17). Of interest, oxidative damage (FORT) correlated with testosterone, cortisol, CMJ and mood state (*p*<0.05).

CONCLUSIONS: NZBK reduces inflammation and oxidative stress in the presence of an increased training volume, with no effects on performance. Furthermore, the monitoring of oxidative damage in endurance athletes may be effective for tracking fatigue and well-being given the relationship with measures of recovery (e.g. hormones, CMJ and mood state).

3271 Board #176 June 2 2:00 PM - 3:30 PM
The Effects Of Cissus Quadrangularis On Body Composition And Blood Lipids

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(No relationships reported)

PURPOSE: The purpose of this study was to determine the effects of 6 wks of supplementation with *Cissus Quadrangularis* (CQ) on body composition and blood lipids in healthy college aged adults. **METHODS:** A total of 27 healthy college aged adults (13 males, 14 females, 21.0±0.6 y; mean±SD) completed this study. All testing was done first thing in the morning following an overnight fast. Baseline body composition was assessed by whole body densitometry using air displacement plethysmography, and blood lipids and glucose were assessed using whole blood obtained via finger puncture. Following baseline testing, subjects were randomly assigned in a double blind manner into one of two groups: 3.2 g/d of CQ; or 3.2 g/d of a maltodextrin placebo (PL). Subjects consumed half of the daily dose in the morning and half in the evening on an empty stomach. All testing was repeated following 6 wks of treatment. Pre to post differences were analyzed using a treatment by time repeated measures ANOVA. **RESULTS:** Compared to the PL group, there was a significant increase in fat free mass following treatment with CQ (CQ= 0.3±1.2 kg, PL= -0.6±0.9 kg, *p*=0.03), a significant decrease in fat mass (CQ= -0.7±1.2 kg, PL= 0.8±1.4 kg, *p*=0.005), a significant decrease in body fat percentage (CQ= -0.7±1.4 % body fat, PL= 1.1±1.8 % body fat, *p*=0.006), and a significant increase in HDL (CQ= 0.01±0.18 mmol/L, PL= -0.20±0.2 mmol/L, *p*=0.009). No significant differences were observed for body mass (CQ= -0.4±1.2 kg, PL= 0.0±1.5 kg, *p*=0.41), total cholesterol (CQ= -0.11±0.42 mmol/L, PL= -0.23±0.29 mmol/L, *p*=0.39), LDL (CQ= -0.12±0.39 mmol/L, PL= -0.08±0.35 mmol/L, *p*=0.93), glucose (CQ= -0.06±0.46 mmol/L, PL= 0.14±0.45 mmol/L, *p*=0.28) or triglycerides (CQ= -0.09±0.61 mmol/L, PL= 0.22±0.30 mmol/L, *p*=0.10). **CONCLUSION:** 6wk of supplementation with CQ prevented

the drop in HDL that was seen in the PL group, with no other changes observed for blood lipids or glucose. CQ significantly increased lean mass and decreased fat mass, resulting in a significant decrease in body fat percentage.

3272 Board #177 June 2 2:00 PM - 3:30 PM
Effects of Tart Cherry Concentrate Upon Muscle Oxygenation During Cycling Exercise

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(No relationships reported)

Previous studies examining the effects of short-term tart cherry (TC) ingestion are primarily limited to inflammatory markers and markers of oxidative stress. Short-term ingestion of nitrate-rich supplements have shown improvements in exercise performance. **PURPOSE:** The primary aim of the study was to determine if short-term TC concentrate ingestion would enhance exercise performance via increased serum nitrate levels, and subsequent increased muscle oxygenation (SmO₂). **METHODS:** Healthy college-age males were randomly assigned to a TC supplement treatment (*n*=18) or a placebo treatment (PL) (*n*=12). Peak VO₂ and baseline measures were obtained. 48 hours later, participants returned to the lab following an overnight fast. The TC or PL supplement was provided and blood was drawn from the cubital vein 30 minutes, 1 hour, and 2 hours after supplement consumption. Subsequently, participants were given additional supplements to consume over the next 6 days. Following supplementation, participants cycled at a power output achieved at 60% of VO₂ peak for a maximum of 60 minutes or until exhaustion. Near-Infrared Spectroscopy sensors were placed on the vastus lateralis of each leg. Serum was analyzed for total nitrate levels via colorimetric assay. All samples were analyzed in duplicate. Results are presented as mean ± SEM. **RESULTS:** A repeated measures ANOVA revealed blood nitrate (µM/L) levels at 30 minutes (TC = 13.01 ± 1.80, PL = 10.78 ± 0.53) 1 hour (TC = 11.70 ± 0.66, PL = 11.00 ± 0.64) and 2 hours (TC = 9.25 ± 1.79, PL = 10.07 ± 0.77) were not significant for treatment, (*F* = 0.14, *p* = 0.71) time, (*F* = 1.89, *p* = 0.18) or treatment by time interaction (*F* = 0.75, *p* = 0.49). One way ANOVA revealed SmO₂ in the left leg (TC = 0.69 ± 0.05, PL = 0.82 ± 0.06; *F* = 2.68, *p* = 0.12) and right leg (TC = 0.65 ± 0.04, PL = 0.78 ± 0.11; *F* = 1.94, *p* = 0.18) were not significantly different between groups. An independent *t*-test revealed no significant differences for time (min) to exhaustion between groups (TC = 39.11 ± 5.66, PL = 42.94 ± 6.06; *t* = 0.46, *p* = 0.65). **CONCLUSIONS:** TC concentrate ingestion does not acutely increase blood nitrate levels. Furthermore, short-term TC ingestion does not increase muscle oxygenation during cycling exercise nor does it improve exercise performance, likely due to an absence of change in blood nitrate levels.

3273 Board #178 June 2 2:00 PM - 3:30 PM
Effects Of Aquarobic Exercise And Burdock Extract On Blood Lipids And Vascular Compliance In Elderly Women

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(No relationships reported)

The elderly's health issues are often complex and tend to lead to chronic diseases; such issues can be due to a fitness decline resulting from a lack of physical activities. **PURPOSE:** The present study aims to determine the effects of aquarobic exercise and burdock intake on blood lipid profiles and vascular compliance in elderly women, by implementing the 16-week program. **METHODS:** Thirty eight healthy elderly female volunteer subjects aged 75.27 ± 4.32 years comprised the control group (*n*=8), aquarobic exercise group (*n*=10), aquarobic exercise and burdock intake combination group (*n*=10), and burdock intake group (*n*=10). This intervention trial was designed to compare pre-and post-exercise intervention variables. Changes from baseline to the end of the intervention were determined by a paired *t*-test and one-way analysis of variance (ANOVA). The variables of body composition, serum blood lipids, and vascular elasticity were measured in all participants before and after the 16-week study. **RESULTS:** TC(176.45 ± 20.61 vs. 189.18 ± 24.28 mg/dl), TG(112.45 ± 38.73 vs. 127.27 ± 48.19 mg/dl), LDL-C(145.83 ± 30.03 vs. 152.32 ± 30.04 mg/dl), glucose(94.00 ± 16.25 vs. 93.18 ± 12.18 mg/dl), and insulin(7.77 ± 3.77 vs. 7.03 ± 5.09 uU/mL) decreased significantly in the aquarobic exercise group and aquarobic exercise and burdock intake combination group(*p*< 0.05). However, no statistically significant changes were found within or between groups in high-density lipoprotein cholesterol and HOMA-IR. No statistically significant changes were found within or between groups in pulse wave velocity before and after participation in the 16-week aquarobics exercise program and /or burdock intake program. **CONCLUSIONS:** The findings of the present study discussed so far suggest that aquarobic exercise and burdock extract

intake had positive effects on risk factors of cardiovascular diseases in elderly women. It is likely that aquarobic exercise prevents and improves cardiovascular disease, and that burdock acts as a supplement against cardiovascular diseases.

3274 Board #179 June 2 2:00 PM - 3:30 PM
No Effect of Acute Beetroot Juice Supplementation on Moderate and Vigorous Intensity Aerobic Exercise

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Nitric oxide (NO) plays a critical role in regulating blood flow to skeletal muscle. NO production in humans is 1) oxygen-dependent via NO-synthases that convert L-arginine to NO and 2) oxygen-independent via the nitrate-nitrite-NO pathway. The latter pathway is largely dependent on the intake of nitrate-rich foods, such as beetroot and beetroot juice supplements (BR). Consumption of BR has been shown to lower resting blood pressure and the volume of oxygen (VO₂) required to perform submaximal aerobic exercise. **Purpose:** The purpose of the present study was to investigate the acute effect of a low dose of BR compared to placebo (PL) during moderate and vigorous intensity aerobic exercise. **Methods:** Ten female division-3 collegiate club-level volleyball players (mean ± SD: age = 19.3 ± 1.3 yr, VO_{2peak} = 37.4 ± 3.3 ml·kg⁻¹·min⁻¹) completed three exercise trials consisting of an initial graded test to exhaustion and two performance trials on a motorized treadmill. For the performance trials, participants consumed either 60 mL of BR or PL, three hours prior to five minutes of walking/jogging at 45%, 65%, and 85% of volume of oxygen uptake reserve (VO_{2R}). **Results:** Separate two-way repeated measures ANOVAs were run to determine the effect of treatment (BR or PL) and exercise intensity (45%, 65%, and 85% VO_{2R}) on VO₂, heart rate (HR), and rating of perceived exertion (RPE). Paired samples t-tests were run to compare differences between resting systolic (SBP) and diastolic blood pressure (DBP) between treatments. All data are reported mean ± standard deviation with statistical significance accepted at p < 0.05. There were no statistically significant interactions between treatment and exercise intensity for VO₂, HR, or RPE. The main effect of treatment was not statistically significantly different for VO₂ (BR: 19.9 ± 6.6 vs. PL: 20.4 ± 6.5 ml·kg⁻¹·min⁻¹; p = .360), HR (BR: 131.3 ± 25.8 vs. PL: 135.4 ± 25.3 beats·min⁻¹; p = .172), or RPE (BR: 9.8 ± 2.2 vs. PL: 9.9 ± 2.4; p = .504). There were no statistically significant differences in resting SBP (BR: 110.6 ± 6.8 vs. PL: 112.7 ± 8.0; p = .166) or DBP (BR: 70.8 ± 5.5 vs. PL: 73.3 ± 6.6; p = .275) between treatments. **Conclusions:** These results suggest that a low dose of BR taken three hours prior to moderate and vigorous intensity aerobic exercise has no effect on VO₂, HR, RPE, or resting SBP and DBP.

3275 Board #180 June 2 2:00 PM - 3:30 PM
Effects Of Spice-TRP Channel Activator Drink on Performance During Intermittent High-Intensity Exercise

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PURPOSE: Transient Receptor Potential (TRP) channel activation in the mouth, esophagus and stomach after ingestion of spicy food extracts can have direct effects on central nervous system (CNS) function that have been linked to increased maximal power output and decreased muscle cramps. However, no studies have evaluated the effects of consuming TRP agonists on exercise performance. **METHODS:** This "proof of concept" study was designed to test the effects of a spice-TRP channel activator drink (1.7 fl oz with organic spice extracts, known TRPV1 and TRPA1 agonists; STA) on intermittent high-intensity cycling (IHI) using a randomized, double-blinded, placebo-controlled (PLA), crossover design in 20 healthy, active, college-aged men (n=10) and women (n=10). Subjects performed 2 trials (STA and PLA), each trial consisting of a 30-s maximal sprint (MS), 10-min rest, 45-min IHI (60% VO_{2max} ride with 1-min 100% VO_{2max} sprints every 5 min), 15-min rest, and a 10-min time trial (TT). Drinks were given before MS and TT. Performance measures included power output during MS (5-s intervals, mean, total), and distance covered during TT. Leg muscle pain (pain), heart rate, mean arterial pressure, core body temperature, profile of mood state (mood), plasma glucose, IL-6, and IL-10 were also measured at multiple times during exercise and rest. Data were analyzed via paired t-tests and 2-way repeated-measures ANOVA. **RESULTS:** No significant differences (p<0.05) were found between STA and PLA for any of the variables. However, there was a consistent trend toward benefits of STA, including increased muscular power output (5s intervals, mean, total, p=0.09), increased TT distance (13 of 19 subjects, p=0.20), reduced pain (p=0.17), and enhanced mood (p=0.20); all except TT produced moderate-to-large

effect sizes (Cohen's d and partial Eta²). Meanwhile, no treatment differences were observed for cardiovascular, metabolic, and inflammatory measures. **CONCLUSION:** Results of this "proof of concept" study support further research on the CNS benefits of consuming natural spice-derived TRPV1 and TRPA1 agonists as a novel intervention to improve performance during intermittent high-intensity exercise, with no apparent adverse side effects. Supported by Flex Pharma, Inc.

3276 Board #181 June 2 2:00 PM - 3:30 PM
Effect Of A Nutraceutical Product On Energy, Fatigue, And Perceived Exertion In Healthy Active Adults

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PURPOSE: Evaluate the effectiveness of a commercially available nutraceutical product on levels of exercise-related energy, fatigue, and exertion before and after 4 weeks of supplementation. Primary ingredients within the product include a proprietary blend of blueberry extract, green tea extract, L-carnosine, and Vitamin D3 (NT-020) and rhodiola rosea, a plant that purports to boost energy. **METHODS:** Twenty-seven participants (12 female, 15male, mean BMI = 23) completed baseline assessment of aerobic fitness (mean VO₂ peak = 40 mL x kg⁻¹ x min⁻¹) before being randomized into a placebo or supplement condition for four weeks. All participants were involved in regular physical activity three or more days per week. Assessment of energy, fatigue, and perceived exertion responses during and after moderately intense cycle ergometry exercise was conducted before and after the 4-week ingestion period during which participants were instructed to maintain existing exercise activities. **RESULTS:** Data were analyzed by way of repeated measures ANOVA and dependent t-tests to determine the presence of significant differences across time and between the supplement and placebo conditions. Participants receiving the supplement reported: greater levels of energy and lower levels of fatigue during the initial moments after completing the exercise trial (p < 0.05), greater levels of energy at the midpoint of the exercise trial (p < 0.05) but not at the end of the exercise session (p > 0.05), and lower perceived exertion at four of the six measurement points during exercise (p < 0.05). No differences were observed from pre to post intervention within the placebo condition (p > 0.05). **CONCLUSIONS:** Findings indicate that a commercially available supplement marketed to boost energy and reduce fatigue can deliver the purported benefits at least in part. Related findings that supplementation for a 4-week period can allow for equal work at a lower rating of perceived exertion provides further, though limited support that this product may have efficacy.

3277 Board #182 June 2 2:00 PM - 3:30 PM
Betalain-Rich Concentrate Supplementation Improves Exercise Performance and Recovery in Competitive Triathletes

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INTRODUCTION: Beetroot juice has been shown to have ergogenic effects on endurance exercise due to its high nitrate concentration, which increases mitochondrial coupling and blood flow. Another possible reason for the ergogenic effects of beetroot could be the abundance of betalains, which have been shown to have anti-oxidant and anti-inflammatory properties at rest, and could therefore be responsible for part of the ergogenic effects of beetroot during exercise.

PURPOSE: We aimed to determine the effects of a betalain-rich concentrate (BRC) of beetroots, containing no sugars or nitrates, on exercise performance and recovery. **METHODS:** Twenty-two (9 men and 13 women) triathletes (38 ± 11 yrs) completed two double-blind, cross-over, randomized trials (BRC and placebo) starting 7 days apart. Each trial was preceded by 6 days of supplementation with 100 mg·d⁻¹ of BRC or placebo. On the 7th day of supplementation, exercise trials commenced 120 min after ingestion of 50mg BRC or placebo and consisted of 40 min of cycling (75±5 % VO_{2max}) followed by a 10-km running time trial (TT). Subjects returned 24 h later to complete a 5-km running TT to assess recovery. **RESULTS:** 10-km TT duration (49.5±8.9 versus 50.8±10.3 min, p=0.03) was faster with the BRC treatment. Despite running faster, average heart rate and ratings of perceived exertion were not different between treatments. 5-km TT duration (23.2±4.4 versus 23.9±4.7 min, p=0.003), 24 h after the 10-km TT, was faster in 17 of the 22 subjects with the BRC treatment. Creatine kinase, a muscle damage marker, increased less (40.5±22.5 versus 49.7±21.5 U·L⁻¹, p=0.02) from baseline to after the 10-km TT and subjective fatigue increased less (-0.05±6.1 versus 3.23±6.1, p=0.05) from baseline to 24 h after the 10-km TT with BRC. **CONCLUSION:** BRC supplementation improved 10-km TT performance in

competitive male and female triathletes. Improved 5-km TT performances 24 h after the 10-km TT and the attenuated increase of CK and fatigue, suggest an increase in recovery while taking BRC.
Supported by a grant from VDF FutureCeuticals, Incorporated.

3278 Board #183 June 2 2:00 PM - 3:30 PM

Effects of Korean Wild Ginseng Drink on Recovery from Acute Strenuous Exercise

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(No relationships reported)

Korean Wild Ginseng (KWG) has been known to have efficacy not only in physical stamina but also in anti-oxidative and anti-inflammatory properties. However, its effect on performance recovery by acute strenuous exercise is not well known.
PURPOSE: To investigate the effects of KWG Drink on performance recovery from acute strenuous exercise (ASE). **METHODS:** This study was conducted in double-blind, counterbalanced, placebo-controlled design with 14 days washout periods. Ten healthy male volunteers (27.1 ± 4.33 years old) were randomly assigned to one of two parallel trials. KWG (2g of KWG; 16.8 mg of ginsenosides/package) or placebo supplementation were consumed right after ASE and following 4 days (2 packs/day). The ASE program consisted of downhill running and jumping exercise. Subjects performed downhill running (-10 %) for 20 minutes at 60 % of VO₂ max. After downhill running, subjects performed jumping exercise that consisted of five sets of 20 maximal drop jumps from height of 60 cm with a 10 seconds interval between jumps and 2 minutes rest between each set. Peak and mean power, isometric muscle strength, electromyography activity, cognitive function, cortisol, interleukin-6 (IL-6), myoglobin, total antioxidant capacity (TAC), and muscle soreness were assessed at each time points: baseline, 2, 48, and 96 hours after ASE. A series of 2 x 4 repeated measures ANOVA, and MANOVA were used to determine differences according to the supplementation. **RESULTS:** There were no statistical differences in performance (F= 0.368, p= .970), cognitive function (F= 0.366, p= .983), blood variables (cortisol: F= 0.598, p= .584; IL-6: F= 1.662, p= .206, myoglobin: F= 0.574, p= .544, TAC: F= 1.508, p= .241), and muscle soreness (F= 0.760, p= .462) according to the supplementation. **CONCLUSION:** Supplementation of KWG extract has no efficacy for performance recovery from acute strenuous exercise in healthy male subjects. Dosage and short duration of KWG application may produce non-significance results. Further studies are needed to investigate the different dosage and duration of KWG supplementation on performance recovery.

3279 Board #184 June 2 2:00 PM - 3:30 PM

Effects of Ursolic Acid Supplementation on Early Strength Gains and Body Composition

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(No relationships reported)

PURPOSE: Ursolic Acid (UA) is a compound commonly found in apple peels and other fruit skins. Previous studies in animal models have shown that UA may inhibit skeletal muscle atrophy, as well as increase the size and strength of skeletal muscle. In humans, one study lasting eight weeks showed significant effects of combined UA supplementation and resistance training on increased muscle strength and decreased body fat percentage, but the mechanisms are unclear. Another study found acute effects of UA supplementation during exercise included stimulating the pathway for muscle hypertrophy in resistance-trained men. Our study was designed to investigate whether any potential effects of UA supplementation on muscle strength gain occur during the early phase of neuromuscular adaptations to resistance training. We hypothesized that oral consumption of 150 mg of Ursolic Acid (UA) three times a day in combination with resistance training would lead to increased muscle strength gain but no effect on body composition over four weeks compared to equivalent training with Placebo. **METHODS:** Twelve untrained adults (six in each group of Placebo or UA) were recruited to participate in our four-week training study. Subjects ingested either a Placebo or 150 mg of UA 3 times a day with every meal, for a total of 450 mg per day for four weeks. A 1 Repetition Maximum (1RM) bench press test was used to assess muscular strength pre and post resistance training. Resistance training consisted of two supervised sessions per week of three sets of 10 repetitions of flat bench press, incline bench press, and flat dumbbell flies at 60-80% of 1RM. Pre and post resistance training body fat percentage was measured via hydrostatic weighing. **RESULTS:** After four weeks of resistance training, subjects experienced a significant increase in muscular strength as measured by a 1RM bench press test and no change in body fat percentage. There were no significant differences in muscle strength gain between the Placebo and UA supplementation groups. **CONCLUSION:** We conclude that any potential ergogenic effects of UA supplementation are unlikely to involve neuromuscular adaptations in the early strength gains of a resistance training program.

3280 Board #185 June 2 2:00 PM - 3:30 PM

Effects of Peppermint Oil Supplementation on the Ventilatory Threshold in Young Women

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(No relationships reported)

PURPOSE: Peppermint oil (*mentha piperita*) has been shown to have cooling effects in animals and humans, as well as beneficial influences on pulmonary function tests possibly due to bronchodilatory mechanisms. In a previous study in our lab, we found that a single supplementation of one milliliter of peppermint oil mixed in one cup of water significantly raised the ventilatory threshold measured as %VO_{2max} with no effect on VO_{2max}, in endurance-trained and moderately active men. In this current study, we replicated the methods in recreationally active women and hypothesized that peppermint oil supplementation would increase ventilatory threshold, but not VO_{2max}, in the female population. **METHODS:** Ten female participants (age 20.4 ± 0.6 yr) performed two maximal oxygen consumption (VO_{2max}) tests on a cycle ergometer under randomized, single-blind trials of peppermint oil and placebo. For each exercise test, ventilatory threshold was determined by detecting the onset of hyperventilation in the ventilation vs. time curve. **RESULTS:** In the recreationally active female population, peppermint oil supplementation had no effect on the ventilatory threshold measured as a percentage of VO_{2max} compared to placebo (peppermint 61.5 ± 4.1 % of VO_{2max} vs. placebo 63.5 ± 2.5 % of VO_{2max}). Additionally, VO_{2max} values were not different between the two conditions (peppermint 36.6 ± 2.1 ml/kg/min vs. placebo 35.8 ± 1.8 ml/kg/min). **CONCLUSION:** Our findings suggest that peppermint oil supplementation may not play a significant role in the ventilatory threshold of recreationally active women, despite a significant effect having been observed in age-matched men. The ventilatory threshold phenomenon is complex, and sex differences may explain the inconsistent responses between men and women in peppermint oil supplementation during incremental exercise.

3281 Board #186 June 2 2:00 PM - 3:30 PM

Heteropterys Tomentosa A. Juss. Extract Improved The Physical Performance And Presented A Powerful Antimutagenic Effect

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PURPOSE: Studies which evaluated the *Heteropterys Tomentosa A. Juss* extract (EHHt)-induced mutagenesis and its effects on swim performance in the animal models are non-existent. Thus, we verified, for the first time, the mutagenic potential (*in vitro*) as well as the acute ergogenic activity of the EHHt (in rats). **METHODS:** Step one: CHO-k1 cells were used for *in vitro* micronucleus (MN) assay; these cells were treated with vehicle, 10, 30, and 100 mg/kg of EHHt; DOXO at 0.03M was used as positive control. Step two: Twenty-four male Wistar rats (90 days old; weight 180 to 220 grams) were divided into vehicle, EHHt 25mg/kg, EHHt 100 mg/kg, EHHt 400 mg/kg and subjected to swimming progressive load test (overload equivalent to 3% of body weight plus 0.5%, every 5 min, until exhaustion); caffeine at 5mg/kg was used as positive control. **RESULTS:** Step one: The MN frequency was extremely lower (P=0.01) at 10 (5.33 ± 0.57), 30 (10.66 ± 4.04), and 100 (19.0 ± 1.41) mg/kg of EHHt if compared to vehicle (24.75 ± 5.18) and DOXO (90.7 ± 3.1), being vehicle < DOXO. Step two: The rats administered with EHHt 25mg/kg presented higher values of time-to-exhaustion [TTE; min] (67.64 ± 7.23; P=0.011) and exercise overload [EO; %] (9.6 ± 0.96; P = 0.019) if compared to vehicle (TTE: 46.28 ± 6.30; EO: 7.3 ± 0.75), EHHt 100 mg/kg (TTE: 51.49 ± 7.8; EO: 7.9 ± 0.96), EHHt 400 mg/kg (TTE: 53.86 ± 7.91; EO: 8.1 ± 0.74), and caffeine (TTE: 59.17 ± 9.43; EO: 8.6 ± 0.89). **CONCLUSIONS:** EHHt acutely improved the performance of the animals subjected to swimming exercise until exhaustion at 25 mg/kg dose and, importantly, showed a strong antimutagenic effect at all doses administered. Further studies are needed in order to better understand the bioavailability of EHHt and which substance(s), in isolation, is(are) the main inductor(s) of these two interesting outcomes and the possible correlation between them.

3282 Board #187 June 2 2:00 PM - 3:30 PM
The Effects Of Long-term Vs. Single Dose Nitrate Supplementation On Skeletal Muscle Oxygenation During A Simulated Cycling Time Trial
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A transient augmentation in the energy efficiency of working skeletal muscle is the purported basis for dietary nitrate (NO₃⁻) supplementation amongst competitive and recreational athletes alike. Previous studies support the ergogenic benefits of NO₃⁻ as results indicated improved microvascular blood flow, skeletal muscle oxygenation, and exercise performance with relatively short-term supplementation. As with most ergogenic aids, the optimum duration of supplementation prior to performance or competition, i.e. loading phase, is a critical determinant for efficacy. **Purpose:** Therefore, the purpose of this study was to investigate the effects of long-term vs. single dosing NO₃⁻ supplementation on skeletal muscle oxygenation and cycling performance. **Methods:** In a randomized, placebo controlled, double blind, parallel design study, healthy, recreationally active male (n=15) and female (n=14) subjects (age= 18-29 yrs.) completed a 5-mi simulated cycling time trial before and after a 14-day supplementation period with either a NO₃⁻ supplement (pre-nitrate loading; PRE) (n=14) or placebo (single nitrate dosing; SGL) (n=15). Both groups consumed a single dose of the NO₃⁻ supplement 2 hours prior to the post-treatment time trial. In addition, skeletal muscle oxygenation was measured via near-infrared spectroscopy during each time trial. **Results:** Fourteen days of NO₃⁻ supplementation (i.e. PRE) significantly decreased time to completion (TTC) (p=0.01) and increased average power (PWR_{AVG}) (p=0.04) and speed (SPEED_{AVG}) (p=0.02) from pre- to post-treatment while a single dosing (i.e. SGL) produced no significant changes to these measures. There were no significant differences over time and across treatments for any other measures including muscle oxygenation variables. **Conclusion:** Overall, long-term NO₃⁻ supplementation appears to have slight benefits over a single pre-exercise dosing in terms of cycling performance. However, this ergogenic response cannot be explained by changes to skeletal muscle oxygenation, thus controverting previously purported mechanisms of action.

3283 Board #188 June 2 2:00 PM - 3:30 PM
Effect Of Inorganic Nitrate Supplementation On O2 Uptake Kinetics And Exercise Tolerance: Influence Of Muscle Oxygenation
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 (No relationships reported)

PURPOSE: To test the hypothesis that inorganic nitrate (NO₃⁻) supplementation would improve muscle oxygenation, oxygen uptake (O₂) kinetics and exercise tolerance (T_{lim}) in normoxia and that these improvements would be augmented in hypoxia and attenuated in hyperoxia.
METHODS: In a randomized, cross-over study, ten healthy males completed work-to-work step cycle tests to exhaustion following acute consumption of 210 mL NO₃⁻-rich beetroot juice (BR; 18.6 mmol NO₃⁻) and NO₃⁻-depleted beetroot juice placebo (PL; 0.12 mmol NO₃⁻). These tests were completed in normobaric normoxia (FIO₂: 21%), hypoxia (FIO₂: 15%) and hyperoxia (FIO₂: 40%). Pulmonary O₂ and quadriceps tissue oxygenation index (TOI), derived from multi-channel near-infrared spectroscopy, were measured during all trials.
RESULTS: Plasma [nitrite] was higher in all BR compared to all PL trials (P<0.05). Quadriceps TOI was higher in normoxia compared to hypoxia (P<0.05) and higher in the hyperoxia compared to hypoxia and normoxia (P<0.05). T_{lim} was improved after BR compared to PL ingestion (250 ± 44 vs. 231 ± 41 s), with the magnitude of improvement being negatively correlated with quadriceps TOI at exhaustion (r = -0.78), in the hypoxic trials (P<0.05). T_{lim} tended to be improved with BR in normoxia (BR: 364 ± 98 vs. PL: 344 ± 78 s; P=0.087), but was not improved in hyperoxia (BR: 492 ± 212 vs. PL: 472 ± 196 s; P>0.05). BR ingestion increased peak O₂ in hypoxia (P<0.05), but not normoxia or hyperoxia (P>0.05).
CONCLUSIONS: NO₃⁻ supplementation is more likely to improve T_{lim} and peak O₂ as skeletal muscles become increasingly hypoxic.

3284 Board #189 June 2 2:00 PM - 3:30 PM
Beetroot-Based Gel Improves Forearm Reoxygenation and Strength after Exercise in Elderly with Cardiovascular Risk Factors.
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 (No relationships reported)

ABSTRACT Muscle oxidative capacity and recovery time of muscle oxygenation following maximal exercise decline with the aging. Although dietary nitrate supplementation has been shown to improve muscle oxygenation in health subjects, these effects in elderly has not been addressed. **PURPOSE:** To evaluate the effect of a beetroot-based nutritional gel (BG) on forearm muscle oxygenation, blood volume and handgrip strength in elderly with cardiovascular risk factors. **METHODS:** 12 elderly participated in a randomized, double-blind and crossover study. Maximal voluntary contraction (MVC) was collected for baseline, immediately and 20 min after exercise in both BG (100 g of beetroot-based gel containing approx. 12 mmol nitrate) or PLA (100 g of nitrate-depleted gel nitrate-depleted) were provided. After 150 min of ingestion of each intervention, elderly performed a rhythmic handgrip exercise which consisted of one 1-min sets at 30 % of the MVC of each subject following 1 min of quiet recovery after exercise. Muscle deoxygenation (SmO_{2min}), muscle reoxygenation (SmO_{2max}), muscle deoxygenation time (SmO_{2sDT}), muscle reoxygenation time (SmO_{2sRT}) and blood volume (tHb) were continuously monitored using an NIRS device. **RESULTS:** significant reduction in SmO_{2min} and SmO_{2sDT} was observed during exercise and SmO_{2sRT} during recovery, as it was in the ΔMVC (BG: -18.56±13.8 vs. PLA: -26.18±14.6 N; P<0.05) only 20 min after handgrip exercise. Significant increase in tHb during and after exercise was observed in BG. There was no significant difference in SmO_{2max} between interventions. **CONCLUSION:** Single dose of BG improve microvascular hemodynamic which may accelerate the muscle recovery after short exercise in elderly with cardiovascular risk factors.
 Supported by FAPERJ (E-26/010.002692/2014) and CNPq (442977/2014-0) Grant.

Table 1. Values of near-infrared spectroscopy (NIRS) during exercise and recovery period of exercise.

Variable	PLA	BET
SmO _{2min} (%)	59.2±5.6	55.7±8.2*
SmO _{2max} (%)	71.4 ± 3.8	71.3 ± 3.2
SmO _{2sDT} (s)	24.2 ± 10.8	19.5 ± 9.5*
SmO _{2sRT} (s)	14.2 ± 8.3	8.1 ± 7.7*
ΔtHb _{exercise} (A.U)	24.1 ± 15.8	31.4 ± 16.6*
ΔtHb _{recovery} (A.U)	7.5 ± 4.9	11.2 ± 7.3*

The values are mean ± SD. * (P<0.05) vs. PLA

3285 Board #190 June 2 2:00 PM - 3:30 PM
Muscle Damage and Inflammation Following a Marathon: Influence of Beetroot Juice
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Purpose The present study examined whether consuming an antioxidant-rich beetroot juice (BTJ) would attenuate markers of inflammation and muscle damage following a marathon. **Methods:** Using a double blind, independent groups design, 34 marathon runners (~16 previous marathons completed) consumed either BTJ (~3mmol/L Trolox equivalent antioxidant capacity; polyphenol content: ~405 mg of Gallic Acid Equivalents) or an isocaloric placebo (PLA) for 3 days following a marathon race (3 x 250 ml per day). Maximal isometric voluntary contractions (MIVC), countermovement jumps (CMJ), muscle soreness, serum cytokines, leucocytosis, creatine kinase (CK), high sensitivity C-reactive protein (hs-CRP) and aspartate aminotransferase (AST) were measured pre, post, and on the 2 days after the marathon. **Results:** Muscle function (CMJ and MIVC) was significantly reduced after the marathon (P<0.05) but no group differences were observed at any time point (P>0.05). At 48 h post-marathon, CMJ was similarly depressed in the BTJ and PLA groups (95 ± 6 vs. 95 ± 9 % of baseline values, respectively), with MIVC returning to baseline levels in both groups (100 ± 13 vs. 99 ± 10 %, respectively). Muscle soreness was increased in both groups in the day after the marathon (BTJ; 45 ± 48 vs. PLA; 46 ± 39 mm) and had returned to baseline by day 2, irrespective of supplementation (P>0.05). Cytokines (Interleukin-6; IL-6, interleukin-8, tumour necrosis factor-α) were increased immediately post-marathon but apart from IL-6 (~0.9 fold change in BTJ and ~0.5 in PLA) had returned to

baseline values by day 1 post. No group differences were evident ($P < 0.05$). Leucocytes increased 1.7 fold immediately after the race and remained elevated 2 days' post, irrespective of supplement. CK, AST and hs-CRP were all still elevated 2 days after the marathon ($P < 0.05$), but no group differences were present. **Conclusions:** Beetroot juice supplementation was no more effective than a PLA for attenuating inflammation and functional markers of muscle-damage following a marathon race.

3286 Board #191 June 2 2:00 PM - 3:30 PM
The Impact of Beetroot Extract Ingestion on Lactate Kinetics During Submaximal Exercise

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PURPOSE: Dietary nitrate supplementation in the form of beetroot extract (BRE) has recently emerged as a potential modulator of exercise capacity. To date, the impact of BRE ingestion on lactate kinetics, a key determinant of endurance exercise performance, has not been rigorously assessed.

METHODS: We performed a single-blinded, randomized crossover study in which competitive masters rowers underwent graded stepwise (3 mins, 20W increment) rowing ergometer testing to define lactate handling profiles. Each participant was tested 2.5 hours after ingestion of a commercially available BRE product (Beet-It Sport Shot, Ipswich, UK) and blackcurrant juice placebo (R.W. Knudsen Just Black Currant, Chico, CA). Capillary lactate concentrations were measured at the completion of each testing stage to develop lactate handling curves.

RESULTS: Participants ($n = 12$, 50% men, age = 54 ± 5 years, peak $\dot{V}O_2 = 47 \pm 7$ ml/kg) with 24 ± 12 years of rowing experience completed all aspects of this protocol. Heart rate, oxygen consumption, respiratory exchange ratio, and perceived effort were similar at all exercise intensities during testing following ingestion of BRE and placebo. Similarly, parameters of lactate handling including absolute lactate concentrations at each exercise intensity, workload at onset of blood lactate accumulation, and workload at 4 mmol lactate concentration were similar following ingestion of the active BRE compound and placebo (Figure).

CONCLUSION: Ingestion of a single dose of commercially available BRE does not appear to have a significant impact on lactate handling. Performance during activities that depend on lactate handling may be unresponsive to BRE ingestion.

Figure. Capillary lactate concentrations during stepwise rowing ergometer exercise testing following ingestion of beetroot extract (BRE) and placebo.

3287 Board #192 June 2 2:00 PM - 3:30 PM
Dietary Nitrate Supplementation Improves Sprint and High-Intensity Intermittent Running Performance

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 (No relationships reported)

The influence of dietary nitrate (NO_3^-) supplementation on indices of maximal sprint and intermittent exercise performance is unclear. **Purpose:** To investigate the effects of NO_3^- supplementation on sprint running performance, and cognitive function and exercise performance during the sport-specific Yo-Yo Intermittent Recovery level 1 test (IR1). **Methods:** In a double-blind, randomised, crossover study, 36 male team-sport players received NO_3^- -rich (BR; 70 mL·day⁻¹; 6.4 mmol of NO_3^-), and NO_3^- -depleted (PL; 70 mL·day⁻¹; 0.04 mmol NO_3^-) beetroot juice for 5 days. On day 5 of supplementation, subjects completed a series of maximal 20-m sprints followed by the Yo-Yo IR1. Cognitive tasks were completed prior to, during and immediately following the Yo-Yo IR1. **Results:** BR improved sprint split times relative to PL at 20 m (1.2%; BR 3.98 ± 0.18 vs. PL 4.03 ± 0.19 s; $P < 0.05$), 10 m (1.6%; BR 2.53 ± 0.12 vs. PL 2.57 ± 0.19 s; $P < 0.05$) and 5 m (2.3%; BR 1.73 ± 0.09 vs. PL 1.77 ± 0.09 s; $P < 0.05$). The distance covered in the Yo-Yo IR1 test increased by 3.9% (BR 1422 ± 502 vs. PL 1369 ± 505 m; $P < 0.05$). The reaction time to the cognitive tasks was shorter in BR (615 ± 98 ms) than PL (645 ± 120 ms; $P < 0.05$) at rest but not during the Yo-Yo IR1 (BR: 612 ± 104 vs. PL: 621 ± 92 ms; $P > 0.05$). There was no difference in overall response accuracy (BR: 34.7 ± 1.4 vs. PL: 34.6 ± 1.5 correct responses; $P > 0.05$) and there were no differences in response accuracy at any specific time point. **Conclusion:** Dietary NO_3^- supplementation enhances maximal sprint and high-intensity intermittent running performance in competitive team sport players. Our findings suggest that NO_3^- supplementation has the potential to improve performance in single-sprint or multiple-sprint (team) sports.

This work was funded by PepsiCo Inc. and Lara Nyman is an employee of PepsiCo Inc.

ACSM May 30 – June 3, 2017

3288 Board #193
Abstract Withdrawn

3289 Board #194 June 2 2:00 PM - 3:30 PM
Acute Nitrate Supplementation Improves Ischemic Exercise Tolerance in Post-Menopausal Women

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PURPOSE: Inorganic nitrate supplementation elicits its most consistent ergogenic benefits during conditions of low muscle oxygen availability. In the present study we tested the ability of acute dietary nitrate supplementation to attenuate perceived effort and increase time to volitional fatigue during blood flow-restricted exercise in post-menopausal women. **METHODS:** Eleven post-menopausal women (57 to 64 yr) performed intermittent isometric handgrip squeezes (10% of MVC, 30 per min) during progressive upper arm cuff inflation (+20 mmHg per min) on 3 study visits, with 7 to 10 days between visits. Approximately one week following visit 1, participants randomly consumed 140 ml of nitrate-concentrated (0.8 gm of nitrate; BrJ_{nitrate}) or nitrate-depleted (BrJ_{placebo}) beetroot juice (James White Beet-It Sport; IND#119978), with handgrip exercise beginning two hours post-consumption. Ratings of perceived exertion (Borg RPE) were assessed each minute. Venous blood was collected (before, 90 min post, 180 min post consumption) on both BrJ visits for measurement of plasma nitrate [NO_3^-] and nitrite [NO_2^-]. **RESULTS:** Compared to responses observed during the BrJ_{placebo} consumption visit, BrJ_{nitrate} consumption raised plasma [NO_3^-] (13-fold) and [NO_2^-] (4-fold), delayed the initial rise in RPE (+50 sec), and increased time to volitional fatigue (526 ± 46 vs. 567 ± 50 sec) (all $p < 0.05$).

CONCLUSIONS: These findings provide further support for the ergogenic potential of nitrate supplementation under conditions of restricted muscle blood flow/oxygen availability. Funding: Penn State Hershey Family & Community Medicine (JAFPE Endowment)

3290 Board #195 June 2 2:00 PM - 3:30 PM
Dietary Nitrate Supplementation Reduces The Oxygen Cost Of Submaximal Arm Crank Exercise

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 (No relationships reported)

There is evidence to suggest that the ingestion of > 5 mmol inorganic nitrate (NO_3^-) can enhance exercise economy [lower pulmonary oxygen uptake [$\dot{V}O_2$]] and performance during cycling and running exercise. However, the effect of dietary NO_3^- supplementation on economy and performance during isolated upper-body exercise is less clear. **PURPOSE:** To test the hypothesis that dietary NO_3^- supplementation would improve economy and performance during arm cranking exercise. **METHODS:** Eight recreationally-active males were assigned in a randomized, double-blind, crossover design to receive NO_3^- -rich beetroot juice (BR; 12.2 mmol NO_3^- ·day⁻¹) and NO_3^- -depleted beetroot juice (PL; 0.01 mmol NO_3^- ·day⁻¹) for 7 days. On days 5 and 7 of supplementation, subjects completed two bouts of moderate-intensity exercise and one bout of severe-intensity exercise that was continued until exhaustion on an arm-crank ergometer. Resting venous blood samples were obtained, for later determination of plasma nitrite concentration ([NO_2^-]) and breath-by-breath $\dot{V}O_2$ were measured during all exercise tests.

RESULTS: Plasma [NO_2^-] was higher following BR, compared to PL (PL: 86 ± 51 nM vs. BR: 542 ± 285 nM; $P < 0.05$). BR supplementation lowered steady-state $\dot{V}O_2$ during moderate-intensity exercise by 3% (PL: 0.93 ± 0.24 L·min⁻¹ vs. BR: 0.90 ± 0.23 L·min⁻¹; $P < 0.05$). Exercise economy and time-to-exhaustion (PL: 459 ± 102 vs. BR: 474 ± 135 s; $P > 0.05$) were not impacted by BR supplementation during severe-intensity arm cranking.

CONCLUSIONS: Short-term dietary NO_3^- supplementation improved moderate-intensity exercise economy, but not severe-intensity exercise economy or tolerance, during arm-cranking exercise in recreationally-active subjects.

3291 Board #196 June 2 2:00 PM - 3:30 PM
The Effect of an Acute Dose of Beet Juice on Female College Soccer Performance
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PURPOSE: Beet juice is a potential source of inorganic nitrates in the diet. Inorganic nitrates have been shown to improve exercise performance. Increased levels of nitrates may reduce the ATP cost of force production and may influence mitochondrial efficiency leading to a reduction in the energy cost of exercise. Most studies to date assessed high intensity endurance performance with time trials lasting 15 - 138 min. However, there is a lack of research on the effect of nitrates on intermittent exercise similar to that performed in soccer. The purpose of this project was to examine the effects of acute beet juice supplementation on performance during a simulated soccer match.

METHODS: 8 female college soccer players (VO_{2max} : 52.3 ± 8.5 ml/kg/min; mean \pm SD) each completed two trials in a randomized, double-blind design. Participants ingested one nitrate rich beet juice shot (BR; ~ 6.5 mmol of nitrate per 70 ml) or one nitrate depleted beet juice shot (PL; ~ 0.04 mmol nitrate per 70 ml) 3 h before performing a modified Loughborough Intermittent Shuttle Test (LIST), separated by 7 days. Participants performed a Yo-Yo intermittent shuttle test to estimate maximal aerobic speed used in the modified LIST. The LIST consists of six 15 min periods of walking, running, sprinting and shooting. Each 15 min period is separated by a 3 min break. O_2 consumption and heart rate were measured continuously using a portable metabolic system. Values were averaged over the last 5 min of each 15 min period. Lactate and RPE were collected every 15 min.

RESULTS: There was no significant difference at any time point in any of the measured variables between PL and BR trials. The average VO_2 between the PL and BR trial was 33.8 ± 4.4 vs 34.2 ± 4.1 ml/kg/min. In both trials the VO_2 was significantly higher in the first 15 min compared to all other time points ($p < 0.05$). The average heart rate between the PL and the BR trial was 172 ± 18 vs 175 ± 6 bpm. The average lactate value between the PL and the BR trial was 3.8 ± 2.0 vs 3.2 ± 1.5 mmol. RPE values between the PL and the BR were 15.4 ± 1.2 vs 15.8 ± 1.6 . In both trials the RPE was significantly lower in the first 15 min compared to all other time points ($p < 0.05$).

CONCLUSIONS: Acute ingestion of nitrate rich beet juice did not improve simulated soccer performance.

3292 Board #197 June 2 2:00 PM - 3:30 PM
Far-infrared Emitting Fabric Improves Aerobic Metabolism, Oxidative Stress and Exercise Tolerance, Independent of Nitric Oxide
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Studies have shown that FIR emitted by materials can, without change temperature, enhance cell metabolism and function, increase cellular availability of nitric oxide (NO) and Ca^{2+} , improve blood circulation and an *ex-vivo* study of skeletal muscle has shown the effect of delay fatigue. However, the effectiveness of FIR fabric as ergogenic aid and its related mechanism in humans remains unknown. **PROPOSE:** Analyze the effect of fabric made by polyamide fiber mixed to FIR emitting substances on exercise bioenergetics, oxidative stress, NO and exercise tolerance. **METHODS:** Eighteen active men performed two ergospirometric tests, two familiarizations and two testing days composed by a square-wave cycling exercise at moderate intensity (2 sets of 10 min), followed by very heavy intensity until exhaustion. Tests occurred two weeks apart and after 96 hours of FIR or Placebo fabric usage, in a crossover, double-blind, placebo-controlled design. The exercise oxygen uptake, lactate accumulation and fast VO_2 off-kinetics were used to calculate Aerobic (Ae), Anaerobic Lactic (ANL) and Anaerobic Alactic (AnA) metabolism relative to total energy expenditure values, using the GEDAE-LaB software. High temperature was measured by an infrared thermometer, oxidative stress by gas chromatography-tandem mass spectrometry measurements of F_2 -isoprostanes, NO by chemiluminescence analysis of Nitrite and Nitrate. **RESULTS:** There were no differences for any variable between FIR and Placebo fabrics pre-tests and post-moderate exercise. For the very heavy exercise until exhaustion, exercise time was higher for FIR than Placebo (403 ± 127 s vs.

338 ± 110 s, $p = 0.004$). Relative energy system contributions (%) were as followed: Ae (FIR 66.48 ± 10.91 - Placebo 61.44 ± 15.58 , $p = 0.04$); ANL (FIR 21.41 ± 5.63 - Placebo 23.02 ± 6.53 , $p > 0.05$); AnA (FIR 12.10 ± 9.38 - Placebo 15.53 ± 13.69 , $p > 0.05$). Temperature ($^{\circ}C$) were not different between fabrics (FIR 31.8 ± 1.6 - Placebo 31.9 ± 2.2 , $p > 0.05$). F_2 -isoprostanes (pg/dl) just increase for Placebo (pre 216.75 ± 52.78 - post-VH 291.53 ± 88.95 , $p = 0.005$). **CONCLUSION:** Far-infrared emitting fabric enhances aerobic metabolism, reduced oxidative stress and improves exercise tolerance during very heavy intensity exercise, independent of NO availability.

3293 Board #198 June 2 2:00 PM - 3:30 PM
Beetroot Supplementation Effects On Exercise Performance During Cycling And Oxidative Damage
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 (No relationships reported)

PURPOSE: The aim of this study was to compare the effectiveness of beetroot power in pill supplementation on cycle exercise performance as well as oxidative damage measured by Malondialdehyde (MDA) concentration. **METHODS:** Twenty-four untrained subjects (20.92 ± 3.60 years) performed on a Monark cycle ergometer exercise session for 15 minutes three times a week for four weeks. The Institutional Review Board (IRB) has approved all experimental procedures and subjects have been considered low risk according to the American College of Sports and Medicine. The subjects were split up randomly into two groups, control versus experimental. Twelve subjects (six females and six males) took two pills of beetroot power (500mg) and the other twelve took a placebo. Urine samples were taken on the last day of weeks 2, 3 and 4. During each exercise session times were noted when the subject reached 85% of their heart rate max and then finished out their 15mins at their 85%. Subjects were provided water during each meeting to make sure they were well hydrated. Since water has a various pH level the same bottle of water was provided for all subjects. Urine was stored at $-20^{\circ}C$ until all samples were collected. Urine creatine levels were measured by using a Specimen Validity Test and a MDA Assay kit (Northwest Life Science Specialties, 2014) was used to determine MDA levels in the urine at the time the subject reach 85% of their heart rate max. A single factor ANOVA was performed on all data to see if there was significance. **RESULTS:** No significant difference ($p > 0.05$) was in any of the parameter that were observed (Time to reach 85% of max heart rate, RPE, MDA concentrations). **CONCLUSION:** Beetroot supplementation had no effect on exercise performance nor did it alter oxidative damage measured via MDA Concentrations.

3294 Board #199 June 2 2:00 PM - 3:30 PM
Effects of Fermented Drink Intake on Post-exercise Glycogen Restoration in Rat Skeletal Muscle and Liver
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Recently, we have created a new fermented drink (FD) containing lots of carbohydrates, amino acids, citric acids, and so on. However, physiological activities which the FD has are still unclear.

PURPOSE: This study investigated the effects of post-exercise FD supplementation on glycogen restoration in rat skeletal muscle and liver.

METHODS: Male Wistar rats (10-weeks-old) were randomly divided into two main groups: sedentary control (Con) and exercise. Following 12 h fasting, rats in the exercise group swam for 2.5 h in five 30-min bouts separated by 5 min of rest in order to deplete skeletal muscle and liver glycogen. The rats were orally ingested either water, glucose solution, or FD 0.5, 1, 1.5, and 2 h after the swimming. Immediately and/or 4 h after the exercise, soleus and deep portion of gastrocnemius (GasD) muscles and liver were dissected and analyzed.

RESULTS: Swimming exercise resulted in an approx. 20-60% reduction of glycogen concentration in all collected tissues compared with the value of fasted Con animals. Thereafter, the glycogen level in both skeletal muscles and liver increased significantly above the fasted Con level at 4 h after the swimming exercise only when either glucose or FD ingestion were performed during the recovery period ($p < 0.05$). The degree of this increase was significantly greater in FD-treated than in glucose-treated animals, particularly in the liver ($p < 0.05$). A similar trend was also observed in the GasD, but not in the soleus muscles.

CONCLUSIONS: These results suggest that FD supplementation will be an effective method for enhancing post-exercise glycogen restoration in both skeletal muscle and liver.

F-59 Free Communication/Poster - Ergogenic Aids V

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3295 Board #200 June 2 3:30 PM - 5:00 PM

Prescription Strength Ibuprofen Interferes with Prophylactic Adaptations to Heavy Unaccustomed Resistance Exercise

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(No relationships reported)

Skeletal muscle typically experiences a repeated bout effect (RBE) following a single bout of heavy unaccustomed exercise, characterized by rapid adaptations aimed at protecting against a subsequent insult. Previous research indicates that non-steroidal anti-inflammatory drugs such as ibuprofen (IBU) may interfere with key mechanisms governing early skeletal muscle adaptive responses. **PURPOSE:** This proof-of-concept study was designed to assess the influence of prescription strength IBU on the RBE following heavy exercise.

METHODS: In a double-blinded crossover design, eight males (23 ± 4 yr) completed two separate testing phases separated by a washout period (7 d). Each phase consisted of two sessions of unilateral eccentric resistance exercise (RE; 10 sets, 10 reps, 120% 1 RM), separated by 10 d. During each phase, subjects consumed either a prescription dose (800 mg) of IBU or placebo (PLA) 45 min prior to RE and in 8 h increments for 72 h following RE. Muscle recovery variables [muscle soreness, peak isokinetic torque, total isokinetic work during 30 reps and plasma creatine kinase (CK)] were measured 24 and 72 h following each RE session (Initial RE = RE₁; RE 10 d later = RE₂). Magnitude-based inferences were used to evaluate treatment effects on muscle recovery variables.

RESULTS: Changes in post-exercise muscle soreness 24 h following RE₂ were 'likely' reduced with PLA (RE₁: 43 ± 15 mm to RE₂: 27 ± 14 mm) compared to IBU (RE₁: 39 ± 23 mm to RE₂: 39 ± 15 mm). In addition, reductions in total work output 72 h following RE₂ were 'likely' attenuated with PLA (RE₁: -598 ± 614 J to RE₂: -13 ± 445 J), but not IBU (RE₁: -335 ± 481 J to RE₂: -343 ± 284 J). The impact of IBU on measures of peak muscle torque and CK were 'unclear'.

CONCLUSION: In general, ibuprofen consumption appeared to interfere with the RBE, compared to PLA. These data suggest that prescription-strength dosing of IBU following skeletal muscle trauma may be detrimental to the initial adaptive responses following heavy exercise.

3296 Board #201 June 2 3:30 PM - 5:00 PM

Acute Naproxen Dose On Gastrointestinal Distress And Performance During Moderate-intense Cycling In The Heat

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(No relationships reported)

Non-steroidal anti-inflammatory drugs are often perceived as performance enhancing due to their anti-inflammatory and analgesic effects. However, these drugs are known to cause gastrointestinal (GI) damage and alter cardiovascular function, which could be detrimental to performance. **PURPOSE:** To determine the effects of naproxen on GI distress and performance in hydrated humans cycling in the heat. **METHODS:** A double-blind, randomized and counterbalanced, cross-over design was utilized. Four trials: 1) placebo and ambient (Control [C]; ambient = $22.7 \pm 1.8^\circ\text{C}$, $52.4 \pm 5.5\%$ humidity); 2) placebo and heat (H; heat = $35.7 \pm 1.3^\circ\text{C}$, $53.2 \pm 3.2\%$ humidity); 3) naproxen and ambient (N; 1 - 220 mg naproxen sodium pill every 8 hrs for 24 hrs); and 4) naproxen and heat (NH) were completed. Eleven volunteers (6 male, 5 female; age = 27.8 ± 6.5 yrs, weight = 79.1 ± 17.9 kg, height = 177 ± 9.5 cm, and $\dot{V}O_{2\text{max}} = 41.4 \pm 5.7$ ml/kg) cycled 80 min at a heart rate (HR) corresponding to 70% $\dot{V}O_{2\text{max}}$ before completing a 10 min time trial for maximum distance. Heart rate, rate of perceived exertion (RPE) and GI symptoms were measured throughout cycling. Gastrointestinal symptoms were also assessed pre-, post-, 3 hrs post-, and 24 hrs post-cycling. Fecal occult blood was measured 24 hrs pre- and 24 hrs post-cycling. **RESULTS:** No statistically significant differences were found between conditions. Max HR was higher during N (176.2 ± 15 bpm) than C (175.7 ± 14.2 bpm) and NH (179.0 ± 18.0 bpm) than H (177.8 ± 18.2 bpm). Mean distance covered was greatest during N (3.3 ± 0.8 miles) and lowest in NH (2.8 ± 0.8 mile). During exercise, GI symptoms

occurred in 64% of all trials (C = 82%, N = 73%, H = 45%, and NH = 55%). At 3 hrs post-exercise, C experienced more frequent and serious upper, lower, and systemic GI symptoms than any other condition. Compared to other trials, H experienced higher serious upper (18%) and systemic (5%) GI scores 24 hrs post-exercise. NH resulted in more serious lower GI symptoms (12%) 24 hrs post-exercise. **CONCLUSION:** Although naproxen did not significantly affect performance or GI distress during 90 min of exercise in the heat, a possible negative interaction between naproxen and heat stress may exist, as indicated by higher max HR and lower distance during NH, which warrants further research.

Supported by the ACSM Foundation Carl V. Gisolfi Memorial Fund

3297 Board #202 June 2 3:30 PM - 5:00 PM

Gender, Past Prescription, and Knowledge of Abuse Impact College Students' Feelings on Prescription Pain Killers

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Roughly 12% of college students report non-medical use of prescription opioid pain killers (OPK). The risk of overdose and addiction are great and information needs to be gathered for creation of effective prevention programs. **PURPOSE:** To determine what factors contribute to college students' perceptions related to their own use of OPKs and how perceptions are influenced by a brief education intervention. **METHODS:** 234 college students (21 ± 3 y, 70% female) completed three separate questionnaires. After responding to demographic questions, participants replied to Likert-style statements regarding responsible use of prescription opioids after being asked to imagine themselves in a situation where they had become injured and prescribed OPKs. The questionnaire was completed a second time after hearing an educational intervention regarding the costs, overdose rates, and OPK alternatives. **RESULTS:** Initially, females disagreed more strongly than males regarding the sharing of OPKs ($t = -3.15$, $p = .002$). Compared to never-prescribed, students that had previously been prescribed OPKs disagreed more strongly that they would finish their prescription regardless of pain ($t = 4.44$, $p < .001$). Those that knew at least one person who was addicted to OPKs, compared to those who did not know an OPK addicted person, were more in favor of prescription monitoring programs ($t = -3.19$, $p = .002$). The intervention positively influenced responses to statements regarding taking OPKs without first visiting a doctor, sharing unused OPKs, favorability of OPK monitoring programs, and agreement with doctors describing the risks of OPKs upon prescription (all $p < 0.002$). Participants were more concerned about the risks of OPKs and agreed more strongly that over-prescription of OPKs is a problem following the intervention (both $p < .001$). **CONCLUSIONS:** Gender and past OPK exposure influence initial feelings regarding OPKs. A brief low-cost and low-intensive educational intervention appears to have potential for positively influencing college students' ratings related to responsible OPK usage.

3298 Board #203 June 2 3:30 PM - 5:00 PM

Hydrogen-rich Water Modulates Redox Status Repeated Three Consecutive Days Of Strenuous Exercise.

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(No relationships reported)

PURPOSE: Repeated sprint exercise breaks redox balance, leading to cause oxidative stress. Excessive oxidative stress is considered as detrimental and thus as a likely cause of cell damage associated with severe exercise. In contrast, there is a growing evidence that the molecular hydrogen reacts with harmful oxidants such as hydroxyl radical in cells, and is proposed its potential for preventive and therapeutic applications. Therefore, we hypothesized that hydrogen-dissolved water drinking might attenuate accumulative fatigue imposed by intensive exercise for 3 consecutive days, by inhibiting excessive oxidative stress generation. To test this, we investigated the effects of hydrogen-rich water on oxidative stress induced by maximal pedaling exercises for three straight days.

METHOD: Eight male volunteers participated in this single blind, crossover, randomized controlled study. They completed two 3-day consecutive cycling exercise tests under the two conditions (i.e., hydrogen-rich and placebo water). The cycling exercise test was two 6-min sprint cycling consisted of 3 repetition of 10-s maximal effort against a resistance of 7.5 % body mass and 110-s active rest (no load pedaling). Before the first exercise test, and after the second exercise test, subjects drank the 500 ml of hydrogen-rich (5.14 ± 0.03 ppm) or placebo water. Seven hours before exercise tests on day 1 as a baseline, and 17 hours after exercise each day, blood sample was obtained to analyze the BAP/d-ROMs as an index of oxidative status.

RESULTS: The cycling performance in both conditions were not significantly changed over three consecutive days. In placebo trial, the relative changes in BAP/d-

ROMs from baseline level gradually decreased, as the day passed (Day 1 and Day 2 vs. Day 3, $P < 0.05$, respectively). However, the hydrogen-rich water drinking suppressed the reduction in BAP/d-ROMs.

DISCUSSION: Our present findings suggest that hydrogen-rich water drinking might contribute to maintain the redox status during consecutive days of strenuous exercise. This indicates that molecular hydrogen might have a potential to reduce exercise-induced oxidative damage.

3299 Board #204 June 2 3:30 PM - 5:00 PM

Effect of Astaxanthin Supplementation on Cardiorespiratory Function in Runners

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Reported Relationships: S.M. Talbott: Contracted Research - Including Principle Investigator; study was funded by Beijing Ginko Group (BGG).

PURPOSE: Astaxanthin (AX) is a naturally occurring carotenoid, synthesized primarily by marine microalgae, with powerful antioxidant and anti-inflammatory properties. Rodent studies suggest that AX supplementation improves fat utilization and exercise endurance (Ikeuchi 2003). In athletes, AX supplementation (4mg/day for 4 wks) resulted in significant improvements in power output and cycling performance (Earnest 2011), however, a higher dose of AX (20mg/day for 4 wks) in well-trained cyclists and triathletes, yielded no significant changes in total antioxidant capacity, oxidative damage, rate of fat oxidation, or time trial performance (Res 2013). The purpose of this study was to assess the effects of 8 wks of AX supplementation (12mg/day) on cardiorespiratory function during higher and lower intensity exercise in recreational runners. **METHODS:** Using a double-blind parallel design, 28 recreational runners (male = 14, female = 14, age = 42) were supplemented for 8 wks w/ 12mg/day of AX (*Haematococcus pluvialis* algal extract) or a placebo. Before and after the supplementation period, subjects performed a maximal running test (VO_{2max} on treadmill) and a maximal cycling test (watts on cycle ergometer). **RESULTS:** There was no improvement in maximal oxygen uptake (running VO_{2max}) or maximal power output (cycling watts) with AX supplementation. Interestingly, subjects in the AX group showed a significant ~10% lower average heart rate at submaximal running intensities (aerobic threshold, AeT; AX 130±17 v. PL 145±14; and anaerobic threshold, AT; AX 139±20 v. PL 154±11, $p < 0.05$) compared to placebo. **CONCLUSIONS:** Supplementation with 12mg/day of AX for 8 wks reduced running heart rate at submaximal endurance intensities (AeT & AT), but not at higher "peak" intensities. These results suggest that AX may be a beneficial ergogenic aid for long/ultra-distance endurance athletes, but not necessarily for athletes competing in shorter higher intensity efforts. In addition, these data are also suggestive of a general "cardiotonic" effect of AX, that should be investigated in non-athletic populations including elderly subjects and those with cardiac complications including post-myocardial infarction, heart failure, statin usage, mitochondrial dysfunction, chronic fatigue, and related conditions.

3300 Board #205 June 2 3:30 PM - 5:00 PM

Effect Of Low Dose Cobalt Administration On Erythropoiesis

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Reported Relationships: W.F. Schmidt: Ownership Interest (Stocks, Bonds); W.F.J. Schmidt is a managing partner of Blood tec GmbH.

Before recombinant EPO became available cobalt chloride has been used as a therapeutic drug to treat anemic patients. Nowadays, cobalt (Co) is offered as nutritional supplement for endurance athletes as it is supposed to stimulate erythropoiesis also in small dosages. As a consequence, WADA has put cobalt on the list of prohibited substances although no information is available on the efficacy of low dose Co application on red cell production. **Purpose:** To evaluate the effect of low dose oral Co administration on erythropoietic activity. **Methods:** Three studies were performed: 1. application of a single dose of either 5mg Co (n=6) or 10mg Co (n=7); 2. application of 5mg (n=9) or 10 mg (n=7) per day for 5 days, and 3. application of 5 mg Co/day for 3 weeks followed by a 3-week wash-out period (n=16). In all studies a control group was included. Venous EPO concentration was determined in all studies, reticulocytes (ret%) and immature reticulocyte fraction (IRF) in study 2 and 3 and tHbmass in study 3 by the optimized carbon monoxide re-breathing method. **Results:** 10 mg Co significantly increased plasma EPO until 7h after the single dose (from 8.7 ±2.6 to 11.5 ±2.4 mU/ml) and after the 5-day administration (from 10.6 ±2.6 to 13.1 ±4.2 mU/ml, $p < 0.05$). 5 mg Co had only a slight effect 5h after a single application (from 8.8 ±4.3 to 10.6 ±5.5 mU/ml, $p < 0.05$). During the 3-week administration 5mg Co transiently increased EPO by 30% (from 9.5 ±3.0 to 12.4 ±5.2 mU/ml after 2 weeks, $p = 0.01$). IRF increased after 5 days of 10mg Co administration (from 0.60

±0.22 to 0.87 ±0.27, $p < 0.001$), but not after short or long-term dosage of 5 mg. Ret% slightly increased in study 3 after 2 weeks (from 1.16 ±0.42 to 1.25 ±0.41%, $p < 0.05$). In study 3, tHbmass slightly increased until week 2 (+17.2 ±22.1g, $p = 0.01$) and remained at higher level thereafter. **CONCLUSIONS:** Low dose cobalt administration which can be achieved with nutritional supplements slightly increases erythropoietic activity and total hemoglobin mass. Supported by WADA Grant 13D21DS.

3301 Board #206 June 2 3:30 PM - 5:00 PM

Using Polyphenol-Based Soap Ameliorates Eccentric Exercise-Induced Muscle Damage

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Reported Relationships: B. Huang: Honoraria; Hong Kong Small Biomolecules Laboratory.

Exercise-induced muscle damage (EIMD) would impair the muscle strength, elevate the activity of creatine kinase (CK), and make individual perceive fatigue. Reactive oxygen species play an important role in EIMD, and supplement with antioxidants might attenuate the undesirable physiological effects. Polyphenols are chemical compounds with antioxidant property extracted from fruit and vegetables. Moreover, studies showed that some kinds of them can be absorbed via skin.

PURPOSE: To determine the effect of using dermal absorbable polyphenol-based soap (PBS) upon EIMD after a single bout eccentric endurance exercise. **METHODS:** Thirteen healthy adults (40±5 yrs) were recruited for a double-blind, cross-over, counter-balanced study. Graded exercise test (GXT) was performed to determine the maximal oxygen consumption (V̇O_{2max}) of subjects one week before eccentric exercise. Thereafter, subjects took a single bout of -5% grade downhill running (DHR) for 60 min at a speed eliciting 75% on a level grade. After the DHR, subjects took showers twice a day (at 12 h intervals) with PBS or commercial neutral soap (CNP) for three days. Before, immediately after, 2 h, 48 h, and 72 h after DHR, capillary fingertip blood was collected and profiles of mood states (POMS) questionnaire were recorded for analyzing the activities of serum CK and the scores of fatigue. Fifteen minutes after blood sampling, isokinetic strength test with 3 maximum voluntary contractions at 150°/s. Data was analyzed by two-way repeated measures ANOVA to compare the differences between treatments and between time points. **RESULTS:** The activities of serum CK were significantly lower in PBS treatment at 48h and 72h after DHR (170±62 U/l vs. 258±146 U/l, 166±67 U/l vs. 287±227 U/l, respectively, $p < 0.05$) when compared to CNP treatment. In PBS treatment, muscle strength at 48h after DHR tended to be larger (133±24 N/kg BW vs. 124±32 N/kg BW, $p = 0.08$) when compared to immediately after DHR. On the contrary, there were no significant differences in fatigue scores between treatments. **CONCLUSION:** Using polyphenol-based soap might attenuate the activities of serum CK after a single bout DHR, and help muscle strength recovery. However, fatigue score of POMS questionnaire didn't reflect this efficacy.

Supported by Hong Kong Small Biomolecules Laboratory.

3302 Board #207 June 2 3:30 PM - 5:00 PM

Effect of an Alpha-GPC Supplement on Physical Performance in Division 2 Football Players

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(No relationships reported)

Previous research relating to Alpha-GPC supplementation and physical performance has been limited to researching Alpha-GPC as a single ingredient supplement. Further research is needed to investigate the effect of Alpha-GPC in combination with other ergogenic ingredients on physical performance. **Purpose:** The purpose of this study was to investigate the acute effect of a supplement on physical performance in Division 2 football players. **Methods:** 14 male Division 2 football players (20.4 ± 1.0 years) participated in a randomized double blind crossover experiment separated by at least 7 days. Subjects were given either supplement or placebo 60 minutes prior to any physical testing measures. Testing consisted of, maximum vertical jumps, maximum voluntary isometric contractions (MVIC), maximal voluntary concentric contractions (MVCC), and fatiguing contractions. Subjects performed 3 maximum vertical jumps with 1-minute rest between jumps. Four MVICs were performed with the knee extensor muscles while seated on a dynamometer at 90° of hip flexion and knee flexion, with 2-minute rest between trials. Seven sets of 2 MVCCs at various loads (1 Nm; 10%, 20%, 30%, 40%, 50% and 60% MVIC torque) were completed with 30-seconds of rest between each set. During the fatiguing tasks, 120 MVCCs (4 set x 30 reps) were performed with a load equivalent to 20% MVIC through 60° range of motion. Recovery measures consisting of one MVIC and 7 MVCCs were taken 10 minutes post completion of fatiguing task. **Results:** MVIC torque was similar between supplemental and control sessions (243.6 ± 41.1 vs. 240.2 ± 29.7 Nm, respectively, $P = 0.34$). Rate of torque development (highest slope of torque during the first 400 ms during MVIC) was greater for the supplement than the control session (1801 ± 336 vs.

1720 ± 346 Nm/s, respectively, $P=0.03$). Impulse for all MVIC significantly increased at time points 30, 50, 100 and 200 ms during the supplemental session ($P<0.05$). No significant differences were found in vertical jump, power and fatigability between sessions. **Conclusion:** Although maximal strength, power and vertical jump did not improve with supplementation, the significant increases in rate of torque development and impulse could be beneficial for a variety of athletes.

3303 Board #208 June 2 3:30 PM - 5:00 PM
Dietary Anti-oxidant Cocktail Supplementation Against Metabolic And Functional Alterations Induced By Physical Inactivity In Humans

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(No relationships reported)

PURPOSE: Recent studies showed several nutrients taken individually, i.e. resveratrol, quercetin, ω -3 fatty acids, vitamins and others, partially prevent metabolic alterations induced by physical inactivity. We hypothesized additive effects will be obtained when these nutrients are taken as a cocktail. In a pilot study, we tested the efficacy of such a cocktail, composed of polyphenols (530mg/d), ω -3 (2.1g/d), selenium (80 μ g/d) and vitamin E (168mg/d) during 20 days of enforced physical inactivity coupled during the last 10 days with fructose supplementation (3.5g/kg/d) to trigger metabolic deterioration. **METHODS:** Twenty healthy active (14000 steps/d measured by accelerometer) young men, randomized in a control ($n=10$) and a cocktail supplemented group ($n=10$), were asked to stop exercise and reduce their daily physical activities (2800 steps/d). Body composition, glucose tolerance, substrate oxidation, blood anti-oxidant capacities and *v. lateralis* muscle biopsies were assessed before and after intervention. Analyses used linear mixed models taking into account repeated measures. **RESULTS:** Twenty days of deconditioning reduced by 20% total and type 2-myosin heavy chain cross sectional areas in the control group that was prevented in the supplemented group ($p<0.01$ for both). While insulin sensitivity was only modestly affected in the two groups, plasma adiponectin was higher in the supplemented than in the control group at the end of the intervention ($p<0.05$). The supplementation counteracted the increase in fasting plasma triglycerides ($p<0.02$) and HDL ($p<0.0001$) induced by reduced activity, was associated with greater fat oxidation ($p<0.02$) and higher muscle FATP1 protein content. The supplemented group had higher blood anti-oxidant capacities ($p<0.01$). **CONCLUSION:** These results are very promising as they can have a number of scientific and clinical implications for both the general sedentary populations and hospitalized bed rested patients.

3304 Board #209 June 2 3:30 PM - 5:00 PM
Folic Acid-layered Double Hydroxide (LDH) Nanoparticles To Improve Endurance Capacity In Mice

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(No relationships reported)

PURPOSE: Folic acid possesses a significant antioxidant effect and reduces oxidative stress. Folic acid-layered double hydroxides (LDH) nanoparticles have been successfully prepared in our previous study. In this study, we determined whether folic acid-LDH nanoparticles could improve the endurance capacity in mice, the increase the anti-fatigue and anti-oxidation effect. **METHODS:** Sixty mice were randomly divided into six groups with ten mice each: two control groups, two folic acid treatment groups, and two folic acid-LDH treatment groups. Endurance was measured on a treadmill enclosed in a plexiglass chamber that was outfitted with a shock grid at the rear of the belt to keep the animal running during the test. For the folic acid, folic acid-LDH and control mice groups, the speed was first set at 15 m/min with a 5 incline. The speed was then gradually increased from 15 to 24.6 m/min and was maintained at 24.6 m/min until exhaustion. The creatine kinase (CK) and lactate dehydrogenase (LDH) activities in blood were determined using commercial diagnostic kits. The antioxidative enzymes superoxide dismutase (SOD), catalase (CAT) glutathione peroxidase (GSH-Px) and activities were determined using assay kits. **RESULTS:** In the treadmill test, folic acid-LDH treated mice could prolong the running time by 25% and 49% compared to folic acid and control groups, respectively. Additionally, plasma creatine kinase (CK) levels of exhausted mice were significantly lower in the folic acid-LDH treated group ($P < 0.05$). While lactate dehydrogenase (LDH) level of mice was significantly increased for folic acid-LDH mice ($P < 0.05$). It also improved the endogenous cellular antioxidant enzymes in mice by increasing the activities of SOD, CAT and GSH-Px. Therefore, folic acid-LDH nanoparticles could significantly improve the endurance capacity in mice; it also can alleviate fatigue of the mice and had an anti-oxidative effect. **CONCLUSION:** These results imply that folic acid-LDH antioxidant system increases the endurance capacity and facilitates recovery from fatigue. It might be used as a novel antioxidant and anti-fatigue sports nutritional supplement. Future work will focus on the study of antioxidant and anti-fatigue mechanisms at the molecular level.

3305 Board #210 June 2 3:30 PM - 5:00 PM

Effects Of Calcium & Magnesium Lactate Supplementation On Vo2peak & OBLA

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(No relationships reported)

Professional and recreational athletes use nutritional ergogenic aids to enhance aerobic performance, facilitate training adaptations, and reduce exercise recovery time. While the use of sodium bicarbonate and beta alanine as ergogenic aids have been investigated extensively, support for the use of calcium and magnesium lactate supplementation to improve aerobic performance has been mixed. To the best of our knowledge, the effectiveness of calcium and magnesium lactate supplementation on aerobic performance markers (i.e., VO_{2peak} and the onset blood lactate accumulation) has not been investigated. **PURPOSE:** The purpose of this study was to examine the effect of calcium and magnesium lactate supplementation on VO_{2peak} and the onset blood lactate accumulation (OBLA). **METHODS:** Eighteen healthy individuals (24±5 yrs) participated in a double-blind, placebo controlled study and randomly assigned to one of 2 groups: placebo (PLA, $n=8$), or supplement (SUP, $n=10$). Prior to and following supplementation, participants performed a graded exercise test on a cycle ergometer to volitional failure. VO_{2peak} , time to exhaustion (TTE), OBLA power, heart rate (HR) at OBLA, VO_2 at OBLA, and rating of perceived exertion (RPE) at OBLA were determined. 2×2 mixed repeated measures analysis of variance (ANOVA) procedures were performed to determine differences in group and time. **RESULTS:** There were no significant differences between PLA and SUP in direct markers of aerobic performance (all $P>0.05$; Table 1). **CONCLUSION:** Lactate supplementation did not present an advantage over a placebo in improving aerobic performance in healthy individuals. The results from this study support those by previous investigators suggesting that there is no physiological rationale for using lactate supplementation to improve performance. Consequently, athletes should explore the use of alternative and/or well-established forms of ergogenic aids to extend the limits of sports performance.

3306 Board #211 June 2 3:30 PM - 5:00 PM

Astaxanthin Formulation Induces Muscle Strength and Endurance Increases Beyond High Intensity Training in Elderly Subjects

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Reported Relationships: S.Z. Liu: Contracted Research - Including Principle Investigator; AstaMed.

Purpose: Reduced muscle strength and endurance is strongly associated with functional decline in older adults. We conducted a randomized, double-blind, placebo-controlled trial of the impact of daily oral astaxanthin treatment with high intensity interval training (HIIT) in the elderly. Astaxanthin is a natural product that combined with vitamin E has both anti-inflammatory and anti-oxidant properties that may improve muscle adaptation to exercise training in the elderly. **Methods:** Healthy males and females ($n=44$), age 65-82 yrs, undertook 3 months (3x/week for 30 min) of HIIT using an incline treadmill protocol (target 85% HRmax). Participants were randomly assigned to formulation (astaxanthin; 12 mg/day and vitamin E; 10 mg/day) or placebo groups. Tibialis anterior muscle (TA) strength and endurance were measured in an exercise tolerance test to fatigue using dorsiflexion exercise. Treadmill and 6-minute walking tests were also performed. **Results:** TA muscle maximal force (MVC) increased by 11% only in the astaxanthin group ($\Delta 8.7 \pm 4.0$ N mean \pm SEM, $P=0.029$). Improvement in TA exercise endurance were found only in the supplemented group as measured by an increase in total contractions of 46% ($\Delta 192 \pm 79$ contractions, $P=0.015$) and in total force generated by 28% in the exercise test ($\Delta 77 \pm 26$ N, $P=0.004$). Similar improvements in treadmill exercise time, exercise efficiency, VO_{2peak} (Balke method), and reduced respiratory exchange ratio in addition to greater 6 minute walking distance were observed in both groups ($P<0.025$ for all). **Conclusion:** In healthy elderly, astaxanthin improved TA muscle strength and endurance with HIIT significantly more than placebo. These results suggest that the anti-inflammatory and anti-oxidant properties from the astaxanthin formulation enhance training adaptations in elderly subjects. An important impact of these findings is the potential to improve exercise tolerance with less frequent or intense training in elderly subjects. Supported by AstaMed NIH/NIA T32 AG000057

3307 Board #212 June 2 3:30 PM - 5:00 PM
Evaluating a Second Generation Phytochemical Nrf2 Activator on Proteostasis and Cytoprotective Gene Expression in Vivo
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 (No relationships reported)

Aging is associated with increases in oxidative stress. Redox imbalance occurs when production of reactive oxygen species (ROS) exceeds the capacity of antioxidant enzymes to eliminate ROS. Increased levels of intracellular ROS can compromise proteostasis by causing irreversible damage to proteins. The transcription factor nuclear factor erythroid-derived 2-like 2 (Nrf2) mediates the cellular endogenous antioxidant defense system by regulating antioxidant enzymes that are cytoprotective against ROS. Nrf2 can be activated phytochemically through the supplement Protandim. Previous work from our lab has demonstrated that a phytochemical based Nrf2 activator improves proteostasis in skeletal muscle in vivo. Recently, we have begun to characterize a second generation Nrf2 activator (PB125) that has increased anti-inflammatory action in addition to anti-oxidant properties. Since inflammation can blunt protein synthetic responses, we speculated that PB125 might provide additional benefits on proteostatic processes. **PURPOSE:** The purpose of the present study was to examine in vivo the effects of three different doses (10, 100, and 300 ppm) of PB125 supplementation on Nrf2 activation and proteostasis. **METHODS:** 60 male CB6F1 mice aged 10-11 months were assigned to diets containing low, medium, or high doses of product PB125 in a 5 week feeding study. Mice were isotopically labeled with 8% deuterium oxide (D₂O) to simultaneously measure protein and DNA fractional synthesis rates (FSR) in liver, heart, and skeletal muscle. Nrf2 activation was assessed through analysis of gene expression profiles via Affymetrix GeneChip microarray. **RESULTS:** Proteostatic mechanisms were increased in the liver mitochondrial fraction in the 10 ppm treatment group (18.9 vs 16.3 FSR%/day, p<0.05). However, there were no differences in proteostatic mechanisms in heart or skeletal muscle. At 100 ppm, there was up-regulation of Nrf2-dependent cytoprotective genes (Akr1d1, Gpx2, Gclm, Fth17b, 3.82, 1.84, 1.42, 1.64-fold increase). **CONCLUSION:** From our data we were able to conclude that all three doses were safe, and that 100 ppm was effective at activating Nrf2. In addition, there was an indication of increased proteostatic processes in the liver, but not heart or skeletal muscle, perhaps due to the healthy status of the mice.

3308 Board #213 June 2 3:30 PM - 5:00 PM
The Effects of Vitamin D3 on Musculoskeletal Performance in College Aged Males
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 (No relationships reported)

Vitamin D (Vit D) plays an important role in the musculoskeletal system and additionally can be deficient in some segments of the population. **PURPOSE:** The present study examined the effects 4 weeks of Vit D supplementation versus placebo on musculoskeletal and psychomotor performance. **METHODS:** The participants were 32 college age males (Age: 22±4 y, Height: 177.7±8.3 cm, Weight: 81.5±14.6 kg, BF%: 19.6±7.9, Vit D: 20.0±7.2ng/ml). Participants were randomly assigned to group (Vit D vs placebo) and remained blind to the treatment throughout the study. The treatments consisted of 4000 IU of Vitamin D3 or similarly sized placebo (dextrose) administered daily for 4 weeks. The participants underwent baseline testing for isometric strength, explosive ability and psychomotor performance, which was repeated at week 2 and week 4. Isometric tests consisted of an isometric mid thigh pull (IMTP) on a force plate and an upper body isometric test (UBIST) using a load cell. Peak force during a countermovement jump (CMJ) was also determined via force plate. A psychomotor vigilance test (PVT) was used to measure sustained reaction time. **RESULTS:** For UBIST there was a significant effect of group (F=4.52, p=0.04) but not a significant group*time interaction (F=0.18, p=0.84; Vit D pre: 553.7±168.3N, post: 585.5±150.2N; Placebo pre: 677.7±182.3N, post: 649.8±236.9N). For IMTP no significant effect of group (F=0.92, p=0.34) nor significant group*time interaction (F=0.17, p=0.83; Vit D pre: 2596.4±342.3N, post: 2606.9±378.3N; Placebo pre: 2684.0±432.9N, post: 2762.6±440.4N) was found. CMJ analysis did not reveal a significant main effect for group (F=0.75, p=0.39) or interaction effects for group*time (F=1.63, p=0.21; Vit D pre: 4429.7±1619.0N, post: 4938.5±2374.8N; Placebo pre: 5537.3±3027.0N, post: 6266.9±4577.3N). For PVT (mean reaction time) there was no significant main effect for treatment (F= 1.29, p=0.29) or interaction effects for group*time (F= 1.08, p=0.35; Vit D pre: 0.304±0.041sec, post: 0.301±0.053sec; Placebo pre: 0.295±0.044sec, post: 0.284±0.029sec). **CONCLUSION:** Four weeks of Vitamin D supplementation was not effective in increasing musculoskeletal or psychomotor performance in college aged males. Further research is needed to clarify the effect of vitamin D on recreationally active persons.

F-60 Free Communication/Poster - Injury Prevention, Recovery, and Rehab in Skeletal Muscle and Connective Tissue
 Friday, June 2, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

3309 Board #214 June 2 3:30 PM - 5:00 PM
Core Stability Before and After Pilates Exercise in Young Individuals with Low Back Pain
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 (No relationships reported)

Abstract: Low back pain (LBP) is a common clinical disease, and most patients require long-term treatment. **PURPOSE:** To observe the change in core stability before and after a 6-week Pilates program in young individuals with low back pain. **METHODS:** Twenty subjects with LBP (age: 22±2 years, 11 males and 9 females) completed a 6-week Pilates exercise intervention. Before and after the intervention, the Y-balance test (YBT) and abdomen bridge test (ABT) were used to assess the core stability of the subjects. During the YBT, which measures the dynamic balance and coordination of core and lower extremity, values on three directions (anterior - A, posteromedial - PM, and posterolateral - PL) of both sides and the difference value(D-value) between the two sides were determined. During the ABT, which measures the core control ability and includes eight levels, the attained level and endurance time of every level were measured. Paired t-tests were performed to compare results before and after the intervention. **RESULTS:** After the 6-week intervention, compared with the baseline values, there were significant improvements in all three directions of the YBT (see table). Specifically, the overall performance score increased significantly on both sides (both p<0.05). Compared with the baseline values, there was an improvement of more than one level and endurance time increased from 95.06±53.50 sec to 117.50±54.99 sec on the ABT (p<0.05). **CONCLUSION:** A 6-week Pilates exercise program improved core stability, as evaluated by YBT and ABT, in young individuals with LBP. Future randomized, controlled studies are needed to confirm these findings.

YBT Result Before and After Intervention

Variables (n=20)	Before (cm)	After (cm)
LA	61.69±7.69	65.86±11.16*
RA	62.19±9.10	65.03±10.24
D-Value	4.11±2.77	2.11±2.47**
LPM	101.17±10.95	105.25±9.28*
RPM	103.31±10.54	105.06±9.08
D-Value	4.69±2.80	1.36±1.53*
LPL	100.19±10.02	102.42±8.55
RPL	99.56±12.30	102.36±10.00*
D-Value	4.31±3.78	3.28±2.87*

*p<0.05, ** p<0.01 compared to before intervention
 Support by the Sports Medicine key laboratory of General Administration of Sport of China/Sports Medicine key laboratory of Sichuan province Foundation.

3310 Board #215 June 2 3:30 PM - 5:00 PM
Microvascular Circulation in Mouse Leg Muscles After A Contusion Injury Examined By Histochemistry Using Lectin
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 (No relationships reported)

Traumatic muscle injury can lead to microvascular perfusion failure; however, the effect of muscle contusion on microvascular circulation is not fully understood due to methodological limitations. We studied microvascular circulation in injured skeletal muscles after a contusion injury by histochemistry using Lycopersicon esculentum lectin. **PURPOSE:** To examine the acute effects of contusion injury on microvascular circulation in mouse leg muscles. **METHODS:** Eighteen ICR male mice (39.0 ± 2.9 g) aged 8 and 9 weeks old were used. Microvascular circulation in leg muscles was examined immediately (n=5), 3 h (n=4), 6 h (n=4) and 24 h (n=4) after contusion injury. Both legs of the mice were injured using a standardized "weight-drop" device with a 250-g weight falling from 15 cm onto the top of the impactor (impact area, radius 6 mm) that directly contacted

the skin over the posterior leg muscles. After the contusion, mice were allowed to recover. One mouse was without contusion and was used as a control. Fluorescein isothiocyanate (FITC)-labeled *Lycopersicon esculentum* lectin was injected into the caudal vein and allowed to circulate for 3 min before sacrifice. Endothelial cells of open and functioning blood vessels were labeled by this lectin for 3 min. Leg muscles were removed, frozen and 3 serial cross-sections (10 µm) were obtained from each specimen using a cryostat. Open and functioning capillaries were detected by immunostaining for lectin using one section, while all capillaries were detected by immunostaining for PECAM-1 (CD31) using an adjacent section. The third section was stained with hematoxylin and eosin for histological assessment. Photographs of these sections were carefully compared.

RESULTS: Muscle swelling was observed immediately after contusion. Myofibers were disorganized due to the expansion of interfiber spaces. At 24 h after muscle contusion, disrupted myofibers with infiltrated cells were observed. Some non-flowing capillaries were found within the injured area by immunostaining for lectin from immediately after contusion to 24 h.

CONCLUSIONS: The present study clearly demonstrated non-flowing capillaries within the injured muscle area after contusion injury for the first time by histochemistry. This method is useful for examining microvascular circulation after muscle contusion.

3311 Board #216 June 2 3:30 PM - 5:00 PM
High Concentration CO₂-water Immersion Promotes A Recovery From The Muscle Hardness Induced By Resistance Exercise

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Clinical observations of CO₂-hot spring (CO₂ ≥1000 ppm) immersion revealed the effects, such as an immersed part reddening, skin blood flow improvements, blood catecholamine decrease, etc. In response to the CO₂-water bath, the reduction of sympathetic nerve activity may imply the facilitation of muscle fatigue recovery.

PURPOSE: We investigated whether the immersion of extremities including agonist muscles into artificially made high concentration CO₂-water (CO₂ ≥1000 ppm) influences recovery of muscle hardness in fatigue after resistance exercise. **METHODS:** The healthy male college students (n=11, age; 18-19 yrs, height; 168.6±4.5 cm, weight; 66.2±9.3 kg) participated in this study. The subjects were randomly divided into the CO₂-water foot bath group (n=6) and the tap-water foot bath group (n=5). A laser Blood flow in the immersed skin (BF) and electrocardiogram (ECG) were recorded continuously throughout the experiment. The subjects performed 100 times calf raise resistance exercise and immersed lower legs into tap-water or artificial CO₂-water at 35 °C for 10 minute after exercise. MG dominant muscle hardness was evaluated using ultrasound real-time tissue elastography and visual analog scale in muscle (VAS) at pre-exercise, immediately exercise, after 10 min recovery. The strain ratio (SR) between the MG and a reference material was calculated. **RESULTS:** BF_{min} in the CO₂-water foot bath was significantly higher than in the tap-water foot bath (CO₂-water vs. tap-water, 5.7±2.4 vs. 1.5±0.6 ml·min⁻¹·100g⁻¹, p<0.05). After 10 min recovery, in the CO₂-water foot bath compared with the tap-water, SR significantly decreased quicker (1.37±0.38 vs. 0.62±0.07, p<0.05). In addition, VAS after 10 min recovery became smaller in the CO₂-water than the tap-water (22.2±13.5 vs. 38.8±13.5 mm, p<0.05). **CONCLUSIONS:** The present study suggested that high concentration artificial CO₂-water foot bath may contribute to rapid recovery from the high intensity exercise-induced muscle hardness.

3312 Board #217 June 2 3:30 PM - 5:00 PM
Using DT-MRI and 31P-MRS to Assess Muscle Damage Following Unaccustomed Eccentric Exercise

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PURPOSE: To detect the musculoskeletal structure and metabolism changes in vivo by diffusion tensor magnetic resonance imaging (DT-MRI) and ³¹P-Magnetic resonance spectroscopy (³¹P-MRS) after a single bout of eccentric exercise.

METHODS: Thirty two male Sprague Dawley rats (body weight 238±15g) were randomly divided into either a sham group (n=8) or a downhill running group (n=24). Rats in the downhill running group ran 120 min on treadmill at a speed of 20 m/min at -16 degrees grade. DT-MRI and ³¹P-MRS were performed in right lower limb at pre-exercise (sham), immediately, 24 hr and 48 hr post-exercise at 7T MR. The MR sequence included RARE T2, RARE T1 and EPI-DTI. MRS observational indices included the peak areas of inorganic phosphate concentration (Pi), phosphocreatine

concentration (PCr) and the ratio of Pi/PCr. The morphological changes were confirmed by histological and immunohistochemical methods. One-way ANOVAs and Tukey's test were used to assess the differences among different time points.

RESULTS: On diffusion tensor tractography images, a single bout of downhill running significantly disrupted muscle fiber structure. The peak areas of Pi were significantly higher after exercise (pre-exercise: 4.1±0.8 mM; 0 hr post-exercise: 4.7±1.4 mM; 24 hr post-exercise: 6.6±1.9 mM; 48 hr post-exercise: 6.1±1.7 mM; all P<0.01). Muscle PCr did not differ between pre- and post-exercise; consequently, Pi/PCr values were significantly higher following EIMD (pre: 0.14±0.05; 0h post: 0.18±0.05; 24h post: 0.22±0.08; 48h post: 0.2±0.08; all P<0.05). According to the histological detection, Z-band streaming was higher post-exercise compared with baseline (all P<0.05). The histopathological indices of damage coincided with changes in DT-MRI parameters of fractional anisotropy and apparent diffusion coefficient.

CONCLUSIONS: The data suggest that exercise-induced muscle damage was accompanied by structural and metabolic alterations in skeletal muscle following a single bout of downhill running. The ability of DT-MRI and ³¹P-MRS to accurately detect these changes *in vivo* makes them promising approaches to evaluate skeletal muscle damage after unaccustomed exercise. (This research is supported by the National Natural Science Foundation of China, Grant#: 81301195)

3313 Board #218 June 2 3:30 PM - 5:00 PM
Relationship Between Knee Extensor Strength And Dynamic Balance Stability In Partial ACL Injury

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PURPOSE: Anterior cruciate ligament (ACL) injury are known to develop muscular weakness in the quadriceps. Also, ligament injuries contribute to loss of stability and function. The purpose of this study was to assess the correlations between dynamic balance stability and isokinetic extensor strength measurements in subjects after partial anterior cruciate ligament injury.

METHODS: We examined 38 men (mean age, 26.3 ± 7.0 years) with partial ACL tear. The isokinetic strength of extensor and flexor muscles was evaluated by using the CSMi isokinetic testing device. The peak torque was determined at speeds of 60°/s and 180°/s. The value of the highest peak torque for each velocity was compared with the uninjured side, and described as a percent of strength deficit. The balance stability was measured with single-leg by using the Biodex Stability System. Correlations between the ability of single-leg balance and knee extensor muscle strength were determined. **RESULTS:** The knee extensor strength deficit of 22.5±18.9% was found in the injured leg that compared to the uninjured leg at 60°/s, and extensor strength deficit was 18.8±17.2% at 180°/s. Single-leg balance stability at 22.1 ±15.8% was required the level of improvement of balance stability. Significant correlations were found between deficient of each extensor muscles in injured knees at 60 and 180°/s and dynamic balance stability (r = 0.61, P = 0.025; and r = 0.58, P = 0.035, respectively).

CONCLUSION: The ability of single-leg balance with injured knees appeared to be influenced by knee extensor muscle strength. The results contribute to the evidence indicating the importance of knee strength for dynamic balance stability for partial ACL injury.

3314 Board #219 June 2 3:30 PM - 5:00 PM
Knee Extensor Strength is Associated with Femoral Cartilage Thickness in Individuals with ACL Reconstruction

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(No relationships reported)

PURPOSE: To (1) determine the relationship between quadriceps function and femoral cartilage morphology in individuals with anterior cruciate ligament reconstruction (ACLR), and (2) compare quadriceps function and femoral cartilage morphology between injured and uninjured limbs.

METHODS: Quadriceps function and femoral cartilage was assessed with unilateral ACLR in 20 subjects (women=15, age= 22.3±3.3years, time since ACLR=44.9±32.8 months). Quadriceps function was assessed using peak isometric knee extension torque (PT) and rate of torque development (RTD) at 45 degrees of knee flexion, and peak isokinetic knee extensor torque at 60, 180 and 240°/sec. Femoral cartilage morphology (area and thickness) were obtained via ultrasound imaging at 140° of knee flexion. Partial correlations were used to evaluate the associations between indices of quadriceps function, and cartilage area and thickness accounting for time since reconstruction. Paired samples t-test were used to evaluate interlimb differences.

RESULTS: The ACLR limb produced smaller isometric peak torque (2.56±0.42 vs. 2.75±0.30 Nm/kg, p=0.04), slower isometric rate of torque development (38.12±13.27 vs. 47.81±17.99 Nm/sec/kg, p=0.03), and isokinetic peak knee extensor torque at 60°/sec (2.38±0.54 vs. 2.80±0.63 Nm/kg, p≤0.01) compared to the uninjured limb.

No differences were found in isokinetic peak torque at 180 or 240°/sec ($p=0.06$ and 0.60 , respectively). After accounting for time since ACLR, a positive association was found between isometric peak torque and medial femoral cartilage thickness ($r=0.41$, $p=0.04$).

CONCLUSIONS: The ACLR limb demonstrated deficits in quadriceps function. We found a moderate association between isometric peak torque and medial femoral cartilage thickness. Our results suggest that restoring quadriceps strength may delay femoral cartilage thinning following ACLR.

3315 Board #220 June 2 3:30 PM - 5:00 PM
Musculoskeletal Pain as Predictors of Health Behavior: Implications for an Ergonomic Intervention

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Background: Work-related musculoskeletal disorders (WMSDs) are significant problems in the workplace that are extremely costly to employees, employers, and society. One of the most common symptoms of WMSDs is musculoskeletal pain which has been associated with detrimental effects to health behaviors including a decrease in physical activity levels. Lower levels of physical activity have been associated with elevated levels of obesity which increases the risk for the negative health consequences associated with a higher BMI.

Purpose: To compare the prevalence of obesity, musculoskeletal pain, and the difficulty to engage in physical activity of Correctional Officers (COs) to the U.S. adult general population at two time points. Furthermore, to explore the associations between musculoskeletal pain and health behaviors amongst COs.

Design: Seventy-seven Correctional Officers from two maximum security correctional facilities in the Northeastern United States were enrolled in the study. The health profiles (musculoskeletal pain, difficulty to engage in physical activity, and BMI characteristics) of participants were collected at two time points (Time 1 (2011) and Time 2 (2013)) and compared to the U.S. adult general population. The health profiles of COs were also used to investigate associations between musculoskeletal pain and the difficulty to engage in physical activity at two time points. Also to explore if musculoskeletal pain at Time 1 predicts the difficulty to engage in physical activity at Time 2.

Results: Correctional employees exhibited a significantly higher prevalence of overweight and obesity, musculoskeletal pain, and difficulty to engage in physical activity than the U.S. adult general population at both time points ($p<.05$). Musculoskeletal pain was associated with a difficulty to engage in physical activity at both time points ($p<.05$). Musculoskeletal pain was predictive of the future difficulty to engage in physical activity ($p<.05$).

Conclusions: As a result of the musculoskeletal pain, COs report difficulties to engage in physical activity. The results of this study provide a rationale for the implementation of feasible ergonomic interventions in the environment of corrections to alleviate musculoskeletal pain and improve the health behaviors of COs.

3316 Board #221 June 2 3:30 PM - 5:00 PM
Effects Of Methol Gel On Delayed-Onset Muscle Soreness (DOMS) In Sedentary Young Adults

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Delayed-onset muscle soreness (DOMS) is common 24 hr after engaging in resistance training. Topical analgesics containing menthol are often used to treat DOMS but little is known about their effectiveness. **PURPOSE:** To determine how long menthol gel may reduce pain associated with DOMS. **METHODS:** Sedentary young men ($n=3$) and women ($n=6$) (age = 23.9 yr; wt = 70.1 kg) participated in the study and were instructed to refrain from exercise and consuming or applying any type of anti-inflammatory medication 24 hr before, and throughout the duration of, the study. After determining 1-RM, participants performed 10 sets of 10 repetitions of barbell back squats at 60% of their 1RM to elicit DOMS. Squats were performed to a predetermined depth using stacked 5-cm spacers so the femurs were parallel to the floor at the end of the eccentric phase. 24 hr later, a gel containing 4.0% menthol was applied (1ml of gel per 200 cm² of surface area) to one quadriceps and the same dose of a menthol-scented placebo gel was applied to the other quadriceps. Application was randomized to each leg and participants were blinded to the gel identity. Prior to application, participants rated pain in each leg using a scale ranging from 0 (no pain) to 10 (pain as bad as it could be). Following application, participants completed this rating scale every 30 min for 8 hr. **RESULTS:** Pain was reported to be exactly the same for both legs at 24 hr (6.67 - severe pain). After application of the menthol gel, pain declined ($p<0.05$) to a minimum at 60 min (pain rating = 5.28; 21% decline) that was classified as moderate

pain. Although pain tended to increase after 1 hr, pain remained less ($p<0.05$) than placebo for 5 hr. **CONCLUSION:** A 4.0% menthol gel reduces DOMS-related pain by ~20% 60 min after application in sedentary young adults and then a lower plateau of pain perception is achieved for 5 hr following application. Our previous study using the same protocol with recreational athletes who had lower ($p<0.05$) levels of pain (4.65) 24 hr after exercise also reported maximum pain relief 1 hr after application. Although a 31% relative decline, their absolute pain scores declined similarly (1.4 points) compared to the current study. Further research is needed to determine whether declines in pain can be attained in less time and/or if a greater decline can be achieved. Supported by Performance Health.

3317 Board #222 June 2 3:30 PM - 5:00 PM
Exercise Intervention Effects On Winged Scapula And Postural Pain: A Case Study

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Researchers have shown that more than 80% of the American workforce has a sedentary lifestyle that can leave people sitting for upwards of 10 hours a day (OECD, 2014). In turn this has a negative influence on posture and back pain. "Molly", a 52 year-old, sedentary individual that has experienced right subscapular pain due to her posture, had developed protracted shoulders and winged scapula. Molly volunteered to take part in an 8-week Community Fitness Partner program as part of Westfield State University's Exercise is Medicine on Campus intervention. A student trainer developed an 8-week total body exercise prescription. **Purpose:** The purpose of the study was to determine if resistance training postural exercises (RTPE), stretches, and self-myofascial release (SMR) could be used to counteract the protracted shoulder posture resulting in her upper back pain. RTPEs have been shown to help healthy population to neutralize the shoulder girdle and improve the overall health of the upper extremity. **Methods:** Initial meetings included goal setting and fitness screening. Subject characteristics include: Height= 1.74m, Body Mass=65kg, BMI=22.4, Resting HR=68bpm, Resting BP= 115/70mmHg and FMS shoulder mobility of left arm grade III and right arm grade II. The program included RTPE, stretching, SMR, and cardiovascular training. After each workout specific exercises, stretches and/or SMR modalities were performed to target her upper back and pectoral area to help with shoulder girdle imbalances. Pre and posttest measures included assisted push-ups, curl ups, and self-awareness of back pain. **Results:** Molly's upper body strength increased from 19 assisted pushups to 35, Curl-ups improved from 23 to 42. Improved alignment of her shoulders were observed in an axillary line with her ear and superior iliac crest. Additionally, she reported changes that included: an increase in overall mood, more energy, reduced upper back pain, improvement in body image and fewer aches throughout the day. **Conclusion:** An 8-week training program consisting of resistance training and specific postural exercises can effectively improve posture and decrease upper back pain. Through a multimodal approach, including strengthening and lengthening of muscles and tendons, posture can be improved which may lead to a decrease in pain.

3318 Board #223 June 2 3:30 PM - 5:00 PM
Comparison of Knee Strength And Stability In Primary And Revision Acl Reconstruction

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PURPOSE: The number of primary anterior cruciate ligament (ACL) reconstructions has increased in parallel with graft failures, with a resultant effect on revision surgery. Primary ACL reconstruction is successful for most patients, but some have had persistent giving-way symptoms and recurrent ruptures, such that revision surgery is required. Knee strength deficits are among the consequences of muscle weakness after ACL reconstruction. This study compared knee strength and stability in primary and revision ACL reconstruction.

METHODS: This was a cross-sectional study with a total of 78 participants, in whom 38 revision surgeries were performed at a single hospital between April 2013 and May 2016. All revision reconstructions used tibialis anterior tendon allografts. Forty patients underwent primary ACL reconstruction using double-looped semitendinosus and gracilis autografts. Strength and stability results were compared in primary and revision ACL reconstruction. All participants were measured with an isokinetic device to assess the main outcome of knee strength; a KT-2000 arthrometer was used to measure anterior laxity. Knee function status was evaluated using International Knee Documentation Committee and Lysholm scores. Knee strength and stability results were compared for primary and revision ACL at 12 months post operatively.

RESULTS: The stability results with revision surgery were inferior to those with primary reconstruction (1.5 ± 1.1 mm vs. 2.6 ± 1.5 mm; $p = .001$). However, there were no significant differences in knee extensor deficits at 60°/sec or 180°/sec (respectively,

$p = .213, p = .994$) or in flexor muscle strength between primary and revision ACL reconstruction (respectively, $p = .473, p = .609$). The statistical comparison of functional scores in primary and revision surgery showed no significant differences. **CONCLUSIONS:** Knee extensor deficits and flexor muscle strength show no differences in a comparison of revision and primary ACL reconstruction. However, the results for stability were inferior to those of primary ACL reconstruction.

3319 Board #224 June 2 3:30 PM - 5:00 PM
Threshold Number Of Low-intensity Eccentric Contractions Of The Elbow Flexors To Induce Muscle Damage

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No indication of muscle damage is evident after 30 or 60 low-intensity (10% of maximal voluntary isometric contraction strength: MVC) eccentric contractions (LIEC) of the elbow flexors (EF; Chen et al., 2012) or the knee flexors and extensors (Chen et al., 2013, 2015). Nosaka & Newton (2002) reported that a large number of LIEC of the EF (lowering a dumbbell of 9% MVC 1800 times) resulted in significant changes in MVC torque, range of motion (ROM), upper arm circumference, muscle soreness (SOR) and plasma creatine kinase (CK) activity lasting for 4 days post-exercise. It appears that LIEC induce muscle damage when the number of contractions exceeds a certain level, but the level has not been determined. **PURPOSE:** This study investigated the threshold number of LIEC of EF resulting in significant changes in indirect muscle damage markers. **METHODS:** A pilot study showed no indication of muscle damage after 480 LIEC, but muscle damage markers changed significantly after 960 LIEC. Thus, the present study focused the number of contractions between 600 and 960. Fifty-two young men who had not performed resistance training were recruited and assigned randomly to one of the four groups ($n=13$ per group) based on the number of LIEC performed in the exercise in which a dumbbell set at 10% was lowered repeatedly either 600, 720, 840 or 960 times by the non-dominant arm. Maximal voluntary concentric contraction torque (MVC-CON), ROM, SOR, CK activity and echo-intensity (EI) were measured before, immediately after and for 5 days post-exercise, and their changes were compared among the groups. **RESULTS:** The 600, 720 and 840 groups showed significant ($P<0.05$) decreases in MVC-CON (8-10%) and ROM (2-3%) immediately post-exercise only, without changes in SOR, CK and EI. All variables changed ($P<0.05$) for the 960 group (peak change, MVC-CON: -18%, ROM: 3%, SOR: 20-mm, CK: 410%, EI: 8%) lasting for 3-4 days post-exercise. **CONCLUSIONS:** These results show that no muscle damage is induced when the number of LIEC is less than 840 for EF. It is interesting to investigate further what changed between 840 and 960 contractions to make the muscles susceptible to muscle damage. Supported by MOST, TAIWAN (MOST105-2410-H-003-052-MY3).

3320 Board #225 June 2 3:30 PM - 5:00 PM
Circulating Mitochondrial Damage-Associated Molecular Patterns (mtDAMPs) Following Skeletal Muscle Contraction-Induced Injuries: Pilot Endpoint PCR Studies

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PURPOSE: The purpose of these pilot studies is to validate PCR primer sets intended to describe mitochondrial damage-associated molecular patterns (mtDAMPs, which influence the immune system) in human plasma samples, after the muscle injury evoked by extreme exercise, such as a marathon. We hypothesize that circulating concentrations of mtDAMPs—specifically, mtDNA—are elevated post-marathon relative to pre-marathon. With quantitative PCR, evaluation of the change in mtDAMP levels pre- vs. post-marathon is enabled via comparing these levels to an internal reference (“housekeeping”) gene that is unaffected by exercise. **METHODS:** All procedures were IRB approved and all subjects ($n=11$) provided informed consent. Blood was obtained by antecubital venipuncture at baseline and within 48 hours post-race. Blood was centrifuged, plasma aliquotted, and stored at -80°C for further analyses. Plasma DNA was isolated using a commercially available mini kit (Qiagen). Primers for human mtDNA (cytochrome B, cytochrome C oxidase subunit III, NADH dehydrogenase), and bacterial 16S rRNA were synthesized by Eurofins Genomics using published sequences. The human sequences have no significant homology with DNA found in any bacterial species published on BLAST. To determine whether levels of 3 candidate housekeeping genes are consistent pre- vs. post-marathon, the housekeeping primer sequences were added to pre- and post-marathon DNA samples, amplified via thermocycling in routine endpoint PCR, and visualized on 1.5% agarose-

EtBr gels. Amplicons of the mtDNA primer sets were similarly assayed. **RESULTS:** Pilot endpoint PCR studies of 3 candidate housekeeping genes (one primer set for beta-actin, and two distinct GAPDH primer sets) indicate that a specific GAPDH primer set provides data which are unaffected by marathon participation, and also indicate that the pattern of these data is consistent among individuals. Additionally, endpoint PCR validated the mtDNA primer sets. **CONCLUSION:** These pilot studies validated the following human primer sets: Housekeeping gene—GAPDH; cytochrome B; cytochrome C oxidase subunit III; NADH dehydrogenase. Supported by the WSSU Research Initiation Program.

3321 Board #226 June 2 3:30 PM - 5:00 PM
The Effects Of An Ergonomic Mat on Musculoskeletal Symptoms and Health Behaviors

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Background: Prolonged standing on hard concrete surfaces has been associated with musculoskeletal pain and discomfort of the lower extremities. Musculoskeletal pain negatively affects health behaviors including sleep quality and levels of physical activity. Ergonomics mats have been reported as an effective intervention for reducing the musculoskeletal pain and discomfort of the lower extremities in occupational settings. Understanding the alleviating effects of ergonomic mats on the musculoskeletal symptoms of the lower extremities may aid in the improvement of the musculoskeletal health and health behaviors amongst prolonged standees. **Purpose:** To investigate the feasibility of implementing ergonomic mats in a correctional facility to decrease the perceived musculoskeletal symptoms (pain, discomfort, and fatigue) of the lower extremities amongst Correctional Officers (COs). Furthermore, to evaluate the potential improvement of reported health behaviors (sleep quality, sleep quantity, and physical activity) during the course of an ergonomic mat intervention. **Design:** Seven overweight and obese ($\text{BMI}<25$) Correctional Officers from a correctional facility in the Northeastern United States participated in the 21-day ergonomic intervention. Musculoskeletal symptoms, physical activity levels, and sleep quality were compared with a 2-phase panel evaluation (with and without the ergonomic mat) and a pre-post evaluation. **Results:** The perceived musculoskeletal discomfort and fatigue of the lower back and discomfort of the foot significantly decreased ($p<0.05$) at the follow-up. There were no significant changes in health behaviors. **Conclusion:** Ergonomic mats are practical to implement in correctional facilities. Following implementation, the reported musculoskeletal discomfort and fatigue of the lower back and foot were reduced. Future research should repeat this feasibility study with a larger sample size and longer intervention duration to investigate the effects of ergonomic mats on musculoskeletal health and health behaviors.

3322 Board #227 June 2 3:30 PM - 5:00 PM
The Effect Of Cold Water Immersion Treatment On Inflammation Factor and MMP-1 Releasing In Post-exercise Patellar Tendon

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The patellar tendinopathy is a common overuse injury. After high intensity exercise, patellar tendon tissue releases mass of TNF- α , IL-1 β , IL-6 that induce COX-2 and MMP-1 releasing, which correlate to inflammation and tissue degeneration. Cold water immersion (CWI) therapy has been considered an effective way to reduce the inflammation and injury in muscle tissue. **Purpose:** To determine the effect of CWI on TNF- α , IL-1 β , IL-6, MMP-1, COX-2 releasing and in post-exercise patellar tendon. **Method:** 66 New Zealand rabbits (18 mon, 2.8 ± 0.2 kg) were divided three groups. In high intensity jumping (HIJ) group, 30 rabbits jumped 150 times by low current electrical stimulation, the jumping force were limited between 80-110N. In cold water immersion (CWI) group, 30 rabbits received 15 minutes 4°C CWI treatment on posterior limbs after 150 times jumping. Rest of 6 animals were control (CON) group which identified as baseline. The patellar tendons were harvested at 0 hour, 6 hour, 24 hour, 48 hours after exercise in HIJ group or after treatment in CWI group. TNF- α , IL-1 β , IL-6, COX-2 and MMP-1 mRNA expression assessed by RT-PCR. All the data was analysis by two-way ANOVA with multiple-comparison test. **Result:** IL-1 β mRNA expression reached peak value at the 0 hour (CWI: 22.89 ± 5.48 , HIJ: 20.47 ± 6.24 vs. CON: 0.99 ± 0.40 , $P<0.01$), and no significant different between exercise groups. TNF- α mRNA expression reached peak value at the 0 hour (CWI: 23.21 ± 6.02 , HIJ: 39.30 ± 8.17 vs. CON: 0.63 ± 0.33 , $P<0.01$), and significantly higher in HIJ group at 0 hour (CWI vs. HIJ, $P<0.05$). IL-6 mRNA expression reached peak value at the 0 hour (CWI: 23.49 ± 5.83 , HIJ: 35.40 ± 6.55 vs. CON: 0.73 ± 0.22 , $P<0.01$), and

significantly higher in HIJ group at 0 hour (CWI vs. HIJ, $P < 0.05$). MMP-1 mRNA expression reached peak value at the 6 hour (CWI: 12.10 ± 3.71 , HIJ: 13.31 ± 5.78 vs. CON: 0.99 ± 0.09 , $P < 0.01$), and significantly higher in HIJ group at 0 hour (CWI: 1.40 ± 0.70 vs. HIJ: 8.72 ± 1.18 , $P < 0.05$). COX-2 mRNA expression reached peak value at the 0 hour (CWI: 7.57 ± 2.01 , HIJ: 18.02 ± 4.17 vs. CON: 0.78 ± 0.29 , $P < 0.01$), and significantly higher in HIJ group at 0 hour and 6 hour (CWI vs. HIJ, $P < 0.01$). **Conclusion:** The CWI treatment transiently reduces the inflammation factors, MMP-1 and COX-2 releasing in patellar tendon after exercise.

3323 Board #228 June 2 3:30 PM - 5:00 PM
Altered Joint Loading Affects Cartilage Degeneration and Limb Function in Rats following Knee Meniscal Transection
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 (No relationships reported)

PURPOSE: Either reduced or elevated joint loading has been associated with post-traumatic osteoarthritis (OA); however, which altered loading condition may be more detrimental to cartilage health post-injury remains unknown. This study examined the effects of reduced and elevated joint loading on cartilage degeneration, knee locomotion kinematics, and degree of voluntary activity in rats following medial meniscal transection (MMT).
METHODS: A total of 22 male Lewis rats (weight: 304 ± 57 gm) underwent MMT in their left hind-limbs and were assigned to one of the three conditions: 1) regular loading (N = 7), 2) reduced loading via hind-limb immobilization (N = 8), or 3) elevated loading via daily treadmill running (N = 7). A sham surgery was performed in 7 separate rats. Rats were evaluated pre-MMT and 8 weeks post-MMT for the amount of voluntary daily run time/distance on a running wheel and hind-limb joint kinematics during treadmill locomotion (speed: 30 m/min) using a 3D X-ray motion analysis. Rats were euthanized after 8 weeks and the 3D microstructure and composition of the tibial plateau cartilage and subchondral bone was quantified using contrast-enhanced microcomputed tomography.
RESULTS: When compared to the elevated-loading group at the 8th week post-MMT, the reduced-loading group demonstrated a greater reduction in voluntary run time (47.7 ± 46.8 % vs. 18.0 ± 69.9 %, $P = 0.043$) and distance (57.2 ± 38.3 % vs. 19.7 ± 81.2 %, $P = 0.029$). Cartilage data from 4 rats per group indicated that the elevated-loading rats had the greatest lesion/exposed bone area and subchondral bone volume (0.50 ± 0.35 μm^2 and 1.16 ± 0.24 mm^3 , respectively), followed by the regular-loading rats (0.43 ± 0.19 μm^2 and 1.06 ± 0.22 mm^3) and reduced-loading rats (0.14 ± 0.17 μm^2 and 0.97 ± 0.03 mm^3). All three MMT groups demonstrated a more extended knee position (by about 8-18°) at mid-stance during locomotion when compared to the sham rats.
CONCLUSIONS: Our current findings suggest that while elevating joint loading (via treadmill running) exacerbated post-traumatic OA, reducing joint loading (via joint immobilization) may delay OA progression in MMT rats. However, the difference in cartilage degeneration among different loading conditions may not correlate with the behavior changes in voluntary activity and knee locomotion kinematics.

3324 Board #229 June 2 3:30 PM - 5:00 PM
Prevalence of Joint Pain Before and After Bariatric Surgery and Impact on Physical Activity
 Alexandra Sirois, Ryan E.R. Reid, Kathleen M. Andersen, Nicolas V. Christou, Ross E. Andersen, FACSM, Susan J. Bartlett. McGill University, Montreal, QC, Canada.
 (No relationships reported)

Consistent physical activity (PA) is one of the strongest predictors of successful long-term weight loss maintenance. However, joint pain is common among severely obese patients and is a significant barrier to regular PA. **PURPOSE:** Our goal was to compare the prevalence of hip, knee, and back/other pain before and after bariatric surgery and explore interrelationships among joint pain, BMI, and PA. **METHODS:** Data were drawn from a convenience sample of adults undergoing bariatric surgery at an urban academic center. In a phone survey, participants reported whether they had experienced knee, hip, and/or back/other pain prior to surgery, and changes in joint pain post-surgery. We compared BMI and PA by pain status (improved vs. same/worse) using t-tests and chi-square. **RESULTS:** The 285 participants had undergone surgery a mean (SD) of 10 (3) years earlier. At follow up [FU], participants had an average age of 51 (10), BMI of 34.4 (8.4), and change in BMI of -19.0 (9.4); 191 (68%) had a BMI ≥ 30 . Prior to surgery, 21-45% reported joint pain; at FU, 123 (43%) reported no pain; 80 (28%); 66 (23%); and 16 (6%) reported pain in 1, 2, or 3 joint regions, and 62 (22%) were on NSAIDs or analgesics. Participants who reported having less joint pain had greater reductions in BMI, and a significantly larger proportion reported being

more active than prior to surgery (Table 1). Those with improved knee and back pain were also more likely to meet recommended PA guidelines. **CONCLUSION:** Joint pain was common among bariatric surgery patients and had improved in 34-40% even 10 years later. Improvements in pain were associated with greater reductions in BMI, greater likelihood of being more active, and of meeting PA guidelines. For the >60% with similar/worse joint pain, effective pain management strategies may be needed to facilitate reaching PA goals.

	Improved	Same/Worse	Mean Difference (95% CI)	P value
Knee (n=164)	n=61 (37%)	n=103 (63%)		
Initial BMI	56.3 (11.1)	53.5 (10.2)	2.8 (-3, 6.2)	.098
Current BMI	33.3 (7.2)	36.2 (9.3)	-2.8 (-5.5, -1)	.045
Change in BMI	-22.9 (10.2)	-17.3 (8.2)	-5.6 (-8.5, -2.8)	.000
More active	49 (82%)	53 (52%)		.000
Meets PA guidelines	18 (30%)	14 (14%)		.011
Hip (n=94)	n=32 (34%)	n=62 (66%)		
Initial BMI	57.8 (12.0)	51.7 (11.3)	6.0 (1.1, 11.0)	.018
Current BMI	33.4 (8.0)	35.2 (8.3)	-1.8 (-5.4, 1.7)	.309
Change in BMI	-24.4 (11.2)	-16.5 (9.9)	-7.9 (-12.4, -3.4)	.001
More active	28 (88%)	31 (50%)		.000
Meets PA guidelines	10 (32%)	16 (26%)		.344
Back/Other Joints (n=159)	n=64 (40%)	n=95 (60%)		
Initial BMI	54.2 (11.6)	52.8 (10.2)	1.4 (-2.1, 4.8)	.975
Current BMI	33.2 (8.0)	35.6 (8.3)	-2.4 (-5.1, 0.2)	.070
Change in BMI	-21.0 (10.3)	-17.2 (9.2)	-3.8 (-6.9, -0.7)	.016
More active	50 (78%)	52 (55%)		.003
Meets PA Guidelines	20 (31%)	13 (14%)		.008

3325 Board #230 June 2 3:30 PM - 5:00 PM
Cartilage and Subchondral Bone Histomorphometry in Osteoarthritis Knee.
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Importance of subchondral bone in the pathogenesis and management of osteoarthritis retain recently the interest of both clinicians and researchers community. In fact, the integrity of articular cartilage relies on subchondral bone to provide mechanical support and nutrition supply. Herein, we investigated the relation between bone and cartilage structures and the vascular supply in human knee OA. **Methods:** 37 osteoarthritic tibial plateaux were collected after a total knee replacement surgery. Samples from macroscopically different ICRS grades were prepared from tibial plateaux. Sample were scanned using the micro-computed tomography at 10µm resolution (Skyscan 1072, Bruker), projections were reconstructed using the manufacturer software. A manual segmentation has been performed on each sample to separate subchondral from trabecular bone and microarchitectural analysis was performed. The same samples were processed for histology, decalcified in 14% EDTA, sectioned into 4µm slides, coloured with HES and scored into 6 groups, based on histological OARSI score. Subchondral bone surface and thickness and articular cartilage surface were calculated. The number of vessels in the subchondral bone area were visually counted by two different operators and a VEGF immunofluorescent staining was performed. **Results:** bone volume fraction, trabecular thickness, spacing, and number were positively correlated OARSI grades. Also, blood vessels significantly increased from grade 1 to 5 ($p < 0.05$). Yet, in grade 6 they significantly decreased ($p < 0.05$). Yet, they were significantly less vessels in grade 6 compared to grade 5. **Conclusion:** Taken together, our data indicate an interplay and dynamic load-bearing structures between subchondral bone and cartilage. Understanding the signaling pathways, the cartilage-bone biochemical unit in joints and the intercellular communication between cartilage and subchondral bone may lead to development of more effective strategies for treating OA patients.

3326 Board #231 June 2 3:30 PM - 5:00 PM
Early Unloading and Loading Exercises for Preventing Posttraumatic Osteoarthritis after Anterior Cruciate Ligament Injury
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 (No relationships reported)

How to prevent posttraumatic osteoarthritis remains controversial. However, a suitable unloading and/or loading exercise offers stimulus to reduce articular joint inflammation

and facilitate cartilage regeneration. Continuous passive motion (CPM) and active treadmill exercise (TRE) have been shown to increase cartilage repair in knee stability condition. **PURPOSE:** To understand the protective effects of early unloading CPM, and loading TRE after ACL rupture. **METHODS:** Sixteen adult New Zealand White male rabbits were studied and randomly assigned to two groups: (I) CPM group, rabbits performed the CPM exercise for continuously 7 days post ACLT. (II) TRE group, rabbits performed active treadmill exercise at the third week for two weeks after ACLT. All animals received the ACL transection of right knee. Left knee was for the sham group. All animals sacrificed at 4 weeks after surgery. All knees were taken out for whole knee evaluations including gross appearance, histology, and OA quantitative scores as well as inflammatory reactions. **RESULTS:** Regarding gross appearance, the TRE group had more obvious cartilage abrasion than the CPM group. The CPM group demonstrated the better cartilage smooth than the TRE group. The total OA scores in the TRE group (13.14) were significantly higher than the CPM group (7.88) ($p < .01$). Regarding histological aspect, the TRE group showed the more severe cartilage degeneration, while the CPM group showed no degeneration status. On the basis of H&E and Alcian blue stainings, the TRE group showed much cell disorganized, decreased of cartilage cells, and decreased of GAG. In contrast, CPM had smoother surface of cartilage, retained GAG, cell density and oriented arrangement of chondrocyte, indicating protecting articular cartilage. We also found that the CPM group had the least TNF- α and caspase-3, suggesting anti-inflammation and sound chondrocyte growth. However, the TRE group had the significantly increased TNF- α and caspase-3 ($p < .01$), particularly in superficial and middle layers of the cartilage. **CONCLUSION:** CPM in the early stage after ACL injury provides the protection of cartilage. In contrast, active treadmill exercise may lead to osteoarthritis. CPM after acute ACL injury for short-term articular cartilage protection is beneficial, while TRE should be judiciously applied.

3327 Board #232
Abstract Withdrawn

F-61 Free Communication/Poster - Musculoskeletal

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3328 Board #233 June 2 2:00 PM - 3:30 PM
Rock Climbers' Utilization Of Healthcare In The Management Of Hand Injuries

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PURPOSE: Examine rock climbers' behaviors and perspectives on utilizing healthcare systems for climbing-related hand injuries.

METHODS: Participants meeting inclusion criteria were identified at seven climbing locations in the Rocky Mountain and Sierra Nevada ranges. Qualitative data was collected via recorded and transcribed semi-structured interviews. Participants were asked about their healthcare utilization and outcomes for each climbing related hand injury.

RESULTS: Twenty-eight climbers were interviewed, with a lifetime injury burden of 88 climbing specific hand injuries. Forty-six injuries occurred when climbers had health insurance. Of those, 78% did not see healthcare professionals. Rationales for not seeking care included (1) trusting one's own and peers' knowledge, (2) trusting medical advice in climbing media, (3) beliefs the injuries would heal on their own, and (4) concern that healthcare providers lack experience managing climbing specific hand injuries. Lack of proper injury management resulted in repeated injury in 42% of the climbers and lasting pain or deformity in 28%. Ten injuries (11%) were evaluated by primary care providers, hand specialists, and/or physical therapists. Climbers sought medical care due to: (1) repeated or worsening injuries, (2) injury requiring urgent intervention such as joint relocation, and (3) knowing a trusted provider. Four were satisfied with the care they received, four were dissatisfied, and two were indifferent.

CONCLUSIONS: Climbers in our study avoided seeking medical care for their climbing-related hand injuries. They preferred to use knowledge from within the climbing community and media to self-manage hand injuries. There was a thematic trust gap between the climbers and healthcare systems. Further study could elaborate on short and long-term negative outcomes from not seeking care. Secondly, further study could evaluate how healthcare provider knowledge of climbing specific hand injuries could help close the trust gap.

3329 Board #234 June 2 2:00 PM - 3:30 PM
Effects of Athletic Tape, Leukotape P, and Prophylactic Bracing During a Dynamic Postural Control Test
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Context: Athletic tape (AT), leukotape P (LEU), and prophylactic ankle bracing (BR) are commonly used in sport activity where dynamic postural control is important in optimal performance. The relationship between balance and these different types of tape and bracing have not been extensively studied. **Purpose:** The purpose of this study was to examine the effect of no intervention (NO), AT, LEU, and BR on modified Star Excursion Balance Test (SEBT) reach distance. **Participants:** Twenty-four healthy volunteers (9 males, 15 females; age: 22.13 \pm 2.37 years; height: 164.99 \pm 8.71 cm; mass: 70.06 \pm 12.42 kg) who were self-reported recreationally active and have not experienced a lower extremity injury in the past six months participated. **Methods:** NO, AT, LEU, and BR were applied during four randomized trials. Reach distance during a modified SEBT were recorded for individual directions and as composite scores for each leg and standardized by leg length. **Results:** One-way repeated measures ANOVA showed a significance F omnibus value between type of tape and reach distance for right composite score, $F(3, 20) = 10.071$, $p = .000$, right anterior reach $F(3, 21) = 7.082$, $p = .002$, and left anterior reach $F(3, 21) = 6.231$, $p = .003$. Post hoc comparisons revealed that AT condition had significantly less right composite score compared to LEU condition; $t(22) = -3.85$, $p = .001$ and BR condition; $t(22) = -4.12$, $p = .000$. Right anterior reach for AT condition was less than NO, $t(23) = 4.179$, $p = .000$ and BR condition, $t(23) = -3.045$, $p = .006$. Left anterior reach for AT was also less compared to NO, $t(23) = 4.579$, $p = .000$; and LEU; $t(23) = -3.690$, $p = .001$. **Conclusion:** AT is often used to address ankle instability, however it may limit dynamic postural control stability. Using other tape or braces may exhibit the same stabilizing effect without impeding dynamic postural control.

3330 Board #235 June 2 2:00 PM - 3:30 PM
Effect of Cold Water Immersion or Contrast Water Therapy on Muscle Soreness After Exercise
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Tissue damage leads to delayed onset muscle soreness (DOMS), often resulting in pain or discomfort that gradually increases within the first 24 hours post-exercise, and typically peaks at 48 hours post activity. Cold-water immersion (CWI) and contrast water therapy (CWT) are commonly used as interventions for reducing DOMS; however, it remains unclear which treatment is more beneficial. **PURPOSE:** To determine if post-exercise cold-water immersion decreases muscle soreness compared to contrast water therapy at 48 hours post DOMS inducing exercise. **METHODS:** Thirty-nine healthy college student volunteers (20 males; 19 females) with ages ranging from 18 to 23 years ($M = 20.36$; $SD = 1.35$) agreed to perform 5 sets of 20 drop jumps from a 0.6m box to induce DOMS. Subjects identified perceived muscle soreness on a 11-point (0 = no pain; 10 = most intense pain imaginable) numeric pain rating scale (NPRS) measured at baseline, immediately post exercise, and at 24, 48, 72, and 96 hours post exercise. Subjects were randomly assigned to a CWI (10^o C) or CWT (1:1 ratio of 40^o C and 10^o C) intervention up to the iliac crest for 10 minutes immediately, 24, 48, and 72 hours post-exercise. An independent-samples *t*-test was used to compare muscle soreness between groups at 48 hours with an alpha level of 0.05 for statistical significance. **RESULTS:** There was a statistically significant difference in NPRS scores for the CWI ($M = 2.90$, $SD = 1.92$) and CWT ($M = 4.32$, $SD = 2.41$); $t(37) = 2.04$, $p = 0.049$, interventions at 48 hours. Further, Cohen's effect size value was $d = -0.66$. **CONCLUSIONS:** CWI significantly decreased muscle soreness compared to CWT 48 hours post DOMS inducing exercise. CWI can be considered superior to CWT to decrease muscle soreness associated with DOMS 48 hours post-exercise. Additionally, the effect size indicates the intervention had a moderate effect. These results add to previous literature indicating CWI is more effective than CWT to treat muscle soreness.

3331 Board #236 June 2 2:00 PM - 3:30 PM

Can Weakness in End-Range Plantarflexion after Achilles Repair Be Prevented?Karl F. Orishimo, Sidse Schwartz-Balle, Timothy F. Tyler, Benjamin Bedford, Steven J. Lee, Stephen J. Nicholas, Malachy P. McHugh, FACSM. *Nicholas Institute of Sports Medicine and Athletic Trauma, New York, NY.* (Sponsor: Malachy P. McHugh, FACSM)

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(No relationships reported)

Purpose

Disproportionate end-range plantar flexion weakness, decreased passive stiffness, and inability to perform a heel rise on a decline after Achilles tendon repair, are thought to reflect increased tendon compliance or anatomical tendon lengthening. Since this was first noted, we have performed stronger repairs and avoided stretching into dorsiflexion for the first 12 weeks after surgery. It was hypothesized that these treatment changes would eliminate end-range plantar flexion weakness and normalize passive stiffness.

Methods

Achilles repairs with epitendinous augmentation were performed on 18 patients. Plantar flexion torque, dorsiflexion ROM, passive joint stiffness, and standing single-leg heel rise on a decline were assessed 43±24 months after surgery (range, 9 months-8 years). Maximum isometric plantar flexion torque was measured at 20° and 10° of dorsiflexion, neutral, and 10° and 20° of plantar flexion. Passive dorsiflexion ROM was measured goniometrically. Passive joint stiffness was computed from the increase in passive torque from 10° to 20° of dorsiflexion measured before isometric contractions. Tendon thickness was measured by digital calipers. Plantarflexor EMG was recorded during strength and functional tests. ANOVA and Wilcoxon tests were used to assess weakness and function.

Results

Marked weakness was evident on the involved side at 20° plantar flexion (deficit 26±18%; $P<0.01$) with no weakness at 20° dorsiflexion (deficit 6±17%; $P=0.39$). Compared to the noninvolved side, dorsiflexion range of motion was decreased 6±8° and tendon thickness was 7±3 mm greater ($P<0.001$) on the involved side. Passive joint stiffness was similar between the involved and noninvolved sides. Only 3 of 18 patients could perform a decline heel rise on the involved side versus 18 of 18 on the noninvolved side ($P=0.01$). There was no difference in EMG amplitude between the involved and noninvolved sides during all tests.

Conclusion

Normalized passive joint stiffness and reduced dorsiflexion ROM were likely due to a stronger, protected repair. EMG data confirmed that end-range weakness was not due to neural inhibition. Weakness with the plantar flexors in a shortened position may be due to inefficient transmission of contractile forces through the thickened tendon when the muscles are in a shortened position.

3332 Board #237 June 2 2:00 PM - 3:30 PM

A Comparison of Two Equipment Removal and Spinal Restriction Protocols on Cervical Spine and Head Motion during Football Player Stretcher TransferTyler Melnicove, Jennifer Kalash, Steven Leigh. *Montclair State University, Montclair, NJ.*

(No relationships reported)

Current research suggests full spinal immobilization is not effective and is potentially harmful during the treatment of spinal injuries. EMS agencies nationwide have adopted new spinal motion restriction protocols in response to these findings. However, these protocols do not account for the protective equipment worn by many athletes. Removing protective equipment from an athlete is necessary for treatment but causes potentially harmful motion of the head and spine. Optimal time on task for equipment removal is also unknown. **PURPOSE:** To compare the differences in time and head/neck kinematics when transferring a football player with a scoop stretcher between full and partial equipment removal. **METHODS:** A stratified sample of twenty students representing a football team (20.8 ± 1.7 years; 1.71 ± 0.12 m; 84.0 ± 15.9 kg). Participants were fitted with football equipment and placed supine. EMS spinal restriction protocols were conducted with helmet and shoulder pad removal (remove) and face mask removal only (keep). Participants were transferred to an ambulance cot with a scoop stretcher. Time to completion, linear/angular head, trunk, cervical spine, and helmet motion were measured in 3-D with an electromagnetic motion tracking system. **RESULTS:** Time on task was twice as fast during keep versus remove (42 s vs 78 s, $p < 0.001$). Cumulative cervical flexion was about 40% less (407° vs 571°, $p = 0.038$) and cumulative cervical rotation was about 50% less (246° vs 378°, $p = 0.026$) during keep versus remove. Cumulative linear head motion was about 1.5 times greater (0.15 m vs 0.35 m, $p = 0.018$) during keep versus remove. Maximum angular and linear motions were similar between conditions. **CONCLUSIONS:** There was considerable head and neck motion during both removal protocols. Motion was cumulatively greater during full equipment removal. Maximum linear and angular head and neck motion was similar between protocols and any deviation from neutral

could put pressure on the spinal cord. Coupled with faster time of task, these findings suggest face mask removal only, before transferring patient to an ambulance cot, is preferred.

3333 Board #238 June 2 2:00 PM - 3:30 PM

Vitamin D3 Supplementation and Stress Fracture Occurrence in High-Risk Collegiate AthletesKevin A. Williams, Christian Askew, Christopher Mazoue, Jeffrey Guy, Toni M. Torres-McGehee, J. Benjamin Jackson III. *Palmetto Health Richland, Columbia, SC.*

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(No relationships reported)

Previous vitamin D research analyzes the regulation of calcium and phosphate levels, as well as bone mineralization and turnover. Very little is known about vitamin D's role in the prevention of stress fractures in high level athletes. **PURPOSE:** We aim to investigate vitamin D's role in the prevention of stress fractures in collegiate athletes. **METHODS: Prospective:** 118 NCAA Division I athletes were recruited from the high risk sports of track and field, cross country, soccer, and basketball. Blood samples were procured in August and February to determine fall and spring baseline 25(OH)D levels. Subjects with serum 25(OH)D <30 ng/ml were supplemented with 50,000 IU of vitamin D3/week for 8 weeks. Treated subjects were re-tested to ensure serum 25(OH)D levels rose to sufficient status. All enrolled subjects were monitored for the development of stress fractures.

Retrospective: A retrospective chart review of non-supplemented athletes from the same sports teams was conducted to determine the incidence of any reported stress fractures. **RESULTS: Prospective:** 112 of the 118 enrolled subjects were tested in August. 61 were of sufficient status (40.2 ng/ml ±8.28) and 51 were either insufficient or deficient (22.7 ng/ml ±4.89). 104 of the 118 enrolled subjects were tested in February. 56 were of sufficient status (40.7 ng/ml ±9.47) and 48 were insufficient or deficient (21.6 ng/ml ±5.87). 2 stress fractures were diagnosed in 118 currently enrolled subjects (1.69%).

Retrospective: 34 stress fractures were diagnosed in 453 subjects from 01/2010-05/2015 (7.51%).

CONCLUSIONS: In our population, almost half of the tested athletes proved to be vitamin D insufficient or deficient by the current normative value standards. Despite vitamin D supplementation, hypovitaminosis D was prevalent throughout the winter months. With vitamin D supplementation in this particular year, the stress fracture rate in our particular cohort significantly decreased from 7.51% to 1.65% ($p=0.009$) following vitamin D supplementation.

3334 Board #239 June 2 2:00 PM - 3:30 PM

Rasch Calibration of the Knee Injury Osteoarthritis Outcomes ScoreJames L. Farnsworth, II¹, Todd Evans², Helen Binkley³, Minsoo Kang, FACSM². ¹Buena Vista University, Storm Lake, IA. ²University of Northern Iowa, Cedar Falls, IA. ³Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Minsoo Kang, FACSM)

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The knee is one of the most commonly injured body regions, accounting for nearly 15% of all sports-related injuries. Patient-reported outcomes such as the Knee Injury Osteoarthritis Outcomes Score (KOOS) have been used to evaluate changes in function following knee injury. Despite its clinical use, ceiling effects have been found across KOOS subscales in the general population. Ceiling effects diminish the clinical usefulness of the KOOS as function improves during recovery. In patients with a high functional ability, such as athletes, it is likely that this problem is even more pronounced. Evaluating the measurement properties of the KOOS in athletes is necessary to determine its clinical value. **PURPOSE:** To calibrate the 42-item KOOS using the Rasch Rating Scale Model. **METHODS:** One-hundred thirty adults (age 29.63 yrs ± 11.32) completed the KOOS. We used the Rasch Rating Scale Model to examine the KOOS. First, model-data fit was evaluated by examining mean square residuals for each item. Second, item difficulty, and person's level of knee-function was estimated. Third, an item-map distribution was evaluated to determine the distribution of knee-function items compared to the person-ability measures. Lastly, the rating scale was evaluated for proper functioning. **RESULTS:** Overall, model-data fit was poor with mean square residuals outside the acceptable range (≤ 0.5 and ≥ 1.5) for many items. The item difficulties ranged from -3.96 to 0.07 logits, where a higher value represents a more difficult item. However, the mean person ability estimate was 0.0 ± 1.41 logits. The item "Have you modified your life style to avoid potentially damaging . . . your knee" represented the least difficult item, while "Pain with . . . stairs" was the most difficult. Item-map distribution indicated poor item distribution with insufficient items covering higher functioning individuals. In addition, the five-category structure of the KOOS demonstrated poor rating scale function.

CONCLUSIONS: The KOOS has limited measurement capabilities for athletes, as the items do not measure the high end of functional ability. For the KOOS to be clinically applicable to athletes, difficult items should be developed.

3335 Board #240 June 2 2:00 PM - 3:30 PM
Knee Rotation Related to Knee Angle and Applied Torque

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(No relationships reported)

INTRODUCTION: Rotational knee laxity is known as an intrinsic risk factor for anterior cruciate ligament (ACL) injury. However, there was no convenient way to measure rotational range of motion (ROM). To this end, we developed the RotorMeter, a simple and non-invasive external device intended to measure rotational ROM of the knee, which we reported to be reliable and valid at the ACSM2016 Annual Meeting.

PURPOSE: The purpose of this current study is to use the RotorMeter to clarify the characteristics pertaining to ROM of the knee in healthy subjects under varying conditions.

METHODS: A total of 10 healthy women (20 knees) participated in the study (20.8 ± 1.8 years). Torques of 2.5 Nm, 5 Nm and 7.5 Nm were applied at 90°, 60°, and 30° angles of knee flexion and the examiner's apprehension of End-Point-Feel (EPF) was used to measure full range of motion using the RotorMeter. One-way ANOVA was used for statistical analysis.

RESULTS: Total (internal + external) ROM of each condition is shown on Figure 1. No laterality was observed at any flexion angle and applied torque. When different torques were applied at the same flexion angle, total rotation significantly increased at all flexion angles with increased torque. Furthermore, with regard to EPF, a significant difference was observed only in comparison with 2.5 Nm. When the same torque was applied at different flexion angles, a significant difference was observed only between 90° and 30° when a torque of 2.5 Nm was applied, whereas when torques of 5 and 7.5 Nm were applied, no significant difference in total rotation was observed at any of the flexion angles.

CONCLUSION: Knee ROM increased when greater torque was applied, but it was not affected by the knee flexion angles during the measurement.

This study was supported by a Grant-in Aid Exploratory Research from NUHW (2013-A-30).

3336 Board #241 June 2 2:00 PM - 3:30 PM
Platelet-rich Plasma Injections For Accelerating Treatment Of Hamstring Tear Injuries

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Platelet-rich plasma (PRP) is an autologous concentration of human platelets and has been used for treatment of tendon, ligament, and muscle injuries. However, it contains deleterious cytokines and growth factors that can cause fibrosis and inhibit muscle healing. PRP therapy has grown in popularity over the past few years but the effect of the PRP with physical rehabilitation is not clear. **PURPOSE:** To assess the effect of physical rehabilitation with PRP injection on treatment of hamstring strain injuries. **METHODS:** Eight physically active males (age 22.7 ± 3.6 yrs) with acute hamstring strain injuries and nine matched controls (age 21.9 ± 2.8 yrs) were recruited as research participants. Approximately 60 mL of blood was drawn from an antecubital venipuncture then centrifuged to approximately 5-6 mL of PRP by a BioMet System. A single dose of PRP was injected into the biceps femoral muscle using ultrasound guidance after 5-7 days of injury and before an 8 wk rehabilitation program. Before and 48 hrs after the PRP injection, the following blood markers were recorded and compared: Vascular endothelial growth factor (VEGF) (0.346 ± 0.182 vs 1.504 ± 0.463 pg/L), platelet-derived growth factor (PDGF) (0.352±0.11 vs 5.72±1.57 pg/L), and Insulin-like Growth Factor-1 (IGF-1) (0.577±0.28 vs 1.101±0.381) (p < 0.05 for all comparisons). Maximal hamstring force (HF) and knee flexion range of motion (ROM) were recorded after an 8-wk physical rehabilitation program. **RESULTS:** There were no significant differences between the PRP and control groups for HF (105.8 ± 3.18 N vs 107.1 ± 1.64 N; p > 0.6), and ROM (148.6 ± 0.78° vs 147.4 ± 0.88°; p > 0.5). **CONCLUSIONS:** Despite the theoretical benefits of PRP to regenerate muscle tissue and expedite return to activity, results indicated that PRP did not affect HF or ROM values when compared to a control group after 8 wk of physical rehabilitation.

3337 Board #242 June 2 2:00 PM - 3:30 PM
Functional Outcomes of ACL Reconstruction with Tibialis Anterior Allograft, Hamstring or Quadriceps Tendon Autograft

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(No relationships reported)

PURPOSE: The quadriceps index is a measure of the relative strength of the involved quadriceps compared to the uninvolved quadriceps. The purpose of this study was to investigate the changes in quadriceps strength in patients undergoing anterior cruciate ligament (ACL) reconstruction using anterior tibial tendon (ATT) allograft and hamstring tendon (HT) and quadriceps tendon (QT) autograft.

METHODS: Fourteen patients (mean age: 26.8±5.8 years, BMI: 22.9±2.4 kg/m²) with ATT allograft and 15 patients (mean age: 27.1±5.4 years, BMI: 23.8±2.8 kg/m²) with HT autograft and 11 patients with QT autograft (mean age: 28.1±4.4 years, BMI: 22.6±3.8 kg/m²) were included in the study. All patients (n=40) were received the same reactive neuromuscular rehabilitation protocol after surgery. Quadriceps strength of the patients was measured at 60°/sec and 300°/sec angular speeds, using the Biodex System 3 (Biodex® Corp., Shirley, NY, USA). Functional outcomes of the lower extremity were measured with hop test and International Knee Documentation Committee Scoring System (IKDC) and the fear of movement was assessed with Tampa Kinesiphobia Scale. All measurements were applied at postoperative first year. Kruskal Wallis test was used for the comparison of variables between groups.

RESULTS: The quadriceps indices were found similar at 60°/sec (p=0.308) and 300°/sec (p=0.716) angular speeds between the groups. There were no differences in IKDC (p=0.237) and fear of movement (p=0.059) scores between groups.

CONCLUSIONS: Patients undergoing primary ACL reconstruction with ATT allograft, HT or QT autografts had satisfactory and similar objective and subjective clinical results. Functional rehabilitation would be the key factor to improve the functional status for different type of graft use in ACL reconstruction patients.

3338 Board #243 June 2 2:00 PM - 3:30 PM
Effects of Tourniquet Use during Total Knee Arthroplasty on Global Cytokine Changes Associated with Ischemia Reperfusion Injury

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(No relationships reported)

Purpose: The use of tourniquets during total knee arthroplasties (TKA) has been debated given the possibility that prolonged application of a tourniquet may result in ischemia-reperfusion injury (IRI), potentially contributing to post-operative muscle atrophy. The goal of this study was to elucidate the influence that tourniquet use may have on the induction of IRI in muscle tissue following TKA surgeries. We hypothesized that tourniquet use during TKA causes larger global increases in pro-inflammatory cytokines, indicating the occurrence of IRI.

Methods: 50 patients undergoing TKA surgeries were separated into 3 groups: no tourniquet (NoT; n=17), operative tourniquet (OT; n=15), and tourniquet during implant cementation (TDC; n=18). Induction of IRI was evaluated by measuring changes in fifteen cytokines present in blood samples collected from an antecubital vein immediately before and after surgery. Pre- to post- surgery changes in cytokine concentrations were compared between groups.

Results: Compared to immediately before surgery, cytokine levels generally decreased after surgery in the NoT and OT groups, but increased in the TDC group. Despite these differences, pre- to post- operation changes in IL-1β, IL-10, IFNγ, IL-4, IL-5, IL-7, IL-8, Eotaxin, IP-10, MCP-1, MIP-1α, MIP-1β, RANTES, and TNFα concentrations were not significantly different between groups. However, significant differences were found for IL-12, a pro-inflammatory cytokine (p=0.01). After surgery, IL-12 concentrations decreased in the NoT (pre: 72.8 ± 89.8 pg/mL, post: 41.3 ± 28.6 pg/mL) and OT (pre: 92.1 ± 142.2 pg/mL, post: 82.9 ± 167.4 pg/mL) groups, and increased in the TDC group (pre: 52.0 ± 85.1 pg/mL, post: 63.0 ± 116.7 pg/mL). However, Cohen's d effect sizes between groups were small (NoT vs OT = 0.08; NoT vs TDC = 0.12; OT vs TDC = 0.18).

Conclusions: Using global changes in pro-inflammatory cytokine levels as an indicator of IRI, these data suggest that the use of a tourniquet does not significantly contribute

to induction of IRI in TKA surgeries. However, additional studies comparing local plasma cytokine changes near the tourniquet site and utilizing larger sample sizes are necessary to determine if tourniquets should be used in TKA without inducing IRI.

3339 Board #244 June 2 2:00 PM - 3:30 PM
To What Extent is Weakness after ACL Reconstruction due to Central Inhibition versus Muscle Atrophy? A Magnetic Stimulation Study.

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PURPOSE: Quadriceps weakness is common after ACL reconstruction. Studies using electrical stimulation suggested that limited central nervous activation may have a role in the weakness. The purpose of this study was to test for deficits in quadriceps strength and activation, using magnetic stimulation, in patients at 3 mo and 6 mo post ACL reconstruction.

METHODS: Ten patients (7M/3F; age 34.7±8.3 yrs; BMI 26.0±4.8 kg/m²) who had ACL reconstruction with BPTB autograft were recruited. Patients underwent standard physical therapy after surgery. At 3 and 6 mo post-op, patients' knee extension maximum voluntary isometric contraction (MVIC) was measured. All tests were done bilaterally at 30° and 65° of knee flexion on a dynamometer. MVIC was augmented with a superimposed burst magnetic stimulation to the femoral nerve. The stimulator coil was placed over the femoral nerve and a 3-sec, 35-Hz pulse train was delivered at 100% intensity after 2 sec of MVIC. Peak torque before (T_{pre}) and after (T_{post}) stimulation delivery was measured, and central activation ratio (CAR) was calculated using the formula: CAR = T_{pre}/T_{post}. MVIC and CAR were analyzed using 3-way repeated measures ANOVA (time x side x angle).

RESULTS: Patients had marked deficits in MVIC (side effect P<0.001), with improvement from 3 mo to 6 mo (side x time P=0.015) that was more apparent at 65° vs 30° (side x time x angle P=0.022): at 3 mo, MVIC deficit was 34.6±14.1% at 30° and 34.7±8.6% at 65°; at 6 mo, MVIC deficit was 27.0±13.0% at 30° and 22.0±12.2% at 65°. CAR was lower on the involved side vs the noninvolved side (side effect P=0.02) and this effect was more prominent at 3 mo vs 6 mo (side x time P=0.026): combining the angles, mean CAR on the involved and noninvolved sides, respectively, was 91.4±7.6% and 97.5±5.3% at 3 mo, and 93.0±7.8% and 95.8±6.8% at 6 mo. **CONCLUSIONS:** At 3 and 6 mo after ACL reconstruction, there were significant deficits in quadriceps strength and activation. The levels of activation were high (>90%) for both sides at both time points. The substantial strength deficits at these postoperative time points may be largely due to muscle atrophy with only a limited contribution from central inhibition. Rehabilitation interventions to normalize quadriceps strength should emphasize hypertrophic stimuli as opposed to neuromuscular activation strategies.

3340 Board #245 June 2 2:00 PM - 3:30 PM
Magnetic Resonance Imaging Detection of Meniscal Injuries in Pediatric and Adolescent Patients with ACL Tears

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PURPOSE: Prior research has shown decreased sensitivity and negative predictive value of meniscal injury detection using MRI in the setting of acute anterior cruciate ligament (ACL) tears in an adult population. This has yet to be investigated in a younger population. The objective of this study was to assess the diagnostic ability of MRI in detecting meniscal injuries for pediatric and adolescent patients undergoing arthroscopic ACL reconstruction.

METHODS: From August 2012 - June 2016, 175 arthroscopic ACL reconstructions were performed at our institution. A total of 83 patients were included in our final analysis. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of meniscal tears on MRI were calculated. ANOVA and two-sample t-tests were used to compare event rates between medial meniscal (MM) and lateral meniscal (LM) tears.

RESULTS: The median age of our cohort was 15 (range: 7-18). Figure 1 shows the accuracy of MRI for patients with arthroscopically confirmed meniscal tears with a concurrent ACL tear. There were 25 (30.1%) cases in which a meniscal injury not detected on MRI was discovered arthroscopically (MM: 5 knees, LM: 19 knees, both: 1 knee). These false negative MRIs were more commonly a LM tear (p<0.001) and of the vertical tear type (13/25 tears, 52.0%). The posterior horn was the most common

location for a missed LM tear (p<0.001). In comparison to an adult cohort studied previously (median age: 32, range: 16-61), the MRIs of our patients with LM tears had a decreased NPV (p<0.001).

CONCLUSIONS: For our younger patients with ACL injuries, there were 25 (30.1%) cases in which preoperative MRI failed to detect a meniscal tear. LM tears in the posterior horn were more commonly missed on MRI versus MM tears. Also, a vertical tear was the most commonly missed tear type. In comparison to an adult cohort, the MRIs of pediatric and adolescent patients with LM tears had a decreased NPV.

Figure 1: Sensitivity, Specificity, PPV, and NPV of 1.5T and 3.0T MRI

MRI Finding	Arthroscopic Finding			Total
	Tear Present (+)	Tear Absent (-)		
Tear Present (+)	47	5		52
Tear Absent (-)	25	6		31
Total	72	11		83
Sensitivity	65.3%			
Specificity	54.5%			
PPV	90.4%			
NPV	19.4%			

3341 Board #246 June 2 2:00 PM - 3:30 PM
Body Mass Index is Associated with Cartilage Turnover in Individuals with ACL Reconstruction

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Obesity is a risk factor for idiopathic knee osteoarthritis, yet little is known regarding how body mass index (BMI) affects metabolic changes that increase the risk of post-traumatic osteoarthritis (PTOA) **PURPOSE:** Determine the association between BMI and the type II cartilage turnover ratio in individuals with a unilateral anterior cruciate ligament reconstruction (ACL). **METHODS:** Forty-five individuals with unilateral ACLR (31 female; 21.8±2.9 yr; 25.6±4.2 kg/m²; 48.3±38.2 months post ACLR) that had been cleared for unrestricted physical activity participated in this study. Physical activity level prior to ACLR (Tegner score) as well as current level of disability (International Knee Documentation Committee [IKDC]) were assessed. BMI (kg/m²) was calculated from objectively measured height and mass. Following 20 min of rest, serum was obtained to measure Type II cartilage turnover (C2C:CPII), which was quantified as the ratio of degradation (collagen type II cleavage product [C2C]) to synthesis (collagen type II C-propeptide [CPII]). Sera were put on ice to clot then spun at 4000 rpm at 4°C for 10 minutes. After centrifugation, sample aliquots were stored at -80° until analysis. Spearman rank order correlations (ρ) were used to determine the bivariate association between BMI and C2C:CPII. Secondary, partial correlations (r) were used to determine associations after controlling for covariates (IKDC and Tegner). All analyses were then repeated with males and females assessed separately. **RESULTS:** Overall greater BMI was associated with greater C2C:CPII (ρ =0.30, P=0.048). After controlling for covariates, we found a similar association between BMI and C2C:CPII (Partial r=0.42, P=0.009). In females, greater BMI was moderately associated with greater C2C:CPII before (ρ =0.51, P=0.004) and after controlling for covariates (Partial r=.50, P=0.01). There was no association between BMI and C2C:CPII (ρ =0.03, P=0.93) in males only. **CONCLUSIONS:** Greater BMI may influence greater collagen turnover in those with ACLR, potentially increasing the risk for developing deleterious cartilaginous alterations that are consistent with PTOA onset. By maintaining a lower BMI or reducing BMI, individuals, especially females, may be able to positively affect the cartilage turnover ratio following ACLR.

3342 Board #247 June 2 2:00 PM - 3:30 PM
Quadriceps Muscle Strength Recovers Faster Than Hamstring Strength After ACL Reconstruction With Hamstring Tendon Autograft

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Strength measurements are extensively performed following anterior cruciate ligament (ACL) reconstruction to better understand the strength recovery of the patients over time and to make the patients return to their sports safely.

PURPOSE: The aim of this study was to investigate the quadriceps and hamstring strength recovery after ACL reconstruction with hamstring tendon autograft (HTG). **METHODS:** Fifty individuals (Age: 27.3±7.6 years; body mass index: 24.8±3.7 kg/m²) who had undergone ACL reconstruction with HTG were included in the study. All participants attended a regular six-month rehabilitation program. Quadriceps and hamstring isometric strength was measured at first, third and sixth months after surgery. Limb symmetry index [(involved/uninvolved limb strength)×100] (LSI) was used to define the muscle strength recovery. Two-way (muscle X time) repeated measures of ANOVA was performed for statistical analysis.

RESULTS: Muscle by time interaction was found significant for LSI ($F_{(2,98)}=4.43, p=0.01$). Quadriceps LSI was lower than hamstring LSI at first month ($p=0.02$) but no difference was observed between quadriceps and hamstring LSI at third ($p=0.62$) and sixth months ($p=0.64$) postsurgery. Both quadriceps and hamstring LSI gradually increased after ACL reconstruction ($p<0.001$). (Table 1)

Table 1. Quadriceps and hamstring strength recovery after ACL reconstruction

	First month	Third months	Sixth months	p value
Quadriceps (%)	49.35±17.17	79.27±14.97	84.09±12.55	<0.001
Hamstring (%)	55.04±12.13	77.87±12.19	85.19±11.29	<0.001
p value	0.02	0.62	0.64	Not applicable

CONCLUSION: Quadriceps strength decrement was greater than the hamstrings' at first month postsurgery when compared to contralateral limbs' strength. However, quadriceps and hamstring LSI's were found similar at third and sixth months postsurgery which showed quadriceps strength recovered faster than hamstring strength. Although the participants attended a regular ACL neuromuscular training program, their LSI for strength could not reach 90% at 6 months after surgery when patients usually return to sport.

3343 Board #248 June 2 2:00 PM - 3:30 PM

Knee Flexor Strength and Activation Levels During Testing After ACL Reconstruction with a Semitendinosus Graft.

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PURPOSE: Assessment specific to medial (MH) vs. lateral (LH) hamstrings may be indicated after graft harvesting from semitendinosus for anterior cruciate ligament (ACL) reconstruction. The purpose of the study was to assess strength and muscle activation levels of MH and LH during isometric strength testing where knee flexion was coupled with medial (MR) vs. lateral (LR) rotation of the tibia in elite athletes 1-5 years after ACL reconstruction, contrasting outcome measures with the non-surgical limb.

METHODS: Maximal isometric strength of 35 athletes (18 male, 17 female) was tested with a Kin Com dynamometer at 40° and 80° of knee flexion. Participants maintained concurrent volitional MR or LR of the tibia to facilitate preferential activation of the MH and LH components, respectively. Maximum values within each of a total of four 5 second trials were thereby collected for both lower limbs. Pre-amplified, wireless surface electrodes were used to collect muscle activity of each hamstring component during testing. Maximum values of smoothed data were identified within each test condition, the highest of which was used for normalization purposes. A mixed model repeated-measures ANOVA was used for analysis and alpha set at 0.05.

RESULTS: A significant interaction of limb by test position by sex was found for strength ($p=0.016$), as males had lower strength values for the surgical side only at 80° whereas females had lower strength at both 80° and 40° with no effect of tibial rotation. Muscle activation data did not specifically reflect this interaction found in strength measures. However, analysis of MH data showed a significant test position by sex interaction ($p=0.003$) across limbs, due to lower MH activation levels found at 40° compared to 80°, a difference not found for males.

CONCLUSIONS: Males and females may use different strategies during rehabilitation. Inhibition of MH activation may contribute to lower strength output during testing and influence readiness of return-to-sports.

3344 Board #249 June 2 2:00 PM - 3:30 PM

The Modified Thomas Test: Does It Matter How It Is Performed?

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The Modified Thomas Test is a clinical physical therapy test used to examine hip extension, typically in patients presenting with low back or hip pain. Multiple versions are described, with little consensus on which is the most useful with respect

to measurement error, practicality, and patient comfort. **PURPOSE:** To compare the repeatability of the most commonly described variations of the Modified Thomas Test. **METHODS:** Two trained, blinded testers, measured hip extension in 10 volunteers (age: 20-30 years), over two consecutive days. For each volunteer, testers performed six different versions of the Modified Thomas Test. Test variations included: two start positions (perched or supine on plinth), and three positions of the contralateral hip (hip ninety degrees, lumbar spine neutral or hip fully flexed). Additionally, two methods of measuring the hip angle with an inclinometer were used (lateral or anterior thigh). **RESULTS:** No differences were observed between testers, sides, or measurement method, however significant differences in start position (perched:17°; supine:14°) and contralateral hip position (hip ninety:21°; lumbar spine neutral:15°; hip fully flexed:10°) were observed. Notably, there were no differences in repeatability of methods or testers, with mean errors between 3.4 - 4.0° for repeated measures of all test versions. **CONCLUSIONS:** Given that the different versions of the Modified Thomas Test exhibit similar levels of repeatability, it seems reasonable to recommend that clinicians use the simplest, safest and most comfortable version of the test. That is, having patients starting by lying supine on the bed and holding their contralateral hip in 90° of flexion.

3345 Board #250 June 2 2:00 PM - 3:30 PM

Competitive Bass Anglers: A New Concern in Sports Medicine

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Background: Angling is a popular pastime for many Americans. Competitive angling involves sport fishing against other anglers while targeting a specific species of fish. Due to the rapidly growing popularity of high school competitive bass angling in Alabama and the similarity of the casting motion to that of overhead athletes, we sought to examine the prevalence of sports-type injuries in this population.

Hypothesis: High school anglers who regularly compete will have a high prevalence of sports-type injury; likely due to the similarity of casting motion to the motions of many overhead athletes.

Study Design: Cross-sectional study

Methods: In spring 2016, an anonymous survey was distributed across two large scale competitive high school fishing tournaments, allowing for a broad sampling of anglers throughout the state of Alabama. Survey items included demographic information, relevant past medical history, and various pains associated with the shoulder, elbow and wrist. Results were recorded and analyzed electronically using Microsoft Excel and IBM SPSS statistical software.

Results: A total of 257 surveys were recorded. The mean age of participating anglers was 15 years old. The majority (42%) of anglers fished year round. On average, anglers casted nearly 1,000 more times while competing versus fishing recreationally. Approximately 15% of anglers experienced shoulder, elbow, and wrist pain. The most common factors associated with pain

included higher tournament cast counts, number of competitive years, number of tournaments/year, number of tournaments, and use of light weight lures. **Conclusion:** Roughly 15% of high school competitive anglers experience upper extremity pain. Knowledge of angling factors associated with pain allow for the creation of a modifiable routine to help reduce pain in affected anglers and prevent pain in healthy anglers.

3346 Board #251 June 2 2:00 PM - 3:30 PM

Comparison Study On Early Postoperative Functional Exercises Of Simple Olecranon Fracture

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Olecranon fracture of the elbow joint is one of the common injuries, especially intra-articular fracture. Due to the anatomical characteristics of the elbow joint, it is easy to cause dysfunction after trauma. Therefore, early postoperative rehabilitation can maximize the recovery of limb function. Early and appropriate active or passive joint activities, not only can draft joint capsule, ligaments, tendons and soft tissue surrounding the joint but also can prevent contracture and improve joint nutrition metabolism. **Purpose** Currently, both active functional exercise and passive functional exercise are used clinically, but there is no uniform standard about how to practice early functional exercise of postoperative olecranon fractures properly. The purpose of the study further compared active and passive functional exercise in order to choose the appropriate training method. **Methods** Seventeen postoperative patients (age: 45.3±15.7 years, 8 males, 9 females) with simple olecranon fractures were randomly divided into two groups (Group A: 9 cases; Group P: 8 cases) and evaluating effects of the two groups with JOA Elbow-Performance after different functional trainings during early rehabilitation stage, respectively (A: active functional training; P: passive functional training). **Results** All 17 subjects completed the study. On the second postoperative day (1st assessment), all patients had to test JOA. The total JOA scores

of two groups showed that there was no significant difference between two groups (A: 49.2 ± 9.3 , poor; P: 54.6 ± 10.9 , poor, $p = 1.09 > 0.05$). Over four-week-exercise period (2nd assessment), A was better than P. There was a significant difference of JOA scores (A: 94.3 ± 2.9 , excellent; P: 79.3 ± 6.9 , good, $p = 0.00 < 0.01$). However, the improvement rates of A and P had no significant difference ($p = 0.26 < 0.05$). Improvement rate = (2nd assessment - 1st assessment) / 1st assessment. **CONCLUSION** Both active functional training and passive functional training are beneficial to postoperative patients with simple olecranon fractures, but active functional training method is the first choice.

3347 Board #252 June 2 2:00 PM - 3:30 PM

Sedentary Behaviour in People with Total Knee Arthroplasty and Those Awaiting Surgery

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High levels of sedentary behaviour are associated with functional decline, elevated blood pressure, weight gain, and increased risk for metabolic conditions in people with osteoarthritis independent of time spent in moderate-to-vigorous physical activity. While physical activity levels do not change substantially after total knee arthroplasty (TKA), the effects on sedentary behaviour have not been investigated. **PURPOSE:** To compare sedentary behaviour patterns in people with osteoarthritis awaiting TKA and individuals recovered from TKA. **METHODS:** Sedentary behaviour was measured with the 7-day Sedentary and Light Intensity Physical Activity Log (SLIPA), the Longitudinal Aging Study Amsterdam Sedentary Behavior Questionnaire (LASA-SB), and 7 day accelerometry (ActiGraph GT3X+, < 100 activity counts/min) in 32 participants awaiting TKA and in 38 individuals one year after TKA (69.9 ± 5.3 SD and 67.9 ± 7.3 yrs of age respectively). T-tests and Mann-Whitney Rank Sum tests were used to detect differences between groups. A one-way RM ANOVA was used to detect differences between measures of sedentary time. **RESULTS:** There were no differences between pre- and post-operative groups for GT3X+ wear time (13.9 ± 1.1 hours/day vs. 14.4 ± 1.1 respectively, $p = 0.09$), total sedentary time (9.3 ± 1.4 hours/day vs. 9.2 ± 1.4 , $p = 0.62$), and number of sedentary bouts/day ≥ 30 min in duration (median 3.4 [1.9 IQR] vs. 3.1 [2.0], $p = 0.37$). In addition, SLIPA and LASA-SB scores did not differ between groups ($p = 0.17$ and $p = 0.14$ respectively). Measures of sedentary time (combined groups) were all statistically different from one another: GT3X+ 9.2 ± 1.4 hours/day, SLIPA 6.7 ± 2.5 hours/day, LASA-SB 10.3 ± 3.7 hours/day (all comparisons $p < 0.05$). **CONCLUSIONS:** Self-reported and objective measures of sedentary behaviour do not differ between people on the wait-list for TKA and one-year recovered from TKA. This suggests that after TKA there is still an increased risk for physical disability and cardiovascular health conditions related to high levels of sedentary behaviour. In addition to promoting increased physical activity after TKA, individuals would benefit from education regarding strategies to reduce sedentary behaviour.

F-62 Free Communication/Poster - Performance

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3348 Board #253 June 2 3:30 PM - 5:00 PM

Variations in Verbal Encouragement Modify Isokinetic Performance at High Speeds

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(No relationships reported)

Verbal directions and encouragement are common in exercise testing; however, the verbiage used during each is rarely controlled despite the likelihood it may affect the participant's performance. **PURPOSE:** To examine the effects of four variations in verbal encouragement verbiage on isokinetic performance during alternating concentric knee extensions and flexions. **METHODS:** Fourteen healthy participants (8M, 6F, height = $1.73 \pm .09$ m, mass = 70.0 ± 20.2 kg, age = 24.2 ± 3.9 y) completed four isokinetic knee extension and flexion testing sessions on a Biodex isokinetic dynamometer. Each session consisted of 5 repetitions at $1.05 \text{ rad}\cdot\text{s}^{-1}$ ($60^\circ\cdot\text{s}^{-1}$), 10 reps at $3.14 \text{ rad}\cdot\text{s}^{-1}$ ($180^\circ\cdot\text{s}^{-1}$), and 15 reps at $5.24 \text{ rad}\cdot\text{s}^{-1}$ ($300^\circ\cdot\text{s}^{-1}$), separated by 5 min passive recoveries. Participants received the same methodological instructions before each session. Variations in verbal encouragement, however, were randomized during each testing session using the following statements: (1) "as fast as you can" (FAST); (2) "as hard as you can" (HARD); (3) "as hard and as fast as you can" (BOTH); and (4) no verbal encouragement (NONE). Repeated measures ANOVAs were conducted to evaluate differences in isokinetic performance metrics. **RESULTS:** FAST produced

significantly higher total work ($M_{\text{diff}} = 172.2$, $SE = 44.3$, $p = .011$), relative work (work/body weight) ($M_{\text{diff}} = 9.0$, $SE = 2.3$, $p = .009$), work first third ($M_{\text{diff}} = 71.0$, $SE = 19.2$, $p = .016$) and average power ($M_{\text{diff}} = 32.0$, $SE = 7.5$, $p = .006$) than NONE during knee flexion at $300^\circ/\text{s}$, with no further differences for any speed or movement direction.

CONCLUSION: Verbal encouragement stating "as fast as you can" is recommended to increase work and power during high speed isokinetic knee testing since it consistently produced the best performances.

3349 Board #254 June 2 3:30 PM - 5:00 PM

Physiological Adaptation, Safety And Finishing Rate To Half Ironman Training For Age Group Triathletes

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Within the past few years, long distance triathlon has gained in popularity amongst the general population, which is by itself good news, since it leads to adopting an active lifestyle. Amateur athletes engaged in such a demanding challenge must prepare themselves wisely in order to achieve their goals without injury. Coaches establish training programs based upon their knowledge, personal experience and on approved training principles. Up to now, no training programs or methods have been evaluated scientifically in order to evaluate its effect on health and on success rate for age group athletes. **PURPOSE:** To evaluate a triathlon training program on the success rate of completing a half Ironman in neophyte amateur athletes. **METHODS:** A triathlon training program was conducted by the research team from February to June 2016 to follow age group athletes for their preparation to the Mont-Tremblant half Ironman. The training program adapted by a certified coach/registered kinesiologist included endurance and strength training in specific areas of running, cycling and swimming. Each participant did a full fitness assessment that included body composition, aerobic and musculoskeletal testing in January and two weeks prior to the event. Training volume was noted each week and injuries were reported to the team's physical therapist. **RESULTS:** Out of the 31 amateur triathletes (19 Males and 12 Females; mean age of 40 ± 9 years old; body weight of 74 ± 12 kg and a height of 172 ± 10 cm), only one did not complete the event. For a mean training volume of 410 ± 201 min per week, the mean finishing time was 6 hours 28 minutes and two participants obtained a qualification for the World Championships. Maximal oxygen consumption (46 ± 8 to 49 ± 7 ml/kg/min, $p < 0.05$) as well as maximal power output (293 ± 62 to 308 ± 57 W) were significantly increased by the training program. Ventilatory thresholds were also significantly increased (158 ± 40 to 175 ± 40 W, $p < 0.05$). No significant changes were observed in body weight (% of body fat and % lean mass), maximal grip strength and flexibility tests. Seven cases of minor injuries were reported during the six months of training. **CONCLUSION:** A 24 week training program adapted by a certified coach/registered kinesiologist is safe and provides a high success rate for amateur athletes that aim to finish a half-Ironman triathlon.

3350 Board #255 June 2 3:30 PM - 5:00 PM

Kinematics of Softball Hitting Off of a Tee versus Front Toss

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(No relationships reported)

Hitting a baseball or softball is one of the most difficult skills in sport. Use of a batting tee as a training technique is viewed as principle for establishing and improving basic fundamentals of hitting.

PURPOSE: To determine lower extremity (knee flexion, pelvis rotation) and trunk (flexion, lateral flexion and rotation) kinematics hitting off a tee and hitting front toss. It was hypothesized that there would be no difference in lower extremity and trunk kinematics between the two conditions. **METHODS:** Nineteen National Collegiate Athletic Association (NCAA) Division I collegiate softball players (20.51 ± 1.53 yrs; 68.99 ± 7.68 kg; 166.87 ± 6.00 cm) participated. Participants were instructed to execute five maximal effort swings hitting from a tee and five maximal effort swings hitting front toss from a pitcher at 9.14 m (30 ft). The hitting motion was divided into five events: stance (ST), load (LD), foot contact (FC), ball contact (BC), and follow-through (FT). **RESULTS:** Data failed the test of normality; therefore, a Wilcoxon signed-rank test was used to determine if there were median differences in hitting kinematics between two hitting conditions during each hitting event. Results revealed kinematic differences in trunk flexion at load ($z = -2.55$, $p = 0.01$). No other significant results were found between hitting events and examined variables during

each condition. **CONCLUSION:** Though there were minimal kinematic differences in the two hitting conditions, these differences were at swing initiation and not exhibited beyond ball contact. These findings are beneficial for this population as decreased variability in swing mechanics across various conditions is desired. Therefore, it is suggested that future research continue to examine hitting mechanics from not only a kinematic approach but also from a kinetic and performance approach.

3351 Board #256 June 2 3:30 PM - 5:00 PM
Handedness (right Or Left Handed) Effect On Bilateral Transfer To Non-dominant Hand

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Bilateral transfer is a common source of experimental study in motor learning. It is suggested that successful transfer from a non-dominant hand to dominant exists in the area of speed. However, there may be a difference between left and right-handed individuals in the interhemispheric transmission of visuomotor information. Left handed may have lower accuracy in trials.

PURPOSE: The focus of this work was to quantify the amount of bilateral transfer of subjects and determine if there is preferred dominant hand for the greatest amount for transfer.

METHODS: Participants first completed a handedness survey to establish laterality. They were then asked to trace a printed star pattern as quickly and accurately as possible while gazing at a mirror image of the pattern. The pattern for tracing was as follows: 1 time with non-dominant hand, 7 times for dominate hand, 1 time for non-dominant hand with 30 second breaks in between. Errors were measured by marks made outside of the star pattern. The distance outside the line was measured with a ruler.

RESULTS: A total of 14 college age students were enrolled in this study, 50% (N=7) were female, and 35% (N=5) were left handed. Significant differences were found in the pre to post test scores in both the number of errors (means \pm standard deviation, significance) pre = 18.14 \pm 8.68, post = 6.93 \pm 4.12, $p=0.0001$ and time to complete the task in minutes (means \pm standard deviation, significance) pre = 1:48 \pm 0:03, post = 1:00 \pm 0:02, $p=0.005$. When stratified by dominant hand (left or right), only time to complete task was significantly different ($p=0.04$); whereas, the number of errors was not significantly different ($p=0.09$).

CONCLUSIONS: This study suggests that there may be significant skill transfer from the dominant to non-dominant hand. It does appear that perfection of a task (number of errors) is as easily transferred, regardless of which hand is dominant. The later may have implications for athletics whose participation in sports requiring perfection of movement is important.

3352 Board #257 June 2 3:30 PM - 5:00 PM
The Physiological Responses Of A Mandibular Repositioning Mouthguard And Their Effects On Athletic Performance

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PURPOSE: The purpose of this study is to understand the physiological responses of a mandibular repositioning mouthguard on athletic performance. We hypothesize that MG designs that produce anatomically desirable jaw adjustments for an increase in the upper airway may have the ability to elicit ergogenic effects thereby improving respiratory capacity and athletic performance.

METHODS: Twenty-four active participants volunteered for this study and were randomly counterbalanced submitted to six performance tests and 3D volumetric imaging with both conditions, without mouthguard (NMG) and with the mouthguard (MG).

RESULTS: The results demonstrated that the mandibular repositioning mouthguard has a significant effect on both aerobic ($p < 0.01$) and anaerobic performances ($p < 0.05$). The MG condition increased the pulmonary ventilation by 9% and maximal aerobic capacity by 5%. In addition, the MG condition increased anaerobic power production by 3% and decreased the 20- and 40-meter sprint time by 4% and 2% respectively. All results were statistically significant ($p < 0.05$). Imaging results demonstrated a 7% increase of the upper airway volume when comparing the MG to NMG conditions ($p < 0.05$).

CONCLUSIONS: Our results support our hypothesis that jaw-repositioning custom-made mouthguards can induce an increase in oropharynx width in the upper airways and these changes may be the cause for an increase in athletic performance.

3353 Board #258 June 2 3:30 PM - 5:00 PM

Inspiratory Muscle Performance is Significantly Related to Agility and Speed in Collegiate Tennis Players

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The Illinois Agility Test (IAT) measures sport agility by combining multi-directional skills with sprints. The Test of Incremental Respiratory Endurance (TIRE) evaluates inspiratory muscle strength and endurance via Maximal Inspiratory Pressure (MIP) and Sustained Maximal Inspiratory Pressure (SMIP). The relationship between athletic agility and inspiratory muscle performance (IMP) is unclear. **PURPOSE:** To examine the association between IMP and IAT results of Collegiate Tennis Players (CTP). **METHODS:** IMP of 7 male CTP (mean \pm SD age = 20.3 \pm 0.8 years, height = 186.2 \pm 3.4 cm, and weight = 77.7 \pm 6.5 kg) and 8 female CTP (age = 20.9 \pm 0.8 years, height = 168.9 \pm 6.2 cm, and weight = 64.7 \pm 6.5 kg) was assessed via TIRE with the best of 3-5 trials providing MIP [measured from residual volume (RV)] and SMIP (measured from RV to total lung capacity). The IAT was performed twice with a 10-min rest between trials. The first and last intervals of the IAT comprised sprints to and from cones set 10 m apart, while the second interval involved weaving back and forth through four cones placed 3.3 m apart. A custom mobile app and tablet were used to time each IAT interval. **RESULTS:** MIP and SMIP of men were significantly ($p < .05$) greater than women (134.5 \pm 19.4 vs. 99.5 \pm 35.3 cm H₂O and 791.1 \pm 193.9 vs. 471.7 \pm 162.8 PTU, respectively). Men were significantly ($p < .05$) faster during all IAT intervals and had a significant ($p < .05$) negative correlation between MIP and last sprint times of both trials ($r = -.77$ and $-.89$, respectively). In women, significant ($p < .05$) negative correlations existed between weaving time and SMIP of the first trial ($r = -.77$) and MIP and SMIP of the second trial ($r = -.93$ and $-.89$, respectively). **CONCLUSIONS:** IMP was significantly correlated to IAT time in CTP but gender differences existed. The correlation between MIP and last sprints in men suggests that men depend on IMP for speed. MIP and SMIP were related to the weave interval in women suggesting that women depend more on IMP for agility. Stronger correlations existed between IMP and IAT during the second IAT trials suggesting that greater IMP provides less susceptibility to performance decrement associated with fatigue. Greater IMP may provide greater balance and contribute to greater agility in women and speed in men, resulting in improved performance in CTP.

3354 Board #259 June 2 3:30 PM - 5:00 PM

An Analysis of Governed vs Different Focal Points on Vertical Jump Performance in Males

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Previous research has suggested that overhead goals (i.e. overhead focal point) can have a positive impact on drop jump performance. It stands to reason that with an increase in jump height, there is an increase in power output. However, there appears to be limited research on focal points and their impact on vertical jump (VJ) performance. **PURPOSE:** To compare the potential differences between no set focal point, a set focal point (i.e. governed), and a sport specific focal point on VJ performance in no less than average fit males. **METHODS:** Thirty-four average fit college aged males participated in this study. After descriptive data and reach height was recorded, subjects completed an 8-min warm-up on a leg cycle ergometer followed by 4-min of passive recovery (i.e. standing still). Subjects then completed 4 practice (i.e. familiarization trials) counter-movement jumps (CMJ) utilizing a VJ measurement device. Upon completion of 2-min of passive recovery the subjects then completed, in a counter-balanced order, 3 different jump series consisting of 4 maximal effort CMJs with 30-sec between each jump. The various jump series were as follows: No Set Focal Point (FPN), Focal Point (FP), and Sport Specific Focal Point (FPS). The highest jumps for FPN, FP, and FPS were compared using ANOVA statistical techniques with an alpha level of 0.05. **RESULTS:** FPS (69.19 \pm 9.40 cm) was significantly different ($p = 0.001$) than FPN (67.77 \pm 10.08 cm). Also, FPS was significantly different ($p = 0.0003$) than FP (67.92 \pm 9.92 cm). Conversely, there was no significant difference ($p = 0.308$) between FPN and FP. **CONCLUSION:** The results suggest that individuals who use a sport specific focal point tend to jump higher than those who use no set focal point or a governed focal point. Therefore, it may be prudent to suggest that a sport specific focal point, as selected by the subject, should be utilized during VJ assessment. Future studies should assess the impact of a sport specific focal point on VJ performance using male athletes who participate in sports with jumping movements.

3355 Board #260 June 2 3:30 PM - 5:00 PM

The Effect of Sport Specific, Governed, and Non-Controlled Focal Point on Female Vertical Jump PerformanceRobert T. Sanders, Andy Bosak, Christopher Carver, Austin Smith, Jonathan Houck, Matthew Sokoloski, Jared Feister. *Liberty University, Lynchburg, VA.* (Sponsor: James Schoffstall, FACSM)*(No relationships reported)*

Few studies have assessed factors that directly impact vertical jump performance in females. Prior studies investigated varying warm-up protocols as a means to enhance jump performance without seeking to manipulate the target (i.e. sport specific focal point, non-controllable, or governed focal point) that the female subjects focused on to complete the jumps. A previous focal point vertical jump study utilizing male subjects suggested that vertical jump performance increased when using a sport specific focal point. However, this has not been assessed using a female population to the best of the researchers' knowledge. **PURPOSE:** To determine if a sport specific focal point contributes to an increase in jumping performance compared to non-controllable (i.e. no set focal point), and a governed (i.e. set focal point) in averagely fit females. **METHODS:** Thirty averagely fit female participants had descriptive data collected (i.e. age, HT, WT, BF). Participants completed an 8 min warmup, which avoided static movements, and then received a 4 min passive recovery. After completing four familiarization jumps in a counter movement manner participants completed four jumps per each jump trial with thirty seconds of rest between jumps and 2 min of passive rest between each trial. The jump series protocol consisted of three separate counterbalanced trials which included a sport specific (FPS), governed (FP), or non-controllable focal point (FPN). FPN, FP, FPS were compared using ANOVA with significance determined at an alpha level of 0.05. **RESULTS:** FPS (51.56 cm 8.69 cm) was significantly different ($p = .0005$) versus FP (50.67 cm 8.70 cm) and FPN (50.50 8.83 cm). Also, there was no significant difference ($p = .245$) between FPN and FP. **CONCLUSION:** It appears that using a sport specific focal point may elicit a higher jump in averagely fit females as compared to the jumps when females utilized a non-controlled focal point or a governed focal point. Further research is necessary in order to evaluate the use of a sport specific focal point on vertical jump performance with females who participate in jumping sports (i.e. basketball, volleyball) at the high school, collegiate, and professional level.

3356 Board #261 June 2 3:30 PM - 5:00 PM

Is Breakthrough Power an Effective Assessment of Team Performance of University Rugby Football ?Masanori Takemura¹, Koji Kurita², Setsuo Komatsu³, Arijit Banerjee⁴, Hayato Yamamoto⁵, Mitsuharu Kaya⁶, Junzo Tsujita⁷. ¹*Ichihashi Clinic, Kobe, Japan.* ²*Physical Conditioning Production, Osaka, Japan.* ³*Tenri University Rugby Football Club, Tenri, Japan.* ⁴*Amagasaki-city Board of Education, Amagasaki, Japan.* ⁵*Yamamoto Trainers Project, Kyoto, Japan.* ⁶*Hyogo University of Health Science, Kobe, Japan.* ⁷*Institute of Health & Sports Medical Science, Osaka, Japan.*
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PURPOSE: We reported in a previous study (ACSM's 60th Annual Meeting) that kinetic energy ($\text{kg}\cdot\text{m}^2/\text{s}^2$) calculated from body weight (kg) and 30m sprint (m/s; maximum value), called breakthrough power (BT), was good as a performance assessment of running with body contact during rugby. The purpose of this study was to determine if the BT of individual players can explain team performance in rugby football.

METHODS: For four years the top level teams of university rugby football in Japan were investigated retrospectively (the number of players of 86 [regular 16, reserve 70] in 2010-11 season, 60 [18, 42] in 2011-12, 96 [19, 77] in 2012-13, and 113 [19, 94] in 2013-14). Every season, number of players of regular and reserve (individual player's performance level) were included in the high BT group (number of the regular players of the season) and in the low BT group. Odds ratio and Fischer's exact test were calculated, and compared to team performance of the Japan university championship. **RESULTS:** Odds ratio (p value as Fischer's exact test) of each season was 28.6 (0.00) in 2010-11, 19.24 (0.00) in 2011-12, 8.40 (0.00) in 2012-13, and 2.88 (0.09) in 2013-14. The adjustment of odds ratio that standardized the player total number of each season to 60 players at the minimum of four seasons was 17.16 (0.00), 19.24 (0.00), 3.95 (0.05), and 0.99 (1.00), respectively. Apart from 2013-14, the regular player group had higher BT than the reserve group. Team result finished second in the Japan university championship in 2010-11 and 2011-12, but defeated in the first round of the championship in 2012-13, and defeated in the qualifying round in 2013-14. In the season when odds ratio was high, i.e. most players with high BT participated in a game as regular players, team result was high.

CONCLUSIONS: In the 2013-14 season, the contribution of breakthrough power, i.e. fitness level to assessment of player performance (regular or reserve) was low, thus

team fitness was low. As result, the team performance was low. Thus the contribution of fitness factor to assessment performance level is important in rugby football. Breakthrough power is an effective assessment of team performance of university rugby football.

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Relationships Between Squat Strength, Velocity, And 40-yard Dash Time In College Softball And Football PlayersMichael F. Carter, Lindy M. Rossow, Christopher A. Fahs. *Lindenwood University Belleville, Belleville, IL.* (Sponsor: Michael G. Bembien, FACSM)*(No relationships reported)*

One-repetition maximum (1RM) back squat and 40-yard dash time are common performance assessments in college athletes. Measuring bar velocity during the concentric portion of barbell exercises can be a useful tool to provide feedback for regulating resistance training intensity. Average bar velocity during a 1RM back squat is lower in experienced squatters compared to novice squatters but it is unknown if bar velocity during a 1RM back squat is related to strength or speed in athletes. **PURPOSE:** To determine the relationships between 1RM back squat strength, bar velocity, and 40-yard dash time in college softball and football players. **METHODS:** Thirteen college football (22 ± 1 yrs) and eight college softball players (20 ± 1 yrs) performed the 40-yard dash and 1RM back squat protocol while peak and average concentric bar velocities were measured. Height (m), body mass (kg), squat experience (years), squat frequency (days/week), and femur length (cm) were also measured. Squat relative 1RM was calculated as 1RM (kg) divided by body mass. Independent samples t-tests were used to compare data between athletes (softball vs. football) and Pearson correlations were used to determine the relationship between variables. **RESULTS:** Absolute squat 1RM (153.7 ± 28.8 vs. 86.8 ± 18.8 kg) was greater in football players compared to softball players ($p < 0.001$) but relative 1RM squat (1.45 ± 0.34 vs. 1.24 ± 0.22), 1RM average bar velocity (0.30 ± 0.05 vs. 0.29 ± 0.06 m/s), 1RM peak bar velocity (0.71 ± 0.20 vs. 0.76 ± 0.19 m/s), and 40-yard dash time (5.40 ± 0.57 vs. 5.70 ± 0.40 s) were similar between football and softball players ($p > 0.05$). 40-yard dash time was inversely correlated with relative 1RM squat ($r = -0.720$; $p < 0.001$) and peak 1RM bar velocity ($r = -0.612$; $p = 0.003$). **CONCLUSIONS:** These data suggest that faster athletes were relatively stronger and had a greater maximum bar velocity during the 1RM back squat. Measurement of peak bar velocity during back squat 1RM testing may be a useful indicator of speed in college athletes.

3358 Board #263 June 2 3:30 PM - 5:00 PM

Carbohydrate Mouth Rinsing Procedure during Repeated-sprints Exercise in Fasted State: Effects on Physical and Cognitive PerformanceKarim Chamari¹, Anissa Cherif¹, Romain Meeusen, FACSM², Joong Ryu³, Lee Taylor¹, Karim Kammoun⁴, Mohamed Amine Fenni⁵, Abdulaziz Farooq¹, Abdul Rashid Aziz⁶, Bart Roelands². ¹*Aspetar, doha, Qatar.* ²*Bruxelles University, Bruxelles, Belgium.* ³*Aspire, doha, Qatar.* ⁴*ISSEP Ksar-Said, Tunis, Tunisia.* ⁵*Sousse University, Sousse, Tunisia.* ⁶*Singapore University, Singapore, Singapore.* (Sponsor: Dr Randall Wilber, FACSM)

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Intermittent fasting (IF) is used for many reasons across the globe. Three-days IF (3-d IF: no eating/drinking during daylight hours) has been shown to reduce physical and cognitive performance in a repeated sprint effort session. Carbohydrate (CHO) mouth rinse (CHO-MR) has shown efficacy in attenuating some of these decrements for different efforts (i.e., endurance exercise), yet CHO-MR has not been utilized within a repeated sprint (RS) exercise 3-d IF paradigm with associated cognitive performance assessment. **PURPOSE:** Determine carbohydrate mouth rinsing (CHO-MR) effects on physical and cognitive performance during repeated-sprints (RS) after 3 days of intermittent fasting (abstaining from eating/drinking during daylight hours). **METHOD:** In a randomized, counter-balanced and double-blinded manner, 15 active healthy males performed a RS-protocol (RSP) [2 sets (5x5-s maximal sprints interspersed with 25-s rest periods and 3-min of recovery between sets) on an instrumented motorized treadmill with embedded force plates] in three conditions [Control (CON)(no-MR), Placebo-MR (PLA-MR; 0% maltodextrin), and CHO-MR (10% maltodextrin)]. Participants rinsed their mouth with either 10-mL of PLA-MR or CHO-MR solution for 5-s before each sprint in the PLA-MR and CHO-MR conditions. Reaction time (RT) tasks (simple and complex) were assessed pre-, mid- and, post-RSP. ANOVA with repeated measures was used to analyze the data. **RESULTS:** There was no statistical main effect of CHO-MR on sprints (i) mean power, (ii) mean speed, and (iii) vertical stiffness compared with PLA-MR and CON conditions. There was also no statistical main effect of CHO-MR on simple- and complex-task (i) accuracy,

(ii) movement time, and (iii) reaction time. **CONCLUSION** Though CHO-Mouth rinsing has been shown to be effective at improving performance in other exercise modalities, the present study showed that frequent CHO mouth rinsing did not affect sprint performance or reaction time during an intensive repeated sprint protocol.

3359 Board #264 June 2 3:30 PM - 5:00 PM
Difference in Power Measures Across Age-Cohorts
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Muscular power declines 6-10% per decade throughout life. It is unknown, however, when the decrease is most apparent. Therefore, it's important to examine the difference in power amongst different age cohorts. **PURPOSE:** The purpose of this study was to examine the difference in power output measures among adults over the age of 18 years, separated into age decade cohorts (18-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80-89 years). **METHODS:** A total of 160 men and women participated in the study (40.6 ± 20.1 years; 71.1 ± 14.0 kg), spanning in age from 18-86 years. Power was assessed using the Tendo power analyzer during a sit-to-stand (STS) task. Participants sat on a standard height (0.47 m) chair, arms crossed over their chest and performed five separate STS trials, rising from a seated to full standing position as quickly as possible; one-minute rest periods provided between each trial. The Tendo was positioned on the floor in alignment with the participant's heel and the Kevlar string attached to the participant's hip with a carabiner clip and belt. With each STS task, peak (PPOW) and average (APOW) power, as well as peak (PVEL) and average (AVEL) velocity were recorded in watts (W) and meters per second (m/s), respectively. PPOW, APOW, PVEL, and AVEL were recorded for each stand, with the average taken. **RESULTS:** One-way ANOVA analysis indicated a significant difference between groups for PPOW, APOW, PVEL, and AVEL measures ($p < .05$). Younger subjects produced significantly greater PPOW and APOW than individuals in age cohorts over 40 years ($p < .05$). When assessing PVEL and AVEL, the younger age cohorts produced significantly greater values than the older age cohorts ($p < .05$). **CONCLUSION:** Findings indicate muscular power to be significantly greater among younger cohorts (≤ 40 years), as compared to older cohorts (> 40 years); however, among older cohorts, there was no significant decline in power. This gives an indication that decline in muscular power may occur around the age of 40, which is when the decline becomes less apparent. Based on findings, preservation of muscular power is necessary before 40 years of age.

3360 Board #265 June 2 3:30 PM - 5:00 PM
Lunar Phases Effects On Short-term, Explosive Physical Performance Among Young Trained Athletes
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Beliefs in lunar effect on human physiology and behavior started back in ancient times. Outcomes recently revealed that (i) aggressive behavior increased around full moon (FM), and (ii) a physical fitness index increased in sedentary students at new moon (NM) and FM compared to other moon phases. This has been attributed to the alteration of cardiovascular parameters (i.e., heart rate (HR) and blood pressure (BP) which were affected by the gravitational pull of the moon. However, there was no attention on the effect of lunar cycle (moon illumination and Gravitational pull) on physical performance in athletes. **PURPOSE:** to evaluate whether short-term explosive performance can be influenced by the different phases of lunar cycle. **METHODS:** Methods: Fourteen young male taekwondo athletes (Age: 16.9±0.7years, Height: 159.7±50.6 cm, Body Mass: 62.85±7.84 kg, Body Fat: 10.9±4.7) performed: squat jump (SJ), countermovement jump (CMJ), and 10-m sprint tests to assess explosive physical performance during the different phases of the lunar cycle (NM, FQ (First Quarter), FM, and LQ (Last Quarter)). The testing sessions at the different moon phases were performed in a counterbalanced order. Tests' order was kept the same (SJ, CMJ, then 10-m sprint) and all sessions were performed at evening times (6:00 to 8:00 p.m.) on the first day of each concerned lunar phase. Each parameter was measured over two consecutive lunar months in the calendar (April and May 2016). Astronomical data (lunar phases) were acquired from the United States Naval Observatory astronomical applications department data services (<http://aa.usno.navy.mil/data/>).

RESULTS: ANOVA showed that there was no significant lunar cycle effect for all explosive tests measures $F_{(3, 93)}=1.834$; $p>0.05$; $\eta_p^2=0.124$.

CONCLUSIONS: Moon phases did not affect evening explosive performances (mainly phosphagens' pathway based efforts) among young trained athletes. Therefore, it seems that moon phase / illumination do not have an effect on short term physical performance in young trained adolescents. Future studies may evaluate whether High Intensity (predominance of the "glycolytic pathway" in addition to the "phosphagen's pathway") and Endurance (predominance of "oxidative phosphorylation"), performances would be affected by lunar cycle in athletes.

3361 Board #266 June 2 3:30 PM - 5:00 PM
The Effects Of Lower Body Fatigue On Vertical Jump Ground Reaction Forces
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 (No relationships reported)

PURPOSE: Ground reaction forces may be used as an indicator of lower body performance and fatigue. It is known that a decrease in muscular force-generating capacity is an indicator of fatigue. Therefore, the purpose of this investigation is to determine the effects of lower body fatigue on ground reaction force measures. **METHODS:** Nineteen recreationally trained males and females (age 22.84 ± 1.77yrs; height 168.82 ± 10.22m; weight 68.70 ± 14.87kg) participated in a combined familiarization and testing session. During familiarization, participants signed an informed consent and anthropometrics were recorded. Participants then performed a dynamic warm-up and were familiarized with two types of vertical jumps and fatiguing protocol. Three trials for both the static jump (SJ) and countermovement vertical jump (CMVJ) were performed on a force plate, pre and post Bosco fatigue test. The dependent variables calculated from the force plate were rate of velocity development (RVD), peak force (PF), impact force (IF), peak velocity (PV), and peak power (PP). Paired-sampled t-tests were used to analyze pre/post differences for each dependent variable. **RESULTS:** There was a significant difference between pre and post PF ($p=0.003$; pre=1,523.68 ± 360.65N; post= 1,464.03 ± 342.24N), IF ($p=0.001$; pre= 1,175.02 ± 1142.37N; post= 1355.05 ± 987.34N), peak velocity ($p=0.002$; 2.63 ± .36; post= 2.38 ± .51m/s), and PP ($p=0.001$; pre= 3373.09 ± 1088.92m/s; post= 2922.89 ± 1100.00m/s) measures for CMVJ. There was a significant difference between pre and post measures for SJ peak force ($p=0.001$; pre= 1298.95 ± 261.97N; post= 1230.60 ± 261.97N). **CONCLUSIONS:** For CMVJ, the Bosco protocol significantly decreased PF, IF, PV, and PP. The fatigue protocol also significantly decreased PF for SJ. This is due to the decrease in force generating capacity in lower-body musculature following fatigue. A decrease in force production may lead to an overall increase in injury risk. As force production decreases, so does ability to maintain proper mechanics. This study shows performing a fatiguing activity, such as the 60s Bosco protocol, significantly alters force production in recreationally trained populations, indicating that programming high-intensity multi-joint activities before maximal vertical jump performance can lead to muscle fatigue.

3362 Board #267 June 2 3:30 PM - 5:00 PM
The Relationship Between Bilateral Asymmetries And Explosive Lower-Body Performance
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 (No relationships reported)

PURPOSE: Bilateral symmetry of the lower extremities may be a critical component of lower-body explosive performance. Therefore, the purpose of this investigation was to determine the relationship between bilateral asymmetry and explosive lower-body performance.

METHODS: Forty-five recreationally trained males and females (age, 23.04 ± 2.36 y; height, 166.45 ± 24.40 cm; mass, 73.86 ± 13.33 kg) volunteered to participate in this study. Day one (familiarization), participants filled out an informed consent and physical activity readiness questionnaire followed by familiarization of vertical jump, sprinting, and isokinetic torque protocols. Day two (testing), participants performed a dynamic warm-up followed by 3 countermovement vertical jumps utilizing the Vertec® and force plates to obtain maximum vertical jump height and peak force. Maximal vertical jump height of the three trials was used for analysis. Participants performed 3 trials with 2 min rest in between of a 40-yard sprint with timing gates positioned at 20 and 40 yards. The fastest times of the three trials were used for analysis. Isokinetic torque was assessed with the Biodex System 4 Isokinetic dynamometer to measure concentric isokinetic torque of both hamstrings and quadriceps, with 5 repetitions on each leg. The maximum isokinetic torque from each leg was used for analysis and bilateral quadriceps (BQ%) and hamstrings (BH%)

percent differences were calculated and used for analysis. Pearson's *r* correlations were conducted to analyze the relationship between hamstring and quadriceps percent differences and lower body explosive performance variables.

RESULTS: There was no significant correlation between BQ% and total sprint time ($r = -.02$; $p = .85$), vertical jump height ($r = .06$; $p = .68$), and peak power ($r = -.13$; $p = .36$). There was no significant correlation between BH% total sprint time ($r = .22$; $p = .14$), vertical jump height ($r = -.001$; $p = .99$), and peak power ($r = -.26$; $p = .08$).

CONCLUSIONS: No relationship was observed between bilateral asymmetry and any lower body explosive performance in this particular population. The lack of a relationship may be due to the type of participants involved in the investigation; since they were recreationally trained there may be varied training experience.

3363 Board #268 June 2 3:30 PM - 5:00 PM
The Importance of Skating Economy to Performance on a Repeated Shift Test in Ice Hockey

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 (Sponsor: James R Whitehead, FACSM)

(No relationships reported)

Ice hockey is a sport characterized by repeated high intensity bouts, with the ability to resist fatigue both between and within bouts conferring competitive advantage. However, there is no evidence to support skating economy as a factor in fatigue resistance.

PURPOSE: To determine the importance of skating economy to fatigue during repeated high-intensity efforts of a simulated ice hockey shift.

METHODS: Forty-five collegiate and Junior A male ice hockey players (aged 18-24 years) performed a continuous protocol graded exercise test to volitional exhaustion using a skate treadmill, as well as an on-ice repeated shift test. Breath-by-breath data for $\dot{V}O_2$ and respiratory exchange ratio were collected and used to derive energy expenditure (EE) averaged over the final 10 seconds of each stage. Economy was determined as the slope of the regression line relating $\dot{V}O_2$ and EE against skating speed separately. Participants who completed fewer than three stages of the graded exercise test were excluded to increase reliability of regression slope measures. Participants also completed eight bouts of maximal ice skating through a course designed to simulate the duration and skating skills of a typical shift, with three separate TC Speed Trap-II wireless timing gates used to determine first half, second half, and total fatigue decrement as calculated by a percent decrement score (Decrement Score = $(100 \times [\text{Total Sprint Time} \div \text{Ideal Sprint Time}] - 100)$). Each bout lasted approximately 23 seconds, with 90 seconds of passive recovery allowed between bouts. Partial correlation was used to determine the association between economy measures and decrement during the repeated shift test.

RESULTS: Twenty-six participants met the inclusion criteria and were included in the data analysis. Skating economy measures (both relative $\dot{V}O_2$ and EE) were moderate and statistically significant correlates of total fatigue decrement ($\dot{V}O_2$: $r = 0.46$, $p \leq 0.05$; EE: $r = 0.44$, $p \leq 0.05$), but not with first or second gate decrement.

CONCLUSION: Our results indicate that skating economy may play an important role in fatigue resistance over repeated on-ice sprints designed to simulate a typical shift. This may lend support to the use of technical skating coaches and training techniques to enhance skating economy as a valid way to improve ice hockey performance.

3364 Board #269 June 2 3:30 PM - 5:00 PM
The Influence Of Pace On Performance During A Five-week Online Fitness Competition.

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(No relationships reported)

Purpose: To determine the influence of exercise pace on individual performance during an annual five-week online fitness competition. **Methods:** Competition pacing data was collected from individuals with more than six-months of experience during the first (16.1; $n = 12$) and last (16.5; $n = 8$) weeks of the competition. For 16.1, competitors completed as many repetitions as possible (AMRAP) in 20 minutes of a circuit that included: 25-ft. overhead walking lunges (L1), 8 bar-facing burpees, 25-ft. overhead walking lunges (L2), and 8 chest-to-bar pull-ups (PU). For 16.5, competitors completed a workout with a 21-18-15-12-9-6-3 descending repetition scheme with barbell thrusters (BT) and bar-facing burpees (BB). Pearson product-moment correlation coefficients were calculated between the average (AVG), fastest (FST), and slowest (SLW) times to complete each exercise and round (RD), in addition to the competitors' score for 16.1 (total repetitions) and 16.5 (time to completion). Significantly correlated variables were entered into a stepwise linear regression to determine the best indicator for success. **Results:** Significant ($p < 0.05$) relationships were observed between 16.1 score and PU_{AVG} ($r = -0.83$), $L1_{FST}$ ($r = -0.61$), $L2_{FST}$ ($r = 0.75$), PU_{FST} ($r = -0.66$), and PU_{SLW} ($r = -0.86$). Of these, PU_{SLW} was most influential

of 16.1 score ($r^2 = 0.74$, $p = 0.001$). Significant ($p < 0.05$) relationships were observed between 16.5 score and BT_{FST} ($r = -0.78$), BB_{FST} ($r = -0.78$), RD_{FST} ($r = -0.88$), BT_{SLW} ($r = -0.79$), RD_{SLW} ($r = -0.93$), BT_{AVG} ($r = -0.85$), and RD_{AVG} ($r = -0.97$). RD_{AVG} was most influential of success for workout 16.5. **Conclusion:** These data suggest that pacing affected score during these two workouts. Specifically, for a 20-minute AMRAP that included pull-ups, lunges, and burpees, the pace of the pull-ups was most influential. However, maintaining a low average round time was most important during a workout with a descending repetition scheme. It is unknown whether these strategies would be consistent in other, similarly-designed workouts.

3365 Board #270 June 2 3:30 PM - 5:00 PM
The Effect Of Drop Jump Height On Post-activation Potentiation As Measured By Vertical Jump Performance

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Post-activation potentiation (PAP) is an enhanced contractile response within the muscles due to prior voluntary activation that has the potential to be used as a warm-up strategy prior to short, high intensity activities. **Purpose:** The purpose of this study was to compare the effects of two different drop jump heights on PAP as measured by subsequent vertical jump performance. **Methods:** 76 male and female NAIA collegiate athletes (19.9±0.2 yrs) completed three different testing session protocols. During the first session, the participants performed a pre-treatment vertical jump test and were familiarized with drop jumps. The second and final testing sessions included five drop jumps with rebound from an 18 and 30 inch box followed by a post-treatment vertical jump test. Three t-tests were performed in order to compare data from both treatments to the pre-treatment vertical jump data and the two treatments to each other. **Results:** The mean pre-treatment vertical jump was 22.2±0.6 inches while the 18 inch treatment mean was 21.3±0.6 inches and the 30 inch treatment mean was 21.8±0.5 inches. Two-tailed t-tests comparing the vertical jump after the varying drop jump heights did not show any significant differences. Delta in vertical jump height between the two treatment groups were also examined, revealing no significant changes in jump height. **Conclusion:** Neither of the drop jump treatments were found to significantly influence vertical jump performance when compared to the pre-treatment vertical jump heights. Therefore, these results do not support the use of this volume of 18" or 30" drop jumps to induce PAP in collegiate level athletes.

3366 Board #271 June 2 3:30 PM - 5:00 PM
Effect of Crank Arm Length on Oxygen Consumption and Mechanical Efficiency During Forward Grinding

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In America's Cup yacht racing grinding is a major factor for boat handling. Resent changes in race regulations concerning number and anthropometry of crew members as well as the need for maintaining hydraulic pressure for boat maneuvering may emphasize the importance of optimizing grinding equipment for optimal aerobic efficiency during grinding. **Purpose:** To investigate the effect of crank arm length on oxygen consumption, mechanical efficiency and perceived exertion during forward grinding. **Methods:** Eight trained male subjects participated (Age: 31.3 ± 11.5 yrs; Body weight: 85.7 ± 9.5 kg; Height: 185.4 ± 3.1 cm; Arm span: 187.9 ± 7.4 cm; Grinding $\dot{V}O_{2peak}$: 49.0 ± 1.4 ml O_2 $kg^{-1} min^{-1}$). Whole body oxygen uptake, mechanical efficiency (net and gross), rate of perceived exertion (local and overall) and time to exhaustion (TTE) were compared during grinding with two different crank arm lengths (Standard: 228,6 mm vs. Long: 298,6 mm). Testing was performed as an incremental discontinuous test, consisting of 3-minute bouts of forward grinding at 70 revolutions per minute separated by a 1-minute pause. Testing started at 90 W and was increased by 30 W until exhaustion. Oxygen uptake was measured using the Jaeger Oxycon Pro metabolic cart and grinding was performed at a Harken@ prototype grinding ergometer (Olesen et al. Eur. J. Sport Science, 2015). Prior to the two test sessions resting metabolic rate was measured in supine position. Data were analyzed using a two-factor ANOVA repeated measures and paired t-test. **Results:** The standard crank arm length elicited lower oxygen consumption ($p < 0.05$) and was more efficient ($p < 0.05$) than the long crank arm length at workloads < 180 W. Interestingly, rating of perceived exertion for local muscular fatigue (local RPE) was significantly higher ($p < 0.05$) for the standard crank arm length at workloads > 90 W and TTE for the standard crank arm length was significantly shorter (1078 ± 44 sec vs 1144 ± 53

sec; $p < 0.05$). **CONCLUSION:** The long crank arm is less efficient than the standard crank arm at lower workloads. Conversely, lower local RPE at high exercise intensities and superior TTE were found with the long crank arm. The authors wish to thank Harken® for building the prototype of the grinder ergometer. No other conflicts of interest, financial or otherwise.

3367 Board #272 June 2 3:30 PM - 5:00 PM

The Relationship Between Academic Stress and Skeletal Muscle Performance

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(No relationships reported)

Student athletes are required to perform both in the classroom and on the field; balancing these commitments can be stressful. It is common to question the burden of athletic demands on student scholarship. However, the inverse is seldom asked: how do scholastic stresses affect athletic performance? **PURPOSE:** To test the effect of psychological stress on skeletal muscle performance in college students. **METHODS:** We enrolled 23 recreationally active students (10 men, 13 women) from a D1 university. Skeletal muscle function was assessed via quadriceps extension and hamstring flexion using a Cybex HUMAC NORM dynamometer. Psychological stress was measured with the Cohen Perceived Stress Scale. Subjects were evaluated at two time points: a high stress period (exams) and a low stress period (no exams). A history of injury excluded subjects from participation; nightly sleep, history of exercise, and recent exercise were controlled. Independent variables were stress, sex, age, weight, BMI, academic load, and participation in organized sports (club or intramural). Dependent variables were peak torque (ft/lb) and time to achieve peak torque (sec). Differences in muscle performance between high and low stress periods were assessed with t-tests. Linear regressions analyzed the effect of psychological stress on muscle performance. **RESULTS:** Subjects were 20.2 ± 1.1 years old, had peak flexor torque of 87.4 ± 19.7 ft/lb (achieved in 0.58 ± 0.12 sec), and peak extensor torque of 145.2 ± 37.5 ft/lb (achieved in 0.58 ± 0.15 sec). T-tests found no differences between low and high stress periods in peak torque or time to achieve peak torque ($p > 0.090$). Linear regression found increases in psychological stress to correlate with improvements in the overall rate of force development ($p = 0.004$). The effect was strongest with flexors: for each point that stress increased, time to achieve peak torque was 2.4% faster ($p = 0.002$). **CONCLUSION:** Despite a small sample size, these findings suggest psychological stress may enhance force development. A possible mechanism could be sympathetically-mediated potentiation of calcium release. While academic stress presents many challenges for student-athletes, it does not appear to be detrimental to muscular performance.

3368 Board #273 June 2 3:30 PM - 5:00 PM

Effect of Cleat Position during Cycling on Running Performance in Elite Triathlete

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(No relationships reported)

PURPOSE: To evaluate the effect of cycle shoes cleat position during cycling on subsequent running time in simulated duathlon in elite triathletes. **METHODS:** Nine male national team caliber triathletes (25.9 ± 2.4 yrs, 69.1 ± 4.4 kg, 176.1 ± 3.7 cm) participated in two occasions of simulated duathlon. In each occasion, they cycled 20 km on a fixed bicycle immediately followed by running 5 km on a treadmill. During cycling, they wore cycle shoes of either traditional cleat position (TCP) or middle cleat position (MCP, approximately 5 cm behind of TCP). During cycling and running, they changed and controlled the speed as well as the cycle gear combinations. The testing order was balanced. They were asked to perform their best. During the exercises, distance, time, speed, the transit time, and heart rate (HR) were recorded. The distance of running was divided into three phases; as 0-2, 2-4, and 4-5 km, and the time record was compared. **RESULTS:** The total time record of the exercises excluding the transit was 3126 ± 137 in TCP and 3096 ± 103 sec in MCP ($p > 0.05$). The cycling time was 1956 ± 69 in TCP and 1967 ± 54 sec in MCP ($p > 0.05$). The running time was 1170 ± 88 in TCP and 1129 ± 66 sec in MCP ($p > 0.05$). The running time was faster in MCP than TCP by 5.4% at the phase of 0-2 km (460 ± 24 in MCP vs. 486 ± 40 sec in TCP, $p < 0.05$), but not at 2-4 km (447 ± 25 in MCP vs. 462 ± 37 sec in TCP, $p > 0.05$). The average HR was 166.7 ± 8.8 in MCP and 165.5 ± 7.0 bpm in TCP during cycling, and 175.3 ± 11.6 in MCP and 175.4 ± 8.1 bpm in TCP during running. No differences were found in HR during the exercises. **CONCLUSION:** The cleat position did not change the total time record of simulated duathlon in elite triathlete. However, the time record of early stage of running following cycling was faster when they cycled with the shoes of middle cleat position. It appears that cleat position during cycling have some influence on muscle recruitment during running in trained elite triathletes.

3369 Board #274 June 2 3:30 PM - 5:00 PM

Electrolytes Drink Increases Performance During Repeated Exhaustive Exercise Tests

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(No relationships reported)

Purpose: To investigate the effects of electrolyte drink on subsequent exhaustive exercises, 14 male-university students voluntarily participated. They were healthy and passed medical screening and physical exam prior to three exercise tests of at least 1 week apart. **Methods:** Two consecutive exhaustive exercise tests, with 2 hours recovery period in between, were done within a day. After the first exhaustive exercise, subject was randomly intervened by drank one of the followings fluids: a) water (WT), b) placebo (PLA, only sucrose 7%, dextrose 4%) and sports drink (SD, NaCl 0.13%, KCl 0.03%, sucrose 7%, dextrose 4%). During 2 hrs recovery period, the amount of energy drink given was divided into 3 parts: first at 50% body weight (BW) at immediately after finished glycogen depletion, then at two sessions of 25% BW at 30 minutes and 60 minutes respectively Exhaustive exercise testing was conducted on cycle ergometer. This study was approved by Mahidol University IRB. Statistical analysis was done using two-ways repeated ANOVA at $p < 0.05$. **Results:** Increasing in most of cardiorespiratory variables (heart rates, stroke volumes, cardiac outputs, end-diastolic volumes, total peripheral resistance, breathing frequencies, tidal volumes, minute ventilations, maximum oxygen consumptions and carbon dioxide productions) are not significantly different among the groups with an exception of ejection fraction where SD was higher than WT ($p < 0.05$). Estimations of substrate utilizations revealed that fat oxidation was higher in WT ($p < 0.05$) where carbohydrate oxidations in PL and SD were higher than WT ($p < 0.05$). On the second exhaustive exercise, SD had significantly higher time to exhaustion and work done than WT and PLA ($p < 0.05$). **Conclusion:** In addition to carbohydrate alone, sports drink-containing electrolytes found to increase endurance performance on the subsequent exercise. The presence of these electrolytes are found to enhance carbohydrate absorption in human gastrointestinal tract and may possibly act as co-enzymes in metabolic pathways. Supported by T.C. Pharmaceutical Industries Co.Ltd. Thailand.

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3370 Board #275 June 2 3:30 PM - 5:00 PM

The Effect of Green Tea Extract on Fat Oxidation during 1hour Arm Cycle Exercise

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Purpose:

Decaffeinated Green Tea Extract (GTE) supplementation can increase fat oxidation during leg exercise, but many people cannot perform leg exercise. The purpose of this study was to investigate the effect of GTE supplementation on fat utilization during 1h arm cycle exercise. We hypothesized that GTE supplementation will increase lipolysis and fat oxidation.

Methods:

This was a randomized, controlled, triple blind study with a crossover design. 8 healthy adults (4 females, 23-37yrs) performed an incremental arm cycle test to exhaustion followed by 4 time trials at fixed workloads. After an 8h fast subjects did 1h of arm cycling at 50% W_{peak} . Subjects were randomly assigned to either decaffeinated GTE (650mg, 611mg EGCG) or placebo (PLA) for 4wks. Subjects then repeated the 1hr arm cycle trial. A 4wk washout period was followed by the corresponding crossover trial. 5ml of blood were drawn pre and post exercise while respiratory gases were collected continuously. Plasma glycerol and free fatty acid (FFA) concentrations were assessed with commercially available analysis kits. The study was powered at $1 - \beta > 95\%$, with $\alpha = 0.05$ given a reported effect size of $F = 3.39$ for the time by treatment interaction.

Results:

Mean VO_2 during all 1hr trials showed no significant differences (83.89 ± 19.25 L/min, $p = .460$). Similarly, mean total energy expenditure (EE) showed no differences across all trials ($264.58 - 266.15$ kcal, $p = .420$). The percentage of total EE from fat oxidation was higher after GTE supplementation compared to PLA, but this difference was not significant (22.83 ± 11.57 to $25.38 \pm 11.3\%$ vs. 23.39 ± 9.97 to $20.69 \pm 8.9\%$, $p = .532$). There were no significant changes in g/min of fat oxidized between treatments before and after supplementation (GTE = $.11 \pm .08$ to $.12 \pm .06$ vs. PLA = $.10 \pm .05$ to $.09 \pm .04$, $p = .220$). Blood Glycerol concentration increased post exercise in all trials, with no significant differences between treatments (8.55 ± 3.44 mg/dl to 8.47 ± 2.6 vs. 10.05 ± 2.86 to 8.99 ± 3.51 mg/dl, $p = .527$). FFA concentration was also increased post exercise for both groups with no significant difference between treatments (8.30 ± 3.8 mg/dl to 8.69 ± 2.59 vs. 9.06 ± 4.49 to 7.16 ± 3.79 , $p = .234$).

Conclusion:

These results suggest that there is no effect of 1m GTE supplementation on fat utilization during 1hr arm cycle exercise at 50% W_{peak} .

3371 Board #276 June 2 3:30 PM - 5:00 PM
The Effects Of Varying Levels Of Crossfit Experience On VO₂max
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 (No relationships reported)

High intensity interval training (HIIT) training has been shown to improve maximal oxygen uptake (VO_{2max}). CrossFit is an adapted high intensity, strength and conditioning program implementing multi joint movements. Recent studies have demonstrated how CrossFit can lead to improved aerobic fitness; however, these results are reported from studies lasting a maximum of 3 months.

PURPOSE: The aim of this study was to investigate the effect on VO_{2max} from the length of CrossFit participation.

METHODS: The participants were 22 male subjects, age 34.8 ± 8.0 months, with at least two months of CrossFit training prior to enrolling in this study. Two groups were formed based on continuous participation in the CrossFit program above 18 months. The participants underwent a VO_{2max} graded exercise maximal exertion test using a modified treadmill protocol. Subjects warmed up for 3 minutes at 8km/h and 0% grade, then started running at 9km/h with 0.5km/h increase every 30 seconds until exhaustion. Exhaustion was defined as three of the four criteria: plateau of VO₂ for at least two consecutive readings, RPE higher than 18, RER > 1.1 and maximal heart rate (HR) within 10 beats of the age predicted maximum HR. The VO₂ data was collected using the ParvoMedics TrueOne 2400 Metabolic System.

RESULTS: The two groups were significantly different in their training participation; 31.6 ± 8.5 months compared to 9.1 ± 4.1 months, P < 0.001. The experienced individuals had a greater VO_{2max} (51.3 ± 5.5 ml/kg/min) compared to the novice individuals [45.3 ± 4.8 ml/kg/min (P = 0.02)]. A forward regression analysis indicated that weight alone was a significant predictor for VO_{2max} (adjusted R² = 0.47, P < 0.001). This group difference appears to be mediated primarily by body weight, as individuals exposed longer to CrossFit were leaner (88.0 ± 9.4 kg) compared to the novice individuals (97.5 ± 14.7 kg, P = 0.03).

CONCLUSIONS: These results suggest that CrossFit provides the appropriate stimulus to increase an individual's VO_{2max} over time. This could be due to increased cellular oxidative metabolism caused by the high intensity nature of the exercise and the ability of more experienced CrossFit athletes to endure workouts at a greater intensity. Most of these adaptations seem to be mediated by the effects of the training program on body weight.

3372 Board #277 June 2 3:30 PM - 5:00 PM
Relationship Between Marathons Completed and Libido in Endurance-Trained Males
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 (No relationships reported)

High levels of endurance training are known to depress testosterone production in males, (EJAP 2003;89:480), which plays an important role in libido maintenance. Research suggests that endurance exercise training (EET; intensity, duration in years) may impact libido status in endurance trained males (MSSEx 2016;48:267).

PURPOSE: This study examined libido status among EET men with varying levels of marathon participation (at least 1 to > 5). **METHODS:** A cross-sectional survey design was used to collect data. Respondents completed the survey via the Qualtrics™ online survey portal. Of the 1,366 respondents, 1,077 were valid (≥ 18 yr age, males, complete data sets). A total of 594 had completed marathons and were included in this analyses. Validity checks were conducted on the data. EET was assessed with components of the IPAQ and Baecke questionnaires. Questions from 3 validated sources (Androgen Deficiency in the Aging Male, Sexual Desire Inventory, Aging Male Symptoms Scale) were selected to make up the libido questionnaire, which was reviewed by a fertility specialist to ensure content validity. Total libido score (TLS) was calculated as the sum score of these questionnaire items. TLS was categorized into high, normal, and low libido categories. A between-groups ANOVA was performed to examine the number of completed marathons (1, 2, 3, 4, 5, >5) and TLS.

RESULTS: Individuals who completed >5 marathons had a significantly lower TLS (p < 0.05; Mean difference [CI], -10.0% [-5.8, -14.2%]) than those who completed 1 marathon. In addition, a cross-tab analysis showed that 30 of the 41 individuals (73.2%) who were in the low TLS category had completed > 5 marathons.

CONCLUSION: Findings suggest the EET necessary for performing multiple marathons may be a factor contributing to lower libido in endurance trained men.

3373 Board #278 June 2 3:30 PM - 5:00 PM
Lactate Response During High Frequency Pitching Among Baseball Players
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PURPOSE: To determine lactate and glucose responses during a high frequency pitching in adult pitchers.

METHODS: Seven pitchers voluntarily participated in this randomized counter-balanced trials. Each pitcher threw 15 fastballs per inning at their best effort for 7 innings. Rest interval trials were 8, 12, and 20 sec between pitches. Blood lactate and glucose concentrations were measured at the end of each inning.

RESULTS: Plasma lactate and glucose levels remained stable over the course of 7 innings during the 20-sec trial. Significant increases in lactate occurred only during the 8-sec trial at the end of 6th and 7th innings. Increases in glucose among pitchers were modest, and no significant difference among trials was observed.

CONCLUSIONS: The increased lactate response during the high frequency throwing (8-sec pace) trial may be associated with greater motor unit recruitment of throwing muscle than the low frequency trials (12-sec and 20-sec trials).

3374 Board #279 June 2 3:30 PM - 5:00 PM
Knee Isokinetic Strength And Fat Free Mass Correlate To Anaerobic Output Among Air Force Operators
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Air Force Special Tactics (ST) Operators have unique tactical demands requiring optimal body composition, strength, and anaerobic energy to perform operationally relevant tasks, i.e. casualty carry or sprints between cover positions. Identified modifiable injury risk factors such as body composition and strength could affect anaerobic performance. **PURPOSE:** To determine relationships of fat free mass and knee isokinetic strength to anaerobic power and capacity in ST Operators.

METHODS: A total of 158 ST Operators (Age = 27.57 ± 4.95yrs, Height = 177.60 ± 5.92cm, Mass = 84.23 ± 8.33kg) participated. Subjects underwent right and left knee flexion (RKF, LKF) and extension (RKE, LKE) strength testing using an isokinetic dynamometer. A BodPod measured fat mass (FM) and fat free mass (FFM). A Wingate testing protocol for anaerobic power (PAnP) and capacity (MAnP) was conducted using the Veletron. The variables included RKF, LKF, RKE, LKE (average peak force), FM, FFM, PAnP and MAnP. Non-parametric statistical analysis was utilized with Spearman's rho significance set at p < 0.05 *a priori*.

RESULTS: Pairwise correlations were statistically significant for RKF and PAnP/MAnP (r = 0.449, p = 0.001/r = 0.454, p = 0.001), LKF and PAnP/MAnP (r = 0.515, p = 0.001/r = 0.503, p = 0.001), RKE and PAnP/MAnP (r = 0.511, p = 0.001/r = 0.443, p = 0.001), LKE and PAnP/MAnP (r = 0.525, p = 0.001/r = 0.419, p = 0.001), FFM and PAnP/MAnP (r = 0.731, p = 0.001/r = 0.803, p = 0.001).

CONCLUSIONS: Air Force ST Operators' isokinetic knee strength and FFM significantly correlated to anaerobic power and capacity. Additional muscle fiber recruitment availability and increased torque generation at the knee could explain these anaerobic output relationships. Optimizing anaerobic pathways could improve Operator tasks requiring short bouts of energy and movements needing power. Knee strengthening and gaining lean mass while decreasing fat mass could reduce injury risk for the Operator. Human performance programming addressing knee strength, body composition, and anaerobic power could positively affect tactical readiness. Opinions, interpretations, conclusions, and recommendations are those of the author and not necessarily endorsed by the Department of Defense, US Air Force, or US Air Force Special Operations Command. Supported by AFMC/AFRL FA86501226271

3375 Board #280 June 2 3:30 PM - 5:00 PM
Effects Of Gaelic Football Match Play On Markers Of Muscle Damage, DOMS And Neuromuscular Performance

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(No relationships reported)

PURPOSE: This study examined the alterations in circulating creatine kinase (CK) levels, leukocyte trafficking, delayed onset muscle soreness (DOMS), neuromuscular function and sprint performance in response to Gaelic football match-play.

METHODS: Participants (n=30, age 17.41 ± 0.78 yr, height 176.42 ± 7.13 cm, and mass 72.03 ± 6.49 kg) played a single competitive 15-a-side Gaelic Football game of 60 min duration. Blood samples were taken before the game, immediately post game (Post), 24 h post game (+24 h), 48 h post game (+48h) and 72 h post game (+72 h). Subjective muscle soreness, sprint performance and muscle power were measured Post, +24 h, +48h and +72 h. Heart rate and movement patterns were continuously measured throughout the game using telemetry and GPS tracking, respectively. Heavy to severe impacts were classified as acceleration G-forces ≥ 7 recorded via portable accelerometry.

RESULTS: Participants covered an average distance of 6.1 ± 1.1 km during match play. The majority (72%) of the distance involved walking and jogging. High speed and maximal running accounted for 10% of the total distance. There were a total of 155 impacts ≥ 7 G-forces. CK levels were significantly higher than baseline immediately post-game and 12h+ and returned to pregame values at +36 h. Compared to pre-match values circulating leukocytes and granulocytes were significantly higher than pre-game values post game and decreased significantly below pre-games values at +12h, +36 h and +60 h. Circulating lymphocyte numbers were significantly decreased below pre-game levels at +36 h. Compared to pre-game values, there was a significant decrease in peak force at +12 h and +60 h and a significant decrease in 5 m and 20 m sprint times at +12 h, +36 h and +60 h. Compared to pre-games values there was no changes in any of the other measured neuromuscular performance indices (flight time, jump time and jump height performance) at any time point. DOMS scores were significantly higher than pre-games values at +12h and +46 h and lower (p<0.05) than pre-game values at +60 h. There was no significant relation between impact and CK levels.

CONCLUSIONS: Competitive Gaelic football match results in significant changes in CK levels, DOMS, leukocyte trafficking, peak force development and 5 m and 20 m sprint performance.

3376 Board #281 June 2 3:30 PM - 5:00 PM
Relationships between Maximal and Rapid Velocity Characteristics of the Leg Extensors and Vertical Jump Performance

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(No relationships reported)

Maximal voluntary contractions (MVCs) of the leg extensors on an isokinetic dynamometer have recently been used to evaluate maximum velocity (Vmax) and rate of velocity development (RVD) in young adults. It has been hypothesized that Vmax and RVD characteristics of the leg extensors may be important predictors of athletic performances for movement activities such as balance recovery and running. However, limited data exist regarding how these parameters associate with vertical jump performance. **PURPOSE:** To examine the relationships between vertical jump height and maximal and rapid velocity characteristics of the leg extensors in healthy young men. **METHODS:** Fifteen young men (mean ± SD: age = 23 ± 3 years; height = 176 ± 8 cm; mass = 80 ± 9 kg) performed three countermovement vertical jumps (CMJs) followed by two MVCs of the leg extensors using an isokinetic dynamometer programmed in isotonic mode. CMJ height was measured based on flight time during the CMJs using a jump mat. For each MVC, participants sat in an upright position and were instructed to extend the right leg as "hard and fast as possible" against a controlled resistance of 20% of the individual's isometric maximum strength. RVD was calculated as the linear slope of the velocity-time curve from the onset of velocity to the point where the velocity reached 2°-s⁻¹ below the maximum velocity. Vmax was the maximum velocity attained during the MVC. Pearson product-moment correlation coefficients (r) were used to evaluate the relationships among CMJ height and Vmax and RVD. **RESULTS:** A significant positive relationship was observed between CMJ height and RVD (r = 0.656, P = 0.008); however, no relationship was observed between CMJ height and Vmax (r = 0.487, P = 0.065). **CONCLUSION:** The present findings of a significant relationship between CMJ height and RVD of the leg extensors suggest that rapid velocity capacities of the lower extremity musculature may play an important role in vertical jump performances in young adults. Based on these findings, coaches and practitioners may consider implementing training programs aimed at increasing leg extensor RVD, which may be beneficial for improving vertical jump height and possibly overall athletic ability.

3377 Board #282 June 2 3:30 PM - 5:00 PM
Determining the Impact of Anthropometric Factors on Rock Climbing Performance

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Rock climbing is an increasingly popular fitness activity; however, little information is available regarding the physical characteristics associated with climbing walls of differing difficulty. **Purpose:** The purpose of this study was to determine which anthropometric factors had the greatest affect on overall rock climbing performance using three different difficulties of rock walls. **Methods:** Fourteen recreational rock climbers participated in this study (9 males, 5 females, Age: 21.9+/-2.6y, Height: 176.8+/-11.1cm, Weight: 73.4+/-18.7kg). Prior to climbing, all participants were assessed on push-ups, sit-ups, pull-ups, vertical jump, and sit and reach performance. Participants then climbed the three different rock walls (easy = 5:6, medium = 5:8 and hard = 5:9) each wall for 10 minutes. The overall climbing performance is represented through the number of successful climbs, average distance traveled, and RPE scale. **Results:** A stepwise regression test showed BMI was significantly (p<0.001) related to average distanced covered for all walls. Total number of successful accents at the easy wall were predicted by pull-ups (p<0.001) & age (p<0.05); while vertical jump (p<0.01) was the sole predictor for the medium difficulty wall; and success for the hard wall was most related to sit-and-reach scores (p<0.05). As the difficulty of climbing wall increased, so did the average RPE. The remaining anthropometric factors showed little predictive capacity. **Conclusion:** Lower BMI, leg strength, and flexibility are key anthropometric factors in overall rock climbing performance; however, quality of climbing experience may also play an equally critical role based on the level of difficulty of the wall.

3378 Board #283 June 2 3:30 PM - 5:00 PM
Comparing Balance and Power to Baseball Throwing Velocity in Collegiate Baseball Pitchers

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In baseball, one game or a season can depend greatly on the pitcher's performance. A pitcher's success can be greatly affected by velocity and their ability to maintain that velocity throughout the game. A better understanding of what physical attributes and training protocols affect a pitcher's velocity would be helpful in designing training programs. **PURPOSE:** To examine variables that may potentially impact baseball throwing velocity (BTV). **METHODS:** 12 Division I collegiate baseball pitchers (height=186.7±9.3 cm, weight=91.2±12.4 kg and age=20.5±2.3 years) underwent assessments for upper and lower body power and balance. Lower body power data was collected using the vertical jump test VERTEC (Jump USA, Sunnyvale, CA), and an incline 4.5 kg medicine ball chest press to measure upper body power. Balance was assessed using the BIODEX Balance System SD (Biodex, Inc, Shirley, NY) and measured in the one legged follow through position of the pitch. BTV was collected while pitcher's participated in actual games, off speed pitches were not used in this analysis and the number and type of pitches thrown varied depending upon the circumstance of the game, BTV was recorded using a Stockersport II (Applied Concepts INC, Plano TX) radar gun.

RESULTS: Overall power output was highly correlated to BTV (r²=0.51, p=.006) with the majority of that correlation coming from lower body power (r²=0.47, p=.01) and upper body (r²=0.33, p=.039). Body weight also correlated with BTV (r²=0.74, p=.001), neither height (r²=0.16, p=.167) or balance (r²=0.07, p=.365), anterior/posterior (r²=0.087, p=.33), and medial/lateral (r²=0.11, p=.208) correlated with BTV. Game BTV was significantly decreased when comparing innings 1-3 to innings 4-6 respectfully (x=88.06 mph, x=86.57 mph; p=.039).

CONCLUSIONS: There is a strong correlation between power and BTV, more specifically lower body power. With no correlation between height and balance with BTV, but a strong correlation with weight. In addition, fatigue appears to negatively impact BTV. Based on these findings it appears that baseball pitchers may benefit from a conditioning program focused on lower body power to increase the velocity of their pitches. Future investigations could help establish if this type of training could also reduce the impact of fatigue on BTV in the later innings of a game.

3379 Board #284 June 2 3:30 PM - 5:00 PM

Effects of Speed and Agility Training on Combine Performance in Young Male Athletes

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PURPOSE: Examine the effects of 9 wks of speed and agility training (SAT) on combine test performance in 7 to 13-year-old male athletes.

METHODS: Forty-six boys (7.6 to 13.4 years; height = 152.3 ± 9.9 cm, mass = 44.5 ± 12.1 kg) participated in this study by completing 3 testing sessions: combines 1 and 2 (C1 and C2) were separated by up to 4 days for familiarization and test-reliability, while combine 3 (C3) was performed 9 wks after C2. Combine measures included vertical jump (VJ, cm), broad jump (BJ, cm), pro-agility drill (PA, s), L-cone drill (LC, s), and 40-yd sprint (S40, s) with 10- and 20-yd splits (S10 and S20, s). The SAT group (n = 23) participated in a 9-wk SAT camp with 1 session-wk⁻¹ (1.5 hr-session⁻¹). The control (CON) group (n = 23) was age-matched, did not perform the SAT, but maintained their regular sports activities.

RESULTS: There was no difference in sports participation hours reported between the SAT and CON groups (p = 0.17). There were no group × time interactions (p ≥ 0.12), no main effects for group (p ≥ 0.28), but there were main effects for time for BJ and PA (p ≤ 0.01). There were systematic improvements in PA, LC, and S10 (p ≤ 0.01) from C1 to C2, but not VJ, BJ, S20 or S40 (p ≥ 0.06). Intraclass correlation coefficients (ICC_{3,1}), coefficients of variation (CV, %), standard errors of measurement (SEM), and minimum detectable changes (MDC) were [test: ICC (CV, SEM, MDC)] VJ: 0.91 (8.6%, 3.4 cm, 9.5 cm); BJ: 0.89 (6.8%, 10.5 cm, 29.2 cm); PA: 0.89 (3.7%, 0.22 s, 0.61 s); LC: 0.84 (4.5%, 0.42 s, 1.18 s); S10: 0.68 (6.8%, 0.15 s, 0.42 s); S20: 0.91 (3.8%, 0.14 s, 0.40 s); S40: 0.72 (7.7%, 0.52 s, 1.44 s). Over the 9 wks, 1 boy exceeded the MDC for BJ and LC; 5 exceeded MDC for S10; and 3 exceeded MDC for S20. Seventeen boys exceeded the SEM for VJ; 16 exceeded the SEM for BJ; 11 exceeded the SEM for PA; 12 exceeded the SEM for LC; 15 exceeded the SEM for S10 and S20; 2 exceeded the SEM for S40.

CONCLUSIONS: The SAT (1 session-wk⁻¹; 9 wks) did not enhance combine performance beyond normal sports participation in young male athletes. Sensitivity, as evaluated by reliability and boys exceeding the MDC (and SEM) after a familiarization session and the 9-wk intervention period, was greatest for the VJ, BJ, PA, LC, S10, and S20 tests. Future studies aiming to examine combine performance enhancement training in youth athletes may consider using these tests.

F-63 Free Communication/Poster - Physical Activity and Health in Youth

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3380 Board #285 June 2 2:00 PM - 3:30 PM

A Comparison of Infant Physical Activity in Daycare vs Homecare Environments

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The impact a childcare environment has on a child's cognitive and behavioral development has been widely studied. Differences have been found between children primarily cared for at home by a stay-at-home parent (homecare) compared to a child who attends full-time daycare. Positive findings can be found in both environments with homecare children potentially showing less aggressive and impulsive behaviors and daycare children achieving cognitive development milestones earlier. However, little work has assessed a child's, particularly an infant's (<12 months old) physical development (i.e., physical activity level) in both environments. **PURPOSE:** To compare the level of infant physical activity in homecare vs daycare environments. **METHODS:** Twelve homecare infants (age = 6.5 ± 0.5 month, weight = 8.20 ± 1.17 kg and length = 66.54 ± 2.66 cm) and fourteen daycare infants (age = 6.5 ± 0.5 month, weight = 8.71 ± 1.34 kg, and length = 68.94 ± 3.02 cm) were recruited to participate in the study. Infant physical activity was assessed using Actigraph GT9X Link accelerometers. Infants wore two accelerometers, left wrist and ankle, for two consecutive weekdays. Accelerometer data from typical daycare hours from 8 am to 5 pm were only utilized for the data analyses. Two-day total (i.e., 18 hours) ankle and wrist vector magnitude counts (VMC) were used as the physical activity indicator.

Statistical analyses were performed using independent sample t-tests for homecare and daycare infants. **RESULTS:** Homecare infants had significantly lower VMC ($t(24) = -1.20, p = 0.036$) at the wrist (VMC=1689546.13) compared to daycare infants (VMC=2091775.09). However, there was not a significant difference in physical activity at the ankle ($t(24) = -0.542, p = 0.800$) between homecare infants (VMC=1300498.16) and daycare infants (VMC=1438831.43). **CONCLUSION:** Daycare infants appear to be achieving more physical activity than homecare infants. Further research studies are needed to understand this variation and to determine why infants may be achieving more physical activity in the daycare environment. Future research should consider utilizing larger sample sizes as well as assessing variables such as infant to caregiver interaction and the type of infant play.

3381 Board #286 June 2 2:00 PM - 3:30 PM

Construct Validity And Test-retest Reliability Of The International Fitness Scale (ifis) In Colombian Children And Adolescents Aged 9-17.9 Years: The Fuprecol Study

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PURPOSE: There is a lack of instruments and studies in Spanish for evaluating physical fitness, and this hampers establishing the current status of this important health indicator regarding the Latin population, especially in Colombia. The aim of the study was two-fold: to examine the validity of the International Fitness Scale (IFIS) on a population-based sample of schoolchildren from Bogota, Colombia; and to examine the reliability of the IFIS in children and adolescents from Engativa, Colombia.

METHODS: Participants comprised 1,875 Colombian youths (56.2% girls) aged 9 to 17.9 years old. We measured adiposity markers (percentage of body fat, waist-to-height ratio, skinfold thicknesses and body mass index), blood pressure, lipids profile, fasting glucose, and physical fitness levels (self-reported and measured). A validated cardiometabolic risk index score was also used. An age- and sex-matched sample of 229 schoolchildren, originally not included in the study sample, fulfilled the IFIS twice for reliability purposes.

RESULTS: Our data suggest that both measured and self-reported overall fitness levels were associated inversely with percentage of body fat indicators and a cardiometabolic risk index score. Overall, schoolchildren who self-reported "good" and "very good" fitness had better measured fitness levels than those who reported "very poor" and "poor" fitness (all p<0.001). Test-retest reliability of IFIS items was also good, with an average weighted kappa of 0.811.

CONCLUSIONS: Our findings suggest that self-reported fitness, as assessed by the IFIS, is a valid, reliable, and health-related measure, and it can be a good alternative for future use in large studies with Latin schoolchildren from Colombia.

3382 Board #287 June 2 2:00 PM - 3:30 PM

The Continuous Metabolic Syndrome Score, Physical Activity, and Inflammation in Adolescents

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Recent reports suggest that metabolic syndrome (MetS) may emerge as early as childhood or adolescence, but no universal definition of MetS is available for these age groups. Continuous metabolic syndrome (cMetS) scores—standardized-normalized z scores based on the 5 components of MetS—take into account the severity of a single risk factor, and subclinical values. This composite score may more appropriately distinguish cardiovascular risk when compared to the traditional dichotomous outcome. **PURPOSE:** To investigate the use of cMetS scoring in a sample of adolescents, and determine associations with physical activity (PA) and inflammation. **METHODS:** As part of a larger study, a subset of 16 y.o. (N=107; 57% female; 68% Caucasian) completed a blood draw, anthropometric (BMI, waist circumference (WC)), and blood pressure measurements. Self-reported PA was assessed using the Godin Leisure-Time Exercise Questionnaire. Blood was analyzed for metabolic and immune markers; glucose, triglycerides (TG), c-reactive protein (CRP), and HDL were used in the present analyses. The cMetS score was calculated as the sum of the z scores based on sample means and standard deviations of each of the 5 factors that make

up MetS (glucose, TG, HDL-inverse, WC and mean arterial pressure). Correlations were performed to assess associations between cMetS, individual MetS components, PA, BMI and CRP. **RESULTS:** Consistent with previous findings, MetS was low in our sample (6/107). Of the 45 participants with the highest cMetS scores, 44 did not achieve clinical MetS criteria. Neither total nor strenuous PA were associated with cMetS, however PA was correlated with WC ($r = -0.49, p < 0.001$). Higher levels of CRP ($r = 0.38, p < 0.001$) and increased concurrent BMI ($r = 0.534, p < 0.001$) were associated with higher cMetS scores. **CONCLUSION:** In populations where clinical MetS is low, cMetS may provide increased resolution and reflect a more global assessment of cardiovascular risk. This is supported in our findings, which show that cMetS scores were not necessarily indicative of the number of clinical MetS risk factors in adolescents. Since cMetS is unrelated to self-reported PA, future work should attempt to identify whether associations exist with other health behaviors or objective PA measures.

Support provided by NIMH 58144, NICHD R01 HD078346-01A1

3383 Board #288 June 2 2:00 PM - 3:30 PM
Physical Activity, Body Mass Index And Cardio-Metabolic Risk In U.S. Adolescents

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PURPOSE: Examine clustered metabolic risk (cMetS) score in adolescents classified as not overweight/active (NOA), not overweight/not active (NONA), overweight/active (OA), and overweight/not active (ONA). **METHODS:** Sample (n=875) included adolescent (12-17 years) participants in the 2007-2012 National Health and Nutrition Examination Survey. The cMetS score included triglycerides, high-density lipoprotein cholesterol, fasting blood glucose, and mean arterial pressure. Age- and sex- specific body mass index percentiles were utilized. Activity data included self-reported frequency of moderate-to-vigorous physical activity (PA). Adolescents reporting ≥ 60 min/d of PA were considered "active". A six-year fasting sample weight was applied to the analyses. Findings were adjusted for age, sex, and race/ethnicity. **RESULTS:** The cMetS scores were significantly ($p < 0.05$) higher in OA and ONA adolescents when compared to NOA ($\beta = 1.08$ and $\beta = 1.57$, respectively). In ONA males, cMetS was significantly ($p < 0.01$) higher when compared to NOA males. In OA and ONA females, cMetS scores were significantly higher ($p < 0.05$ for both). **CONCLUSIONS:** The cMetS scores were higher in OA and ONA adolescents when compared to NOA.

3384 Board #289 June 2 2:00 PM - 3:30 PM
Muscular Strength And Endurance And Cardio-metabolic Health In Low-income Hispanic Children

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 (No relationships reported)

The predictive relationship between muscular strength and endurance and cardio-metabolic health, independent of aerobic fitness, is not clear in disadvantaged Hispanic children. **PURPOSE:** The purpose of this study was to examine the predictive relationship between muscular strength and endurance and clustered cardio-metabolic risk, controlling for aerobic fitness, in Hispanic children from low-income schools. **METHODS:** Participants were 320 Hispanic children (Mean age = 10.1 ± 1.1 years; 164 girls, 156 boys) recruited during the 2014-2015 and 2015-2016 academic years from five low-income schools from the state of Utah in the U.S. Muscular strength and endurance was assessed using the push-up and curl-up tests and estimated $\text{VO}_2^{\text{peak}}$ was calculated from the Progressive Aerobic Cardiovascular Endurance Run. A clustered metabolic syndrome composite score (MetS) was calculated from cardio-metabolic health measurements consisting of HDL cholesterol, triglycerides, waist circumference, blood glucose, and mean arterial pressure (MAP). Multi-level general linear mixed effects models were used to examine the predictive relationship between muscular strength and endurance and MetS, controlling for the effect of aerobic fitness and the clustering of children within classrooms and schools. **RESULTS:** Children who were in the middle and upper tertiles for muscular strength and endurance associated with a lower (more favorable) MetS score (middle tertile: $\beta = -2.59, 95\% \text{ C.I. } [-4.23, -0.95], p < 0.05$; upper tertile: $\beta = -1.57, 95\% \text{ C.I. } [-3.20, -0.16], p < 0.05$). **CONCLUSION:** The results suggest that higher levels of muscular strength and endurance have a protective effect on cardio-metabolic risk, independent of aerobic fitness, in Hispanic children from low-income schools.

3385 Board #290 June 2 2:00 PM - 3:30 PM
The Association Between Physical Activity And Health Risk Behaviors in Brazilian Adolescents

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Adolescence is a critical period where major physical and psychologic changes occur. It is also a period where several lifelong health related behaviors are adopted and established. Behaviors such as unhealthy eating, tobacco use, alcohol use, and physical inactivity are related to major causes of morbidity and mortality among young and adults. Physical activity (PA) is an important behavior during adolescence not only because it is associated with general health, but also because it may be associated with other health-related risk behaviors.

PURPOSE: To examine the association of physical activity with health risk behaviors in adolescents from Curitiba- Brazil.

METHODS: A cross-section study was carried out with a representative sample of 928 (mean age 14.06 ± 1.91 years old, 467 girls) adolescents enrolled in 14 randomly selected public schools from Curitiba, Brazil. The Brazilian version of the Youth Activity Profile survey evaluated PA levels and the YRBS survey evaluated fruit, vegetable, alcohol, and tobacco consumption in the past 30 days. The Adolescent Sedentary Questionnaire evaluated total screen time. Binary Logistic regression measured the association between PA levels and risk behaviors after controlling for gender, age, BMI status, income status, and parent educational level.

RESULTS: PA was inversely associated with low fruit consumption (OR = .50, 95% IC = .38 - .66, $p < 0.001$), low vegetable consumption (OR = .55, 95% IC = .42 - .73, $p < .001$), and high screen Time (≥ 3 hours/day) (OR = .79, 95% IC = .65 - .96, $p < .001$).

Additionally, PA was positively associated with the consumption of at least one dose of alcohol in the past 30 days (OR = 1.47, 95% IC = 1.15 - 1.88, $p < .001$), and with the excessive consumption of alcohol (OR = 1.73, 95% IC = 1.29 - 2.33, $p < 0.001$). PA was not associated with Tobacco consumption (OR = 1.01, 95% IC = .67 - 1.52, $p = .96$).

CONCLUSION: The results indicated that adolescents with higher PA levels consumed more fruits and vegetables and spent less time in front of electronic screens. However, adolescents with higher levels of PA were also more likely to report alcohol consumption in the past 30 days. The social characteristics of alcohol consumption may explain its positive relationship to PA.

Supported by CNPq, Brazil.

3386 Board #291 June 2 2:00 PM - 3:30 PM
Understanding the Relations between Physical Activity and Obesity among Chinese Children and Adolescents

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Purpose: The purpose of this study was to examine the relations between self-reported physical activity and obesity among children and adolescents in China.

Methods: The participants are 18424 students (51.9% boys, 49.1% girls) aged 8-18 years old in grades 3 to 12 from six provinces in China. They were divided into three groups by age: 8-12, 13-15, and 16-18. Physical activity level (PAL) was measured by Physical Activity Questionnaire for Children and Adolescents in Chinese (PAQ; Chen, 2008; Li, 2015; Jing, 2016). The summary scores of the PAQ were classified into three PAL categories "low (PAL ≤ 2), medium ($2 < \text{PAL} \leq 3$), and high (PAL > 3)".

In addition, physical fitness including high and weight were measured according to national standards of physical fitness during physical education classes. Weight status was classified into four categories "malnutrition, normal, overweight and obese" using BMI cut-points. Descriptive analysis, independent t-tests, ANOVA and Chi-square were used in the study.

Results: The distribution of PAL decreased for girls with age and the PAL of boys was significantly higher than girls in all three groups ($t = 9.12, t = 18.91, t = 16.72, p < 0.01$). The percentage of PAL of girls in the low category dramatically increased from 15 years (47%) to 18 years (66%). Significant differences in PAL were found across obesity classifications (for 8-12, $f_{\text{boys}} = 12.39, f_{\text{girls}} = 6.86$; for 13-15, $f_{\text{boys}} = 11.88, f_{\text{girls}} = 7.66, f_{\text{girls}} = 6.69, p < 0.001$) except girls aged 13-15 years ($f = 1.42, p > 0.05$). Furthermore, the distribution of PAL in obesity classifications presents like a "U" that shows values of PAL were higher in the classifications of malnutrition and obesity than values in normal and overweight. Obesity status was significantly related to PAL (for 8-12, $\chi^2_{\text{boys}} = 34.86, \chi^2_{\text{girls}} = 28.07$; for 13-15, $\chi^2_{\text{boys}} = 27.80$; for 16-18, $\chi^2_{\text{boys}} = 21.56, \chi^2_{\text{girls}} = 29.04, p < 0.01$), but not girls aged 13-15 ($\chi^2 = 5.81, p > 0.05$).

Conclusions: PAL was significantly related to weight status in Chinese children and adolescents. Boys demonstrated higher levels of PA across all age groups. Girls demonstrated a 19% decrease in PAL across 15 to 18 years of age.

- 3387 Board #292 June 2 2:00 PM - 3:30 PM
The Correlations Between Types of Families and Physical Activity Levels of Adolescents in Shanghai, China
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Previous studies have indicated that families can influence adolescents' physical activity. The fifth census in China (2010) showed that 65.3% of the families in China are nuclear, but few studies have explored the association between the various types of families and the physical activity (PA) levels of adolescents in China using a large sample survey.

PURPOSE: To determine the correlations between types of families and the PA levels of adolescents aged 9-19 years while accounting for background demographic factors, such as age, gender, and socioeconomic status, in Shanghai, China.

METHODS: In 2014, 9-11-year-old ($N=13,237$), 12-14-year-old ($N=11,157$), and 15-19-year-old ($N=8,819$) adolescents and their guardians were randomly sampled from 17 districts in Shanghai, China. The adolescents' moderate-to-vigorous physical activity (MVPA) levels, information about the type of family, and the guardians' sociodemographic factors were collected via a questionnaire completed by the adolescents and guardians.

RESULTS: Analysis of covariance revealed that, after controlling for socioeconomic status and the age of the adolescents, 9-11-year-old boys from two-parent families spent more minutes per week in MVPA (297.4 ± 120.4) than those who live with their grandparents (286.9 ± 120.1) and those from single-parent families (284.6 ± 129.4 , $P < 0.05$). Regarding the girls aged 12-14 years, those who live with their grandparents spent more minutes per week in MVPA (274.4 ± 105.7) than those from two-parent families (271.9 ± 105.1) or single-parent families (257.3 ± 107.0 , $P < 0.05$). Regarding the adolescents aged 15-19 years, we did not find significant differences between the boys and girls. Logistic regression analysis showed that 9-11-year-old adolescents those who live with their grandparents had 28% for boys (OR 0.72, 95% CI 0.61-0.84) and 16% for girls (OR 0.84, 95% CI 0.72-0.98) decreased odds of did not reach the recommended level (≥ 60 min/day MVPA), respectively, compared with those who from single-parent families. **CONCLUSION:** Being from a single-parent family and living with grandparents are two important factors that influence adolescents' MVPA levels in Shanghai, China.

- 3388 Board #293 June 2 2:00 PM - 3:30 PM
Self-Reported Physical Activity of High School Students in Southern Maine
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Knowledge of high school students' physical activity (PA) can assist in identifying areas of programmatic need within physical education (PE) and for out of school programs. **PURPOSE:** The purpose of this study was to assess the PA levels and patterns of high school students in southern Maine. **METHODS:** Participants were 142 students (86 females, 56 males) from 4 high schools in southern Maine (one urban, one suburban, two rural). Mean age was 14.9 years with 87% of the sample in grade 9. The validated Physical Activity Questionnaire for Adolescents (PAQA) was used in this study to assess PA. The PAQA asks participants to recall their PA during the previous 7 days. Surveys were administered to students enrolled in PE and were part of a larger study examining attitudes toward PA and PE. **RESULTS:** Mean overall score for the PAQA was 2.62 ± 0.60 (1=low PA, 5=high PA), with a range of 1.18 to 4.29. Males were slightly more active than females overall (2.75 ± 0.72 vs 2.53 ± 0.66 , $p = 0.068$) and reported more PA during evenings (2.96 ± 1.37 vs 2.50 ± 1.29 , $p = 0.044$) and the weekend (2.70 ± 1.08 vs 2.32 ± 1.00 , $p = 0.036$). Students in urban (3.98 ± 0.81) and suburban schools (4.30 ± 0.76) reported significantly greater activity in PE classes than rural students (3.54 ± 0.86) ($p < 0.05$) while students in rural schools (1.65 ± 1.23) reported greater activity during lunch than urban (1.23 ± 0.43) and suburban students (1.12 ± 0.39) ($p < 0.05$). Jogging, walking, basketball, and soccer were the most cited activities overall. Females preferred walking, jogging, dance and skipping rope while males preferred jogging, basketball, walking and soccer. Overall, 10% reported daily activity while 14% reported no activity. In PE, 73% reported doing vigorous activity quite often. At lunch, 80% reported sitting. After school, 46% were very active while 28% reported no activity. During evenings, 29% reported being very active while 29%

reported no activity. Over the weekend, 52% reported being very active 2 or more times, with 21% reporting no activity. **CONCLUSIONS:** These findings provide information on high school students' PA from a sample of southern Maine schools. In addition to PA levels and patterns, knowledge of student preferences for PA would help in PA program development both in PE and for out of school programs.

- 3389 Board #294 June 2 2:00 PM - 3:30 PM
ICT USE Influence on Activity Pattern & Body Composition Of University Students In Kwara State
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The use of ICT is a prominent aspect of students' lifestyle in tertiary institutions. ICT creates efficiency in performing tasks but encourages sedentariness, alters body composition and may affect health. **PURPOSE:** To determine influence of ICT use on physical activity pattern and body composition of tertiary institution students. **METHODS:** The study design was Ex-post facto. Multistage sampling was used to select 2,442 students with mean age 22.8 years from three tertiary institutions in Kwara state, Nigeria. Body composition was determined using height scale, body fat/hydration monitor scale (brand number 7032497) and two birds non-elastic tape rule. Validated ICT Use and Physical Activity Questionnaire (IUPAQ) (Rho of .71) was used to assess level of ICT use and physical activity pattern. Approved Ethical Clearance from University of Ilorin and informed consent were duly obtained. Inclusion criteria were penultimate and final year students. Percentage, Mean, and Standard Deviation described the data. Hypotheses were tested at 0.05 alpha level using PPMC, ANOVA and Multiple Regression. **RESULTS:** Many of the students did not perform the recommended physical activity ($n = 1,065$; 43.6%) and their physical activity pattern was sedentary-based (14 hours per day). Average ICT time per day was 9 hours (65%) of which mobile phone time was 4 hours (25%). Strong positive relationship existed between ICT use and sedentariness $r = .84$, $p = .001$; physical activity pattern and ICT use $p = .001$, $r^2 = 15\%$; and ICT use and body composition $p = .001$. Sedentariness was the highest predictor of excessive ICT use $Beta = .120$, $p = .001$ & BMI predictor of risk factor $Beta = .156$. However, light to vigorous intensity physical activity levels indicated low predictive ability of ICT use $p > .05$; Significant difference in the level of ICT use based on age range, $p = .001$ and type of institution of participants $p = .001$ existed. **CONCLUSION:** Prolonged ICT use causes sedentariness and alters body composition with BMI as the highest predictor of risk. This study advocates for institutional physical activity awareness for regulated ICT use campaign.

- 3390 Board #295 June 2 2:00 PM - 3:30 PM
Physical Activity, Sedentary Time and Cardiorespiratory Fitness in Brazilian Children
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PROPOSE: to evaluate physical activity (PA), time expended in sedentary activities and cardiorespiratory fitness (CF) in boys and girls before and after 3 months of regular school.

METHODS: children were evaluated at school after summer vacation and 3 months after regular classes. Weight (kg), height (m), maturational stage was evaluated. CF was evaluated by determining the maximum volume of oxygen during the Test Come and Go 20 meters by Léger. In addition, a questionnaire about PA and screen time during 3 days (3-DPAR instrument) was applied. Data are expressed as average and standard deviation. T Student and Wilcoxon tests were applied to estimate the difference between averages. Level of significance of 5 % was adopted. **RESULTS:** 319 students were included, 146 boys (age 13.6 ± 1.2 yrs) and 173 girls (age 13.6 ± 0.9 yrs). For girls, first VO_{2max} was 43.5 ml/kg/min and second was 48.3 ml/kg/min ($p < 0.002$). For boys, respective numbers were 45.8 ml/kg/min and 49.8 ml/kg/min ($p > 0.05$). No significant difference was found among boys and girls. No difference was found for PA > 300 min/week between the two evaluations and among boys and girls. In time spent with sports, only girls increased significantly from the first to the second assessment ($p < 0.001$). Boys spent more time in sedentary activities (TV, computer and video game) and increased this time between initial evaluation and re-evaluation ($p < 0.001$). **CONCLUSION:** Girls became more active after school start, with increment of VO_{2max} and less time in sedentary activities.

3391 Board #296 June 2 2:00 PM - 3:30 PM
Daily Musculoskeletal Pain Affects Health And Sports Performance Negatively In Youth Athletes

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In sports, musculoskeletal pain (MSP) is often studied from the perspective of sport specific injuries, why little is known about the prevalence of daily or multisite MSP that does not affect participation in sports. It is also unclear if daily or multisite MSP is a risk factor for worse health-related quality of life (HRQoL) and worse sports performance in youth athletes.

PURPOSE: To study how HRQoL and sports performance is affected by daily MSP in youth athletes that are able to participate in sports.

METHODS: 136 Swedish youth athletes attending a sport school (13 to 14 years, boys n=83, girls n=53) completed the EQ-5D measuring HRQoL (range 0 to 1, worst to best), a pain questionnaire including current pain (yes/no), pain in 18 body regions (never to rarely/monthly to weekly/more than once a week to almost daily), and pain intensity in the last week (0 to 10, best to worst), anthropometric measures to estimate biological age, and sports performance tests (grip strength, 20 meter sprint, and countermovement jump(CMJ)).

RESULTS: 109 to 117 of the 136 students answered the different pain questions. 53 of 113 (47%) reported current MSP, and 28 of 109 (26%) experienced MSP 'more than once a week to almost daily' from one or more body regions (frequent MSP group), while 28% (n=30) stated 'never to rarely' in MSP (no MSP group). Boys in the frequent MSP group reported worse HRQoL, higher pain intensity, performed worse in all sports performance tests, and had a younger biological age than boys in the no MSP group. Girls in the frequent MSP group reported worse HRQoL and higher pain intensity than the girls in the no MSP group. No other differences were found (table).

CONCLUSIONS: Every other youth athlete attending a sport school reported current MSP and one out of four reported almost daily MSP. MSP affects HRQoL negatively in both boys and girls, and sports performance negatively in boys. The prevalence of MSP in youth athletes is concerning since pain in younger ages may predict pain in adult ages.

3392 Board #297 June 2 2:00 PM - 3:30 PM
Appropriate Physical Activity on Mental Health in Early Adolescents

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The appropriate intensities, amount and details of physical activity (PA) for mental health (MH) have not yet been elucidated for adolescents.

PURPOSE: To investigate the PA factors (intensity, time, activity details [ADs]) that affect MH characteristics, such as depression tendency (DT), in early adolescence

METHODS: The International Physical Activity Questionnaire, including ADs and the Depression Self-Rating Scale for Children, was conducted on 6,969 children (grades 5–8) in Japan. Decision tree analysis was applied to four groups (primary- and secondary-school students for each gender) in order to investigate the effect of PA on DT. The dependent variable was the factor score of decline of fun and activity (F_{DFA}) and depression mood (F_{DM}). The independent variables were amount of time of vigorous-intensity PA (VPA, min/week), moderate-intensity PA (MPA, min/week), walking time (WT, min/week), sedentary behavior on the weekdays (SB_w) and on holidays (min/day), VPA + MPA (MVPA), MVPA + WT (total MVPA), and ADs.

RESULTS: For the results of F_{DFA} excluding ADs, the first classification variable was VPA for primary-school boys (PB), total MVPA for primary-school girls (PG) and secondary-school boys (SB), and MVPA for secondary-school girls (SG). The branch points for F_{DFA} improvement were as follows: PB 4 h 40 min for VPA; PG 5 h and 12 h 45 min for total MVPA; SB 13h 30min and 21h 30min for total MVPA; SG 3h 30min and 21 h for MVPA. When ADs was included in the analysis, the results were same as those for PB and PG but significantly differed for SB and SG. ADs was the only classification variable for SG and was the second classification variable for SB; and sports activities were better than cultural activities for SB & SG.

For the results of F_{DM} , MPA contributed for PB, SB_w for PG, and WT for SG, but these branch points were not confirmed. ADs were associated with F_{DM} for SB, and sports activities were better than cultural activities.

CONCLUSION:

MVPA is a determinant for reduction of DT, such as F_{DFA} , in early adolescence. ADs are an important factor for secondary-school students. Recommended MVPA time is minimally 5 h/week for all early adolescents, >10 h/week for primary-school children, and >21 h/week for secondary-school students.

Supported by Grant-in-Aid for Scientific Research (B) (15H03108), Japan.

3393 Board #298 June 2 2:00 PM - 3:30 PM
Physical Activity and Diet Behavior Patterns of U.S. Adolescent Girls with Different Weight Status

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Purpose: The study was to identify the physical activity and diet behavior patterns of U.S. adolescent girls with different weight status.

Method: Data was derived from the 2012 National Youth Fitness Survey. A representative/weighted sample of 7,785,784 girls, aged 12-15 yr. old responded to both the physical activity and diet behavior and nutrition questionnaires. ANOVA analysis was applied to determine the difference in physical activity patterns and eating behaviors among girls with different weight status (underweight, normal weight, overweight, and obese defined by the CDC percentile classifications).

Results: Significant differences were detected in the physical activity and diet behaviors patterns, and the results are displayed in the table below:

	Under-weight	Normal weight	Over-weight	Obese	Total	F	p-value
Vigorous-intensity work (min)	71.54±35.33	81.72±54.62	0	0	97.86±91.52	3168.29	<.001
Moderate-intensity work (min)	32.78±15.95	58.65±45.41	60.37±36.81	51.29±9.92	57.06±47.28	22446.75	<.001
Sedentary activity (min)	530.97±132.19	506.04±154.50	522.75±125.89	489.72±156.12	508.88±150.59	8608.16	<.001
# of times/week get school lunch	3.16±2.24	3.17±2.24	3.96±1.56	4.17±1.40	3.29±2.18	45525.19	<.001
# of times/week get school breakfast	1.09±2.06	1.28±2.08	1.64±2.07	.65±1.23	1.28±2.06	15198.79	<.001
# of meals not home prepared/week	2.29±2.62	1.87±1.85	1.98±2.04	.99±1.08	1.88±1.92	31966.502	<.001
# of ready-to-eat foods in past 30 days	.27±.95	.88±2.91	1.00±2.51	1.35±1.61	.87±2.74	12704.638	<.001
# of frozen meals/pizza in past 30 days	3.23±3.85	2.61±4.06	1.86±3.00	2.42±2.67	2.57±3.91	14507.226	<.001

Conclusion: Overweight and obese girls tended to have less vigorous work and more ready-to-eat food.

3394 Board #299 June 2 2:00 PM - 3:30 PM
The Effect of Bullying on Health Behaviors in Adolescents

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PURPOSE: To examine the association of bullying with physical activity, sedentary behaviors, and participation in organized sports in a sample of adolescents living in Ireland. **METHODS:** The sample consisted of 7,314 adolescents (13 years of age; 55 % female) who were part of the Growing Up in Ireland (GUI) study, a national study that focused on a broad range of adolescents' characteristics, experiences, and development. Adolescents completed a series of questionnaires assessing whether participants had been victims of bullying, and their feelings associated with bullying (fear, isolation, and anger). Participants also reported amount of time engaging in vigorous physical activity (VPA), sedentary behaviors (SB) (watching the television, playing computer games, and playing video games), playing an organized sport (SPORTS), and the number of friends who engage in these activities with participants. Multiple regression analysis was used to examine the association of bullying with

VPA, SPORTS, and SB. Significance was set at $\alpha \leq 0.05$. **RESULTS:** Engaging in greater amounts of VPA was associated with lower levels of SB ($\beta = -0.03$, $p < 0.0001$), and a greater number of friends ($\beta = 0.20$, $p < 0.0001$), however, bullying did not affect participation in VPA. Increased participation in sports was associated with lower levels of SB ($\beta = -0.02$, $p < 0.0001$) and a greater number of friends ($\beta = 0.09$, $p < 0.0001$), however, participants who reported bullying were less likely to participate in sports ($\beta = -0.12$, $p < 0.002$). Greater time spent in SB was associated with increased anger as a result of being bullied ($\beta = 0.64$, $p = 0.03$). **CONCLUSION:** Greater attention should be paid to the prevention of bullying in schools. In addition to the negative psychological effects on adolescents, bullying may deter adolescents from participation in sports, and indirectly increase time spent in SB.

3395 Board #300 June 2 2:00 PM - 3:30 PM
The Relationship between Outdoor Time and TV Viewing Time With Children's Physical Activity At Child Care

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Childhood obesity is a public health concern with the trajectory into adult obesity. Increasing moderate-to-vigorous physical activity (MVPA) and decreasing sedentary behavior (SB) are associated with lowered childhood obesity. Environmental factors, such as outdoor time and TV viewing time (TVVT), may contribute to MVPA and SB in preschool children. The child-care environment influences MVPA and SB, and is an area for improving activity patterns. **PURPOSE:** The purpose of this study is to determine the relationship between outdoor time and TVVT with physical activity in preschool children at the child-care center, while adjusting for classroom similarities. **METHODS:** An observational study at child-care centers was conducted during 2011-2014. Outdoor time was defined as time children spent in an outdoor play space, and TVVT was defined as time children spent watching TV. Outdoor time and TVVT were observed on two days using a digital wrist watch. Physical activity intensity and duration was measured for the entire school-day using waist-worn accelerometers. Data were recorded in 15-second epochs and analyzed with age-specific cut points to determine intensity. Dependent movement variables included minutes of SB, light physical activity (LPA), MVPA, and total steps. Hierarchical models were adjusted for weather, and used for the clustering of children within the classroom. **RESULTS:** Participants ($n = 202$) of 34 classrooms were 3.7 ± 0.7 years old, 51% male, and 60% Caucasian. Children took 4453 ± 1655 steps, 310 ± 83 minutes of SB, 36 ± 13 minutes of LPA and 19 ± 10 minutes of MVPA. Outdoor time was observed in 87% of classrooms for 77 ± 65 minutes, and TVVT was observed in 52% classrooms for 57 ± 39 minutes. In hierarchical modelling, outdoor time was associated with SB ($p < 0.01$), LPA ($p < 0.01$), MVPA ($p < 0.01$) and steps ($p < 0.01$). At the classroom level there were mixed results on the impact of outdoor time, some classrooms with higher outdoor time exhibited higher LPA, MVPA and steps, while others engaged in more SB. TVVT was only associated with MVPA ($p < 0.01$), with differing directions of association at the classroom level. With higher TVVT, some classrooms showed more and others less MVPA. **CONCLUSIONS:** Investigating the differences between classrooms and the role of the teacher may help increase children's physical activity.

3396 Board #301 June 2 2:00 PM - 3:30 PM
Time Segment Specific Physical Activity During School Hours In Six- Nine- And 15-year-olds

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It is recommended that youth spend ≥ 60 min/d in physical activity (PA) of moderate-to-vigorous intensity (MVPA). Because the vast majority of children attend school, this environment can provide an ideal arena for PA promotion and it has been argued that schools should provide opportunities to accumulate ≥ 30 min/d of MVPA (i.e., $\geq 50\%$ of recommended daily minimum). However, the current knowledge of MVPA accumulated during school is limited by small sample sizes, short duration of observation and inaccurate segmentation of periods during the school day. **Purpose:** To examine time segment specific MVPA during school hours, using accurately segmented accelerometer data collected over a full school week in a representative, population-based sample of 6-, 9-, and 15-year-olds attending a diverse sample of schools. **Methods:** We used accelerometer data (ActiGraph GT1M/ GT3X+) from a sub-sample of the PA among Norwegian Children Study. Participants attended 34 different schools (82 classes) that provided class schedules describing the exact start

and end time of the school day, recess periods and physical education (PE) classes. To classify time segment specific MVPA, we summed all 10 sec epochs within the different time segments containing > 333 activity counts (vertical axis). We applied random effects linear regression models, accounting for the clustered nature of the data. **Results:** Among 6- ($n = 166$), 9- ($n = 296$) and 15-year-olds ($n = 323$), 57%, 35% and 9% accumulated ≥ 30 min of MPVA per school day, respectively. Boys accumulated significantly more MVPA than girls during school hours, recess and PE (adjusted for wear time (WT) and month, $p \leq 0.011$). We found an inverse association between age and school hour MVPA ($p < 0.001$), whereas the association was inverted and J-shaped with age (adjusted for WT, month and sex, $p < 0.001$) for recess MVPA. We found no association between age and MVPA during PE ($p \geq 0.154$). **Conclusion:** Low proportions of 6-, 9- and 15-year-olds accumulated ≥ 30 min of MVPA during school hours, and girls accumulated less MVPA than boys throughout the school hours in all age groups. Our results indicate that self-organised MVPA (recess), but not teacher organized MVPA (PE), declines with age. This suggest that schools should provide opportunities for structured PA during recess, especially for adolescents and girls.

3397 Board #302 June 2 2:00 PM - 3:30 PM
Day-to-day Reciprocal Associations Between Sleep Health, Physical Activity, And Sedentary Behavior In Adolescents

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Physical activity (PA) has been continuously examined as one of the modifiable lifestyle factors influencing sleep health in adolescents. However, the evidence is inconclusive and scarce data are available exploring temporal, bidirectional relationships between PA, sedentary behavior (SB), and sleep health in this population. **PURPOSE:** This study examined the day-to-day reciprocal associations of objectively measured PA, SB, and sleep parameters in young adolescents. **METHODS:** 263 adolescents (135 boys) in 6th-8th grades were asked to wear the ActiGraph GT9X accelerometer on their non-dominant wrist for 24-hour across three consecutive school days while completing sleep quality survey every morning. The parents recorded daily screen time of their child. Total sleep time (TST), sleep efficiency, and sleep fragment index (SFI) were estimated using the Sadeh algorithm. The % of moderate and vigorous PA (MVPA) and SB, relative to total wear time in a day, before and after school ends (BS and AS, respectively), were estimated using the Chandler's cut points for each measurement day. Multilevel models were constructed to examine the day-to-day reciprocal associations between study variables after adjusting for the repeated measures within participants as well as study covariates. **RESULTS:** MVPA and SB on one day were significantly associated with TST on that night. The reduced TST was associated with increased MVPA-AS ($b = -2.72$; $p = .045$) and SB-AS ($b = -2.62$; $p < .001$) while an inverse relationship was observed with SB-BS ($b = 2.20$; $p < .001$). The increased SB-AS was associated with improved sleep efficiency ($b = 0.16$; $p = .006$) and SFI ($b = -0.24$; $p = .002$), and screen time was associated with a decreased likelihood of having good sleep quality ($OR = 0.89$; 95% $CI = 0.82, 0.97$). Meanwhile, TST on previous night was associated with SB-BS ($b = -0.02$; $p < .001$) on next day, and lower sleep quality was associated with decreased MVPA-BS ($b = -0.24$; $p = .042$), increased SB-AS ($b = 1.62$; $p = .022$) and screen time ($b = 14.54$; $p = .049$) on next day, respectively. **CONCLUSIONS:** The current study suggests that, in general, a good perceived sleep quality on the previous night can potentially promote PA and reduce SB on next day. However, the temporal effects of PA and SB on sleep health are still inconclusive that warrants future study.

3398 Board #303 June 2 2:00 PM - 3:30 PM
Recess, Regular Physical Activity Outside Of School And Academic Achievement In U.S. Elementary School Students

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Physical activity (PA) in general, but also time for recess, has declined in recent decades among children in the U.S. Carlson et al (2008) found small beneficial effects of time spent in physical education on math and reading scores but did not include recess or other PA measures.

PURPOSE: To assess the association between recess, regular PA outside of school, and math scores in U.S. elementary school students. **METHODS:** We used the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K) for this analysis. Students in the ECLS-K cohort were followed from Kindergarten (KG) through 1st, 3rd, 5th and 8th grade; but here only data from full-time KG, 3rd and 5th grade was used ($N = 1036$). Mixed models with random effects were estimated to account for clustering by schools and repeated measures by students.

RESULTS: We confirmed the decline of recess over time; however, the majority students in KG, 3rd and 5th grade had daily recess. In the unadjusted models, we found significantly higher math scores in 5th grade among students with more than average ($\beta=4.3$), average ($\beta=4.1$) and below average ($\beta=4.4$) time for recess compared to students with no recess (all $p<0.001$). The effect of recess in 3rd grade was similar but less strong. Additionally, regular PA/exercise outside of school resulted in significantly higher math scores in 3rd grade students ($\beta=4.9$) and 5th grade students ($\beta=3.3$) compared to children without regular exercise (all $p<0.001$). However, once we adjust for race, parental education and gender, the majority of effects of recess on math scores did not remain significant. Only students with a low amount of recess compared to no recess in 5th grade had significantly higher math scores ($\beta=2.1$, $p=0.03$). Also, regular exercise outside of school was positively associated with math scores in 3rd grade ($\beta=2.5$, $p=0.001$).

CONCLUSIONS: Academic achievement is related to future health since school outcomes are highly correlated with future socio-economic status which itself is correlated with health status in adults. We conclude that - compared to race and SES - recess and regular PA seem to be beneficial but of lower importance for academic achievement. Nonetheless, both PA measures are modifiable factors and thus can potentially play a vital role in both health promotion and improved school outcomes.

3399 Board #304 June 2 2:00 PM - 3:30 PM
Tracking Of Clustered Metabolic Syndrome Risk Factor In Japanese Children

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PURPOSE: Longitudinal studies about "tracking" of metabolic syndrome (MetS) risks are limited in Asian children. It is also unclear whether fitness and/or fatness level are contribute the tracking of MetS risk. The purpose of this study was to investigate tracking clustered metabolic syndrome (MetS) risk taking into account of fatness and aerobic fitness from childhood to adolescence in Japanese children.

METHODS: This cohort study included 113 participants (47 boys and 66 girls) who were measured for MetS risk factors at 9 years and 12 years of age. This study was performed in Ibara city of Okayama prefecture in Japan. All participating children and their parents provided written informed consent before participation. MetS risk scores were calculated from the total sex-specific values (z-scores) of the following five parameters: waist to height ratio, predicted $\dot{V}O_{2peak}$, triglycerides, high density lipoprotein cholesterol, and mean arterial pressure. All measurements were investigated at baseline (September, 2008) and follow-up (September, 2011). Partial correlation coefficients were calculated to determine the tracking of MetS risk variables and clustered MetS risk score from childhood to adolescents. A correlation ranging from 0.00 to 0.29 indicates low relationship, a correlation from 0.30 to 0.59 indicates a moderate relationship, and a correlation from 0.60 to 1.00 indicates a high relationship.

RESULTS: Sex-adjusted partial correlation coefficients were higher for HDL-c ($r=0.804$, $p<0.001$), W/H ($r=0.753$, $p<0.001$) and $\dot{V}O_{2peak}$ ($r=0.715$, $p<0.001$). TG ($r=0.436$, $p<0.001$) and MAP ($r=0.3970$, $p<0.001$) indicated a moderate relationship. In addition, Met risk score ($r=0.647$, $p<0.001$) indicated a high relationship. Correlations coefficients of MetS risk score between 9 and 12 years in high W/H ($r=0.713$, $p<0.001$) was higher than that in low W/H ($r=0.402$, $p<0.01$). In addition, that in low $\dot{V}O_{2peak}$ ($r=0.630$, $p<0.001$) was higher than that in high $\dot{V}O_{2peak}$ ($r=0.452$, $p<0.01$).

CONCLUSIONS: We found that MetS risk was stable from childhood to adolescence in Asian children. Furthermore, our results show that both the fatness and fitness are crucial for tracking clustered MetS risk factors.

3400 Board #305 June 2 2:00 PM - 3:30 PM
The Association of FNPA Score and Nighttime Sleep with Preschooler Body Size and Adiposity

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Purpose: The purpose of this study was to examine the cross-sectional associations between characteristics of preschoolers' home environment and sleep habits with body size and adiposity. **Methods:** Parents of 2-5 year-old children completed the Family Nutrition Physical Activity (FNPA) tool and Children's Sleep Habits Questionnaire (CHSQ). Child height and weight were determined according to standard procedures and BMI percentile was determined using the 2000 CDC growth charts. Adiposity was assessed using skinfold thicknesses (tricep, subscapular, suprailiac) and sum of skinfolds was calculated. **Results:** To date, 19 children (10 boys, 9 girls; mean age 3.1 ± 0.9 y) have participated in the study. Boys and girls did not differ in terms of any anthropometric variables; therefore, analyses are not divided by sex. Twenty-one percent of the sample ($n=4$) met criteria for overweight or obesity based on BMI percentile. Correlations between anthropometric variables and the FNPA total score did

not reach statistical significance. Nap duration tended to be inversely related to BMI percentile ($r=-0.51$, $p=0.06$) and z-score ($r=-0.50$, $p=0.07$). The FNPA total score was strongly correlated with total daily sleep ($r=0.88$, $p<0.0001$), indicating that children who live in generally healthy family environments are more likely to demonstrate healthy sleep habits. **Conclusion:** To our knowledge, this is the first study to use the FNPA as a measure of the family environment in a preschool-aged sample. Our results suggest that sleep characteristics may be associated with the family environment and adiposity in preschoolers; however, additional research with larger sample sizes is necessary to confirm these findings.

3401 Board #306 June 2 2:00 PM - 3:30 PM
Physical Activity Levels of 7th and 8th Graders During a Studio-Based Learning Experience

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Schools are viewed as optimal settings for intervention efforts aimed at reducing childhood obesity. Identification of ways to increase physical activity throughout the school day is an important public health issue. Modest modifications to curriculum delivery or physical environment provide direct avenues to address this issue.

PURPOSE: The purpose of this study was to examine physical activity levels of middle school-aged students during a studio-based learning experience. The studio-based learning environment utilizes the "purpose, critique, iterate" cycle of repetitive thinking and learning that comes from the system of training used by designers across many professional fields. **METHODS:** Eleven 7th and 8th grade students who were identified as being "at-risk" for dropout were invited to participate in an educational service project aimed at developing areas of core curriculum by working on design problems in a studio-based learning environment. The studio-based learning experience was conducted between the hours of 8AM and noon (240 minutes) for two weeks in the summer. Participants were issued an Actigraph GT3x+ accelerometer upon arrival and monitors were collected at the end of each day. Physical activity was also measured the following fall semester in the same students. General anthropometric measurements were also assessed. **RESULTS:** Height approximated the 50th percentile for both boys and girls. Weight and BMI approximated the 90th percentile for boys and the 75th percentile for girls. Participants took part in an average of 25.0 and 7.2 minutes of moderate and vigorous physical activity, respectively, during the studio-based learning experience. During the regular school year, these students participated an average of 7.4 and 3.1 minutes of moderate and vigorous physical activity, respectively, during the hours of the school day corresponding with the summer experience. **CONCLUSIONS:** Studio-based learning may provide a viable option for increasing physical activity levels while addressing academic performance. This is particularly important for students classified as "at-risk" for dropout as they are often the same population affected by health disparities.

3402 Board #307 June 2 2:00 PM - 3:30 PM
Metabolic Syndrome And Activity Levels In College Students

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PURPOSE: It is estimated that greater than 30% of young adults attending college are overweight or obese. Many of the known risk factors that are often associated with obesity also place an individual at risk for developing metabolic syndrome (MetS). In particular, physical activity has been shown to insulate against future risk of such metabolic disorders. The purpose of this study was to examine the relationship of the risk factors associated with MetS and activity levels in college students.

METHODS: Twenty-one college students (age: 23.1 ± 4.2 years; BMI: 28.1 ± 6.2 kg/m²) participated in the study. The following information was obtained from each participant; body anthropometrics, fasting glucose and lipoproteins, and accelerometry measured activity levels. Participants wore, at the waist, the wireless activity monitor (wGT3X-BT, ActiGraph, Pensacola, FL) for seven consecutive days. MetS was determined if the participants met three of the five criteria utilizing the NCEP guidelines.

RESULTS: Metabolic syndrome was prevalent in 9.5% of the population. The average daily step count for the participants were 7982.6 ± 2209.6 steps/day. The observed categorical activity levels (not including while asleep) for the participants included $84.3 \pm 0.05\%$ spent in a sedentary state and $0.04 \pm 0.01\%$ engaged in moderate to vigorous physical activity.

CONCLUSIONS: Metabolic syndrome is becoming more prevalent in all populations including college students. Current levels of activity in college students do not meet the CDC's established guidelines for total steps/day, elevating their risk of acquiring

metabolic disorders. In order to reduce the increasing prevalence of MetS, increasing the total number of steps/day in conjunction with a focus on moderate-vigorous physical activity levels may reduce the risk factors associated with MetS later life. On-going participant collection will continue, looking to establish correlates between MetS criteria and physical activity.

3403 Board #308 June 2 2:00 PM - 3:30 PM
Discrepancies Among Children at the 99th Percentile

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(No relationships reported)

PURPOSE: Use of the body mass index percentile curves (BMI%) allows for consideration of growth and maturation throughout childhood but creates a ceiling effect for children with severe obesity who are classified at the 99th percentile. This study aimed to evaluate variances by age and gender of alternative measures of weight status in children and adolescents.

METHODS: Age, height and weight from all children ages 3-18 were obtained from NHANES 2009-2010, 2011-2012, and 2013-2014 and BMI variables were calculated. These included raw BMI (kg/m²), BMI%, BMI z-score, and percent over the 50th and 95th percentile. Means and variances of these variables were calculated for all children with BMI% of 99% as well as 50% for comparison purposes. Analyses were conducted for 3-6, 7-11, and 12-18 year-old age groups.

RESULTS: Data was available for 9049 subjects. Raw BMI for all subjects with BMI% = 99 ranged from 19.06 - 57.1 kg/m² and mean BMI was 22.5, 29.6, and 39.6 kg/m² for 3-6 year olds, 7-11 year olds, and 12-18 year olds, respectively. The range was much narrower among children at the 50th percentile (15.2 - 22.0 kg/m²). Average BMI z-score for subjects at the 99th percentile ranged from a low of 2.5 in 7-11 year olds to a high of 2.9 in 3-6 year olds. Percent over the 50th percentile ranged from 22.3% - 155.8% in 3-6 year olds, 44.6%-189.6% in 7-11 year olds, and 60.0%-169.1% in 12-18 year olds. These ranges were narrower in children at the 50th percentile (-0.3% to 0.9%, -0.8% to -0.4%, and -0.9% to -0.2%, respectively). Among subjects at the 99th percentile, percent over the 95th percentile ranged from 6.5%-114.1% in 3-6 year olds, 17.8%-122.7% in 7-11 year olds, and 20.8%-99.6% in 12-18 year olds.

CONCLUSIONS: Alternative weight variables including percent over the 50th percentile and percent over the 95th percentile may allow for better distinction among children and adolescents presenting with severe obesity.

3404 Board #309 June 2 2:00 PM - 3:30 PM
Tracking BMI in Childhood Through Adulthood

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Does a child's BMI percentile change from 1st to 10th grade?

Purpose: Obesity, specifically in childhood, has become an important public health concern because of possible long-term correlations with heart disease and chronic illnesses in adulthood. However, there is limited evidence measuring the link between childhood to adolescent BMI by trained professionals. The purpose of this study is to track BMI measurements in 1st graders and later in 10th graders to analyze BMI trends from childhood to adolescence.

Methods: Child height and weight were measured in 1st grade (by school nurses) and 10th grade (by Physical Education teachers) and converted to Body Mass Index percentiles (BMI%) for sex and age using standard CDC SAS code. Subjects were grouped into BMI Categories (Cat) based on 1st grade BMI% with all children with BMI% less than 10% in Cat0, BMI% from 10-19% in Cat1 and so forth, up to Cat9 with 1st grade BMI% of 90% or higher. Average 10th grade BMI% and average change in BMI% from 1st to 10th grade were computed for each BMI Category.

Results: Complete data was available for 559 subjects. Average 10th grade BMI% ranged from 35.8% in Cat1 to 90.2% in Cat9. Average BMI% change was 2.86% from 1st to 10th grade. Average BMI% in Cat0 increased by 31.4% while Cat9 showed an average decrease of 6.9%. Cats 7, 8, and 9 all showed overall decreases in BMI% while Cats 0-6 showed increases

Conclusion: Categories 7, 8, and 9 show a decrease in BMI; however, that may be due to the maximum category limit. Childhood and adolescent obesity is an important public health concern as it shows an increased risk of becoming overweight and obese in adulthood, placing them at higher risk for chronic illness and heart disease. Obesity remains an issue and should continue to be monitored from childhood to adolescents. Singh, A. S., Mulder, C., Twisk, J. W. R., Van Mechelen, W. and Chinapaw, M. J. M. (2008). Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obesity Reviews*, 9: 474-488. doi:10.1111/j.1467-789X.2008.00475.x Cole Tim J, Bellizzi Mary C, Flegal Katherine M, Dietz William H. Establishing a standard definition for child overweight and obesity worldwide: international survey *BMJ* 2000; 320 :1240

3405 Board #310 June 2 2:00 PM - 3:30 PM

Associations between Physical Activity, Sedentary Time and Percent Body Fat in Chilean Adolescents

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(No relationships reported)

The prevalence of overweight and obesity among Chilean adolescents in 8th grade has increased from 41% in 2014 to 45% in 2016. However, physical activity (PA) and sedentary characteristics in this group of adolescents has not been evaluated. **PURPOSE:** To evaluate PA and sedentary time (ST) and their association with percent body fat among 8th grade adolescents in Chile. **METHODS:** A group of 156 adolescents (87 males, 69 females, mean age= 13.4±0.7 yrs) were recruited from 4 public schools in the metropolitan region in Chile. Measures of height, weight, and percent body fat using bioelectrical impedance were obtained. Physical activity and sedentary behavior were measured with ActiGraph GT3X+ accelerometers that adolescents wore in the right hip area attached to an elastic waist band for 8 consecutive days. T-tests were conducted to detect gender differences, and Pearson correlations and linear regressions were used to evaluate associations between PA, ST, and percent body fat. **RESULTS:** Males and females were not different in ST (9.0±2.6 vs. 8.9±2.8 hr/day, P=0.97), but females had higher percent body fat compared with males (27.8±5.9 vs. 17.2±7.1; P<0.001), lower moderate to vigorous PA (MVPA) (170.7±112.8 vs. 285.3±161.1 min/week; P<0.001), and lower steps/day (5951±2139 vs. 7181±2668; respectively, P=0.002). MVPA was inversely associated with percent body fat (r= -0.30, P=0.0004) but ST was not associated with percent body fat. However, a strong inverse association was observed between percent of the day in ST and MVPA (r= -0.62, P<0.001). **CONCLUSION:** This group of Chilean adolescents had high ST and no compliance with PA recommendations, particularly females; and those with less MVPA had higher percent body fat. To help control the obesity trend among adolescents in Chile, school programs that incorporate more PA and reduce ST is warranted.

3406 Board #311 June 2 2:00 PM - 3:30 PM

Associations with Physical Activity and Sedentary Behavior with Physical Fitness in Chinese Children and Adolescents

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(No relationships reported)

Associations with Physical Activity and Sedentary Behavior with Physical Fitness in Chinese Children and Adolescents

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PURPOSE: The purpose of this study is to examine the associations of physical activity and sedentary behavior with physical fitness in Chinese children and adolescents. **METHODS:** A total of 33,414 participants (boys:48.9%, age:12.5±2.5 yr, weight:48.0±14.9 kg, height:154.6±13.9 cm, BMI:19.7±3.9 kg/m²) completed physical activity and sedentary behavior questionnaire and physical fitness test including Body Mass Index (BMI), lung capacity, sit and reach, jump rope/long jump, sit-ups/pull up and shuttle run /800meter/1000meter run. The participants were categorized into either "fit" or "unfit" by using National Students Physical Fitness Standard depending on whether they met the standard or not. Multiple logistic regressions were performed to examine the associations of physical activity and sedentary behavior with physical fitness after controlling for gender, age and BMI. **Results:** After adjusting gender, age and BMI, physical activity and sedentary behavior were significantly associated with physical fitness, independently. The children and adolescents who did not meet the recommendation of 60 min/day of moderate and vigorous physical activity (MVPA) had 1.97 times the odds of being unfit compared to those meeting guideline (95% confidence interval [CI] of Odds Ratio:1.69-2.30). The children and adolescents who did not meet the sedentary behavior guideline had 1.27 times the odds of being unfit (95% CI of Odds Ratio: 1.07-1.50). In joint association analysis, children who did not meet physical activity nor sedentary behavior guidelines had 2.26 times higher odds of being unfit than children who met both guidelines (95% CI of Odds Ratio: 1.61-3.17). **CONCLUSION:** The results demonstrated that being physically active and reducing the sedentary behavior are independently and positively associated with physical fitness in children and adolescents.

3407 Board #312 June 2 2:00 PM - 3:30 PM

Anthropometric Measures are Associated with Canadian Agility and Movement Skill Assessment Scores

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(No relationships reported)

PURPOSE: Recent literature suggests that anthropometric measures are correlates of gross motor competence in children. The purpose of this study was to determine if body mass index (BMI) or waist circumference (WC) are associated with children's scores on the Canadian Agility and Movement Skill Assessment (CAMSA).

METHODS: Children aged 8-12 years ($n = 7,773$), with parental consent, from 7 Canadian provinces had their physical literacy level measured using the Canadian Assessment of Physical Literacy (CAPL). CAPL testing was completed between 2012-2016 and administered by trained research staff. As part of the CAPL tests, movement competence was measured using the CAMSA which evaluates fundamental, combined, and complex movement and motor skills. Children were scored on time to complete the CAMSA (range 1-14 points) and ability to demonstrate the movement skill criteria (range 0-14 points) for a combined score out of 28, with the best of two trials used for analyses. BMI was calculated from measured height and weight and converted to BMI z-score using the World Health Organization's (WHO) BMI-for-age charts and formulae based on the LMS method. WC was measured in duplicate using an elastic tape measure at the level of the iliac crest and recorded in centimeters, with the average of the two measures used for analyses. Children were grouped for analysis based on those meeting (≥ -2.0 to ≤ 1.0) and not meeting (< -2.0 or > 1.0) the WHO's recommended level of BMI z-score. Separate multiple linear regression models were used to predict CAMSA score for BMI z-score and WC, with both models adjusting for age and sex.

RESULTS: The difference in CAMSA scores between BMI z-score groups was significant ($p < 0.001$, Cohen's $d = 0.3$). In the BMI z-score model, results of the regression ($F [3,7455] = 353, p < 0.0001, R^2 = 0.12$) indicated that CAMSA scores were lower by 0.3 units for every 1 unit increase in BMI z-score. In the WC model, results of the regression ($F [3,7455] = 402.2, p < 0.0001, R^2 = 0.14$) found lower CAMSA scores of 0.1 units for each 1 centimeter increase in WC. Age and sex were strongly associated with CAMSA score in both models, as expected.

CONCLUSIONS: These results align with previously reported findings suggesting that anthropometric measures have a moderate relationship with children's performance on movement competence assessments.

3408 Board #313 June 2 2:00 PM - 3:30 PM

The Relationship Between Fundamental Motor Skills and Physical Activity in College Age Students in Puerto Rico

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Physical activity (PA) is associated with disease prevention and maintaining a healthy lifestyle. It is expected that individuals with higher levels of Fundamental Motors Skills (FMS) would be more physically active. The lack of PA is currently a global problem for it has caused 1.9 million deaths. Furthermore, only 33.8% of the population in Puerto Rico meets the current PA guidelines, thus placing in the top position with the lowest percentage among all the states and territories of the United States. **PURPOSE:** To investigate the relationship between PA and FMS in college-age students in Puerto Rico. **METHODOLOGY:** Participants were 91 college-age students that completed the International Physical Activity Questionnaire (IPAQ)

and used the Walk 4 Life Pedometer for 7 days. Also completed a series of motor skills tests: running 60 meters, overhand throw, and horizontal jump. A Spearman correlations analysis was used to identify relationships between variables.

RESULTS: The results showed that students did not fulfill the current PA recommendation assessed by pedometer (6,546.6 steps/day + 3234). Nevertheless, according to IPAQ, the population obtained a moderate/vigorous PA (5,499 METS + 6993), and engaged an average of 285 min/day of sedentary time in their most active day. Total FMS score averaged was 19.4 ± 4.38 . PA (step/day) and METS were not correlated with FMS ($r^2 = .034, p = .75$) and ($r^2 = .124, p = .24$). PA (METS) was significantly correlated with overhand throw ($r^2 = .255, P = .02$).

CONCLUSION: In conclusion, the participants did not comply with the total amount of daily steps recommended for PA and did not reach the expected level of FMS.

3409 Board #314 June 2 2:00 PM - 3:30 PM

Physical Activity Levels In Preschool Children During Winter & Summer

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Background: The Norwegian Directorate of Health recommends that children between 3 to 5 years accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily. However, knowledge about physical activity levels in preschoolers is limited.

PURPOSE: To compare physical activity levels in kindergarten preschool during summer and winter in children aged 3-5 years.

METHODS: From Monday to Wednesday, physical activity levels were monitored using the Actigraph GT3X between 07.30 am and 4.30 pm. ($n = 81$; 4... yrs). Physical activity levels were measured twice, in February ($n = 81$; 4.45 ± 0.86 years), ($n = 71$; 4... yrs) and in June. June ($n = 71$; 4.75 ± 0.89 years). The primary physical activity outcome was time spent at different activity intensities. We defined moderate-to-vigorous physical activity (MVPA) as all activity above 2000 counts/min. As used previously (Ekelund et al., 2004).

RESULTS: During the winter period, 64 % of the children reached MVPA the recommendations of 60 minutes physical activity daily, whereas 29% was in MVPA between physically active 30-59 minutes per day, and 6% were in MVPA active <29 minutes. During the summer period less children reached MVPA, physical activity were lower, as 50 % reaches MVPA active > 60 minutes per day, while 39% were active reached MVPA between 30-59 minutes per day, and 11% was in MVPA less than were active <29 minutes. In total for bout periods the boys spent significantly more time in MVPA, (84.11 minutes ± 37.97) compared to girls (63.46 minutes ± 31.39) ($p < 0.001$). In the winter, 65.8% of the boys met the recommendations, and the percentage was reduced to 58% in the summer. For girls, the respective numbers were 34 % and 41%. Boys were significantly () more active than girls () in both periods.

CONCLUSION: More than 2/3 of preschoolers do not reach the recommendations of 60 minutes moderate-to-vigorous physical activity. More children in preschool reached the recommendations of MVPA above 60 minutes in the winter, compared with the summer period.

3410 Board #315 June 2 2:00 PM - 3:30 PM

Changes in Sedentary Behaviour, Physical Activity and Body Mass Index in Schoolchildren: A 3-Year-Longitudinal Study

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There is growing interest in sedentary behaviour (SB) and its association with health outcomes. However, few studies have considered the changes in SB its association with change in MVPA and BMI in schoolchildren longitudinally and it is need better understanding. **PURPOSE:** To describe the 3-years changes in objectively measured SB, moderate-to-vigorous physical activity (MVPA) and body mass index (BMI), and to investigate changes in SB and its association with change in MVPA and BMI in a 3-year follow-up. **METHODS:** The sample consisted in 68 children ($n = 39$; 57.4% female) aged 6 to 9 years-old, from schools in metropolitan area of Porto, Portugal. Height and weight of children were measured and BMI was calculated (kg/m^2). SB and MVPA were measured by accelerometer. Changes between 2009/2012 and between 2010/2013 in SB, MVPA and BMI indicators were computed as the value recorded in the end of the follow up minus the value recorded in the baseline (Δ). Differences between baseline and follow-up SB, MVPA and BMI were examined by paired-sample

t-tests. ΔSB and its associations between ΔMVPA and ΔBMI were assessed using a multivariate linear regression model, adjusted for gender and baseline values of age, SB, MVPA and BMI. **RESULTS:** The SB and BMI baseline increased significantly compared with follow-up (562.51 ± 46.81 and 577.29 ± 49.81 min/day; $p = 0.033$; 17.55 ± 2.44 kg/m², 19.61 ± 3.21 kg/m²; $p = 0.0001$, respectively) and MVPA was not significantly different (67.23 ± 15.38 and 65.24 ± 20.73 ; $p = 0.380$). Multiple linear regression analyses showed that ΔSB was negatively related to ΔMVPA (β : -0.609; 95%CI: 2.30, -1.39; $p = 0.0001$), however it was not associated significantly with ΔBMI (β : -0.088; 95%CI: -6.79, 1.58; $p = 0.218$). **CONCLUSIONS:** The increase of SB with age could displace the time spent in MVPA, although the influence of the BMI values remained unclear for the children sample presented here. This reinforces public health measures and suggests the need of interventions focusing in decline SB and increase MVPA during childhood. Supported by the CIAFEL under grant number UID/DTP/00617/2013; FCT under grant number SFRH/BD/86538/2012; CNPq under grant number 206862/2014-8 and CAPES under grant number 6099/13-0.

3411 Board #316 June 2 2:00 PM - 3:30 PM

Effect of a Lifetime Health and Fitness Class on College Students

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PURPOSE: A pre-post, quasi-experimental study was conducted to evaluate the association between a health and fitness class, physical education 215 (PHED 215) and chronic disease risk, cardiorespiratory fitness (CRF) level, body fat percentage, self-motivation, exercise self-efficacy, and transtheoretical model (TTM) physical activity stage of change progression among male and female college students ($n = 64$).

METHODS: Secondary data were analyzed via descriptive statistics, paired *t* test (or Wilcoxon signed-rank test if data were not normal), and Bowker's test of symmetry.

RESULTS: Results showed a statistically significant association between PHED 215 and 2 dependent variables: cardiorespiratory fitness level ($p = 0.0001$) and progressive movement through the TTM stages of change ($p = 0.0061$). No statistically significant difference was found between PHED 215 and 4 dependent variables: disease risk, body composition, self motivation, and self-efficacy.

CONCLUSIONS: Because college age students are shaping their adult behaviors, positive health change adopted during this critical time could increase CRF, establish lifelong exercise habits, improve quality of life, and delay and decrease obesity risk and chronic disease and related costs. While further study in different settings is warranted, PHED 215 could be used as a blueprint for other interventions in the education, community, and healthcare settings.

Variable	Measurement Tool
Disease risk	ACSM Guidelines for Exercise Testing and Prescription (2010) Table utilizing combination of BMI and waist circumference to obtain disease risk
Cardiorespiratory fitness	Three Minute Step Test (Powers & Dodd, 2009)
Body fat percentage	Bioelectrical Impedance (Tanita 350 Body Composition Analyzer)
Self-motivation	Self-Motivation Inventory (Dishman & Ickes 1981; Merkle, 1997)
Exercise self-efficacy	Exercise Self-Efficacy Scale (Bandura, 1997)
Stage of change	Assessing Physical Activity Stages of Change (Marcus & Forsythe, 2003; ACSM Resource Manual, 2010)

Analysis Results									
Variables	Pretest Mean (SD)	Post-test Mean (SD)	Mean Difference (post-pre)	<i>t</i>	<i>P</i>	Skewness	Kurtosis	SW	<i>P</i> (Wilcoxon)
Body fat percentage (N=43)	23.42 (11.36)	23.53 (10.96)	0.11	0.26	0.7945	0.20	0.11	0.8317	0.9212
Cardiorespiratory fitness level (N=54)	160.74 (31.48)	152.70 (30.92)	-8.04	-3.04	0.0037*	1.48	5.17	0.0003	0.0001*
Self-motivation score (N=41)	129.51 (16.45)	131.71 (19.11)	2.20	1.41	0.1675	0.67	2.65	0.0042	0.1758
Self-efficacy score (N=41)	67.05 (14.22)	65.62 (16.73)	-1.42	-0.75	0.4560	0.51	1.77	0.1543	0.2510
PA stage (N=39)	2.56 (1.37)	3.15 (0.93)	0.59	2.85	0.0070*	-0.32	0.46	0.0059	0.0061*
N=sample size	SD=standard deviation			<i>t</i> =paired t-statistic	<i>P</i> = <i>p</i> -value for paired t-test; *indicated significance at the 0.05 level			SW= <i>p</i> -value of Shapiro-Wilk test	<i>P</i> (Wilcoxon) = <i>p</i> -value of Wilcoxon signed rank test; *indicated significance at the 0.05 level
Disease Risk Analysis Results									
Disease risk assessed via Bowker's test for table symmetry (N=56)	55/56 subjects had same pretest and posttest disease risk ($p=0.9536$)								

3412 Board #317 June 2 2:00 PM - 3:30 PM

Moderate to Vigorous Physical Activity during Recess and Physical Education by Gender and Body Fat

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PURPOSE: To compare the intensity of physical activity using accelerometers and heart rate monitor during physical education class and recess in students of third and fourth grade of primary education according to gender and body fat percentage.

METHODS: In order to determine the intensity of physical activity accelerometers ActiGraph GT9X Link and heart rate monitors Polar bluetooth smart were used, in 28 boys and 26 girls during 8 physical education classes and recess periods, to determine the percentage of body fat as normal or high bioelectrical impedance analysis was performed using the 720 Inbody equipment.

RESULTS: Student *t* test for independent samples resulting a *P*-value less than $\alpha \leq 0.005$ with significant differences in physical education classes between the averages of moderate to vigorous physical activity (men:0,003 women:0,001) and heart rate beats/min (men:0,001 women:0,000) in participants with normal body fat percentage compared to high.

CONCLUSIONS: The intensity of physical activity during recess was higher in relation to physical education classes and with a moderate to vigorous physical activity less than 50% of the duration of the class, due, is important a feedback for the teachers in strategies for involving the students with increased risk of obesity in moderate to vigorous physical activity.

3413 Board #318 June 2 2:00 PM - 3:30 PM
Effects Of Moderate To Vigorous Program On Vo2max And Body Fat In Overweight Children
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 (No relationships reported)

PURPOSE: To evaluate the effect of a program of physical activity with moderate to vigorous under the model of CATCH on body fat percentage and aerobic capacity in overweight or obesity children.

METHODS: Twenty-six children (15 male and 11 female (age 9.4±0.3 years), diagnosed with overweight or obesity participated in a program of physical activity with moderate to vigorous under the model of CATCH, 2 times a week over a period of 10 months, consisting of exercise intensity of 56% evaluated by the system for observing fitness instruction time (SOFIT), before and after the program body fat percentage was evaluated determined by the equation Slaughter with the anthropometrics measurements of triceps and media calf skinfolds. Aerobic capacity (VO_{2max}) was determined through the test course navette 20 meters. **RESULTS:** The results of student T test showed significant improvement ($p<0.05$) comparing before and after the program in VO_{2max} ($p=0.000$) and percentage change ($\Delta\%$) of 11.3. **CONCLUSIONS:** Physical activity with moderate to vigorous under the model CATCH was able to enhance aerobic capacity in overweight or obesity children, however, will be appropriated in the future more studies to better clarify the possibilities of improvements improvement in the percentage of body fat.

3414 Board #319 June 2 2:00 PM - 3:30 PM
The Relationship between Sit & Play and Gross Motor Coordination in Preschoolers
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Gross motor coordination (GMC) is positively associated with physical activity (PA) and inversely associated with sedentary behaviour (SB) in childhood. Although children behave sedentarily while sitting and playing there is effectively movement in this behaviour. We considered the transition between SB (≥ 150 c.p.m) and light physical activity (LPA) (≤ 800 c.p.m) as sit & play (SP), that is when preschoolers are sitting but there is some movement playing. No studies to date have examined how GMC is related to SP. **PURPOSE:** To examine the association between SP and GMC during the early years regardless physical activity levels.

METHODS: The sample comprised 209 children aged 3-6 years, GMC was assessed according to the Movement Assessment Battery for Children (MABC-2). The battery comprised the aiming & catching and balance component. We summed the item standard scores for each component. The GMC was categorized in the red zone, as poor GMC, and the green zone, as high GMC. Body mass index (BMI) was assessed as mass (kg)/stature squared (m^2), LPA, moderate vigorous physical activity (MVPA), SB and SP were assessed by accelerometer. SP was defined between ≥ 150 c.p.m until ≤ 800 c.p.m. For data analysis, the SP and SB were divided into two categories by median split.

RESULTS: The sample was 42.5% in the red zone for the aiming & catching component and 14.9% in the red zone for the balance component. Binary logistic regression analysis showed that preschoolers who had a low level of SP were 2.9 times more likely to be classified as having poor GMC level in aiming & catching than their counterparts with high SP level. (OR: 2.9; IC: 1.3-6.6) regardless gender, SB, BMI, LPA and MVPA. No statistical significant association was found for balance. Further binary logistic regression that examined the relationship between SB and GMC, did not show statistical significant association.

CONCLUSIONS: This study showed an association between low SP levels with poor GMC regardless of physical activity levels. Thus, children are sitting position, doing some movement playing looks good for GMC. No association has been found between SB and GMC. Further longitudinal studies are needed to confirm this data. Supported by the CIAFEL under Grant UID/DTP/00617/2013; FCT under Grant SFRH/BD/86538/2012; and CAPES under Grant 6099/13-0.

F-64 Free Communication/Poster - Pregnancy

Friday, June 2, 2017, 1:00 PM - 6:00 PM
 Room: Hall F

3415 Board #320 June 2 2:00 PM - 3:30 PM
Postpartum Mothers' Physical Activity & Sleep: A Comparison of Overweight/Obese and Normal Weight Mothers
 Shane Warehime, Kailey Snyder, Jung-Min Lee, Danae Dinkel. *University of Nebraska at Omaha, Omaha, NE.* (Sponsor: Dustin Slivka, FACSM)
 (No relationships reported)

Lack of physical activity (PA) and sleep are associated with several negative health outcomes. Two populations that are particularly vulnerable to these risk factors are postpartum mothers (<1 year of childbirth) and overweight/obese individuals. Thus, postpartum mothers who are also overweight/obese may be especially susceptible to issues related to lack of PA and sleep. However, research exploring this topic is lacking. **PURPOSE:** To compare PA and sleep of overweight/obese and normal weight mothers. **METHODS:** Physical activity and sleep levels were objectively measured using accelerometers worn on the non-dominant wrist. A total of 21 mothers (n = 13 overweight/obese, n = 8 normal weight) were recruited as part of a larger study. Mothers' PA and sleep levels (minutes) were assessed three times - when their infant was three months old, the onset of their child's sitting (~5 months of age), and one month post onset of sitting (~6 months of age) - for four days (two weekdays, two weekend days). Anthropometric measures (i.e., height weight) were collected at each visit to calculate BMI. Average BMI was used to classify mothers as normal weight or overweight/obese. A mixed-design ANOVA was used to examine differences between visits while comparing normal weight and overweight/obese mothers. **RESULTS:** Increases ($p < 0.05$) in normal weight mothers' PA was observed between visits one ($M = 78.98 \pm 20.83$ min/day) and three ($M = 99.89 \pm 14.57$ min/day, $p = 0.01$), and visits two ($M = 84.49 \pm 17.33$ min/day) and three ($p = 0.045$). Overweight/obese mothers displayed no significant change in PA over time. No significant change in sleep over time was observed in either group. No significant differences were observed between the PA and sleep levels of overweight/obese and normal weight mothers. **CONCLUSION:** Normal weight mothers tended to increase PA levels while overweight/obese mothers did not significantly change their PA levels over time. These findings can help guide future efforts aiming to increase the health of postpartum mothers, especially those that are also overweight/obese.

3416 Board #321 June 2 2:00 PM - 3:30 PM
Factors Associated With Household And Job Physical Activity In Low-income Pregnant Women: Ecological Perspective
 Alicia B. Stannard¹, Lanay M. Mudd, FACSM², James M. Pivarnik, FACSM³, Jean Kerver³, Lorraine Weatherspoon³. ¹Sacred Heart University, Fairfield, CT. ²National Center for Complementary and Integrative Health, Bethesda, MD. ³Michigan State University, East Lansing, MI.
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Low-income pregnant women are less likely to meet physical activity (PA) recommendations compared to higher income counterparts. Some studies suggest that the difference in activity levels is diminished when household (HPA) and job physical activities (JPA) are considered but little is known about factors that may influence HPA and JPA levels. **PURPOSE:** To examine personal, social, and environmental factors impacting HPA and JPA during pregnancy in low-income women based on the Ecological Model. **METHODS:** Low-income pregnant and postpartum women were recruited nationwide using an online platform. Participants (n=109) recalled pregnancy HPA and JPA using the International Physical Activity Questionnaire (IPAQ) and answered a survey on personal (demographics, self-efficacy, lifestyle beliefs), social (social support, social perceptions, social roles strain) and environmental factors (safety, community involvement). Descriptive statistics were assessed for all variables. Median split was used to categorize HPA and JPA. Correlation matrices were created for personal, social, and environmental factors. Based on established criteria, significant variables were selected to be included in confirmatory factor analysis (CFA). A CFA model for each personal, social, and environmental latent factor and two structural equation models were created for predicting HPA and JPA. **RESULTS:** Participants' mean age was 29.5 years (± 5.6) and 51.9% of women were on Medicaid. Median, range HPA was 28, 0-354 MET-hrs/wk and JPA was 0.2, 0-367 MET-hrs/wk. Latent personal, social, and environmental factors were not significantly related to HPA or JPA. However, significant interactions occurred between personal and environmental factors (-0.218 , $p<0.05$) and social and environmental factors (-0.207 , $p<0.05$) in the HPA model as well as personal and environmental factors

(-0.221, $p < 0.05$) in the JPA model. **CONCLUSIONS:** Reported HPA and JPA levels were low, varied widely, and could indicate a lack of understanding of PA questions. Latent factors were not related to HPA or JPA, but the interactions among latent factors indicate that this analysis might not capture the complexity of PA behaviors. Other correlates not included in this study, such as job type, may have greater influence on HPA and JPA among low-income pregnant women.

3417 Board #322 June 2 2:00 PM - 3:30 PM
The Relationships Among Social Support and Self-Efficacy on Physical Activity during Pregnancy
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 (No relationships reported)

There is some evidence to suggest that social support and self-efficacy aid in goal directed behaviors and may increase levels of physical activity (PA). **PURPOSE:** To examine the relationship between social support from family and friends, self-efficacy, and PA in a sample of pregnant women. **METHODS:** Participants ($n=23$) ≥ 18 years of age and 14-20 weeks gestation were enrolled in a nutrition and physical activity intervention. A survey assessing demographics (age, marital status, education, and race) was administered. Social support and self-efficacy for engaging in PA was also assessed. Height and weight were objectively measured to calculate body mass index (BMI). An accelerometer was worn to assess percent of day spent sedentary, in light PA, and in moderate to vigorous PA. Relationships were examined utilizing Pearson correlation coefficients. **RESULTS:** On average, participants were 27.2 ± 4.4 years of age and had a mean BMI of 26.7 ± 5.7 kg/m². A majority of the sample was married (82.6%), had some college education (78.3%), and was white (81.8%). The sample spent 57.5% of the day sedentary, 41.0% in light PA, and 1.5% in moderate to vigorous PA. For social support from friends, Pearson correlations showed a significant negative relationship with light PA ($r=-0.43$, $p=0.04$), a significant positive relationship with moderate to vigorous PA ($r=0.45$, $p=0.03$) but no relationship with sedentary time ($r=0.36$, $p=0.09$). Pearson correlations also indicated significant positive relationships between self-efficacy and sedentary time ($r=0.43$, $p=0.03$) and light PA ($r=0.45$, $p=0.02$), but no relationship with moderate to vigorous PA ($r=0.07$, $p=0.71$). No significant relationships were found between social support from family and any intensity of PA. **CONCLUSIONS:** Findings indicate that social support from friends may be an important factor to consider when encouraging participation in moderate to vigorous PA during pregnancy. Future research is needed to fully understand the effects of social support and self-efficacy on PA during pregnancy. Prospective research with larger sample sizes should consider including more diverse samples of pregnant women. Furthermore, relationships between social support from family and friends, self-efficacy, and PA should be assessed across trimesters.

3418 Board #323 June 2 2:00 PM - 3:30 PM
Why are Pregnant Women Physically Active or not?
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Physical activity (PA) during pregnancy has an important impact on public health as it reduces the risk of common pregnancy complications and chronic diseases and provides numerous protective factors for pregnant women and their children. Although national and international guidelines have recommended regular PA for all pregnant women since the 1980s, only a small proportion of women achieve the recommended levels of PA during pregnancy, and longitudinal studies have shown a decline in PA levels as pregnancy progresses. PA levels are also lower in pregnant women compared to their non-pregnant counterparts. Understanding correlates of PA during pregnancy is crucial in order to target effective interventions to preclude inactivity among pregnant women.

PURPOSE: To systematically review the literature regarding different correlates of PA during pregnancy including studies from all over the world.

METHODS: A comprehensive and systematic search of the Medline, Embase, PsychInfo, Cochrane Library, SweMed+, Sociological Abstracts and Web of Science databases up until January 14 2016 was conducted by a professional librarian. Only studies in which PA was assessed prospectively during pregnancy were included. We conducted the present review as suggested by the PRISMA group and used a predefined PICO (Population, Intervention, Comparison, and Outcome) worksheet.

RESULTS: Out of 342 records, we reviewed 16 original studies. Half of these used a cross-sectional design. We identified different types of correlates and categorized them into 1) demographic or biological variables; 2) psychological variables; 3) behavioral variables; and 4) social and cultural variables. Most studies reported demographic (e.g. maternal age, education and ethnicity) and biological correlates (e.g. pre-pregnancy

PA, smoking and diet) of PA during pregnancy but the results varied widely. Pre-pregnancy PA was the most robust correlate reported. None of the studies reported environmental correlates such as neighbourhood, transport, or weather conditions. **CONCLUSIONS:** PA before pregnancy was the most consistent correlate of pregnancy PA across studies. We need more knowledge on psychological, social and environmental correlates of pregnancy PA, particularly from low- and middle income countries.

3419 Board #324 June 2 2:00 PM - 3:30 PM
The Effects of Exercise Training on Cardiorespiratory Fitness in Obese Sedentary Pregnant Women
 Eva C. Diaz Fuentes, Aline Andres, Kartik Shankar, Elisabet Børshiem. *Arkansas Children's Nutrition Center, and University of Arkansas for Medical Sciences, Little Rock, AR.*
 (No relationships reported)

Purpose: Maternal obesity has profound detrimental effects on the offspring's risk of obesity and cardiometabolic health. Although pre-conception interventions are preferable, exercise during pregnancy can potentially mitigate the effects of maternal obesity on metabolic health in both the mothers and the offspring. The Expecting study is an ongoing RCT in obese sedentary women aiming to determine if combined resistance and aerobic exercise during pregnancy improves maternal health and decreases the risk of obesity in the offspring. The purpose of the current analysis was to assess the effects of 11 weeks of exercise training on markers of cardiorespiratory health in women participating in the study for whom data are available at gestation week (GW) 12 and 24. **Methods:** Women ($n=40$) were recruited at GW 12. Body composition and submaximal aerobic capacity were assessed at GWs 12 and 24 using air displacement plethysmography and an incremental treadmill test, respectively. Twenty-one women were randomized to receive standard of care (SOC) and 19 received a combined exercise intervention (EX) 3 times/week. Oxygen consumption (VO_2 , ml·kg⁻¹·fat-free-mass⁻¹) and oxygen pulse [OP, ml/beat, (VO_2 /heart rate)] are reported for the work load corresponding to a rate of perceived exertion of 15 on Borg's scale (RPE-15). The intervention effect was assessed using analysis of covariance where baseline measurements and incline were used as covariates. Data are presented as mean \pm SE. **Results:** at GW 12, groups were comparable in terms of age (EX=30 \pm 4 vs. SOC=29 \pm 4 years, NS), BMI (37.4 \pm 5.2 vs. 37.8 \pm 6.6, NS), body fat mass (48.8 \pm 5.4 vs. 47.8 \pm 5.2%, NS), and body fat free mass (51.1 \pm 5.9 vs. 51.4 \pm 7.5 kg, NS). Mean attendance to EX sessions was 80 \pm 9% (2.4 \pm 0.3 visits/wk.) After 11 weeks of training, the EX group had higher VO_2 (34.0 \pm 0.8 vs. 30.3 \pm 0.7, $p=0.002$) than the SOC group. Oxygen pulse was also higher in the EX group compared to the SOC group (11.6 \pm 0.3 vs. 10.6 \pm 0.3). **Conclusion:** A structured exercise intervention during pregnancy in obese sedentary women is not only well-received and easy to adhere to, but also results in improved aerobic fitness. Supported by USDA-ARS # 6026-51000-010-05S, ACRI, and Arkansas Biosciences Institute, the major research component of the Arkansas Tobacco Settlement Proceeds Act of 2000.

3420 Board #325 June 2 2:00 PM - 3:30 PM
Are There Benefits Of Physical Activities Centered On The Trunk For Pregnant Women?
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Abstract

Purpose. To examine the effect of trunk exercise program on pain, quality of life (QoL) and physical health (PH) in the late pregnancy and post-partum periods as well as baby weight and size and delivery.

Methods. 90 nulliparous women allocated to a training group (TG) or to a control group (CG). TG carried out a structured program with exercises for flexibility, balance and strengthening for the majority of skeletal muscles specifically for the spinal ones, between the 24th and 36th week of pregnancy. Both TG and CG are evaluated for the pain at the beginning of the program (T1), at the end of the program (T2) and two months post-partum (T3). (QoL) at (T1; T2 and T3). (PH) at T1 and T3.

Results. At T1, no significant difference was found between the two groups in: pain intensity (pain interference $p=0.317$), QoL ($p=0.18$) and PH (flexibility $p=0.06$; walking $p=0.85$). At T2, women of TG had a lower intensity of pain than CG (legs ($p=0.029$), low back ($p<0.0001$), upper back ($p=0.022$), pelvis ($p=0.017$), groins ($p=0.043$), lower pelvis ($p=0.009$) and interference of pain ($p<0.0001$)). At T3, TG had a lower intensity of pain than CG, in low back and upper back ($p<0.0001$) and interference of pain ($p<0.0001$). Best scores of QoL were observed in TG compared to

CG at T2 ($p<0.0001$) and at T3 ($p<0.0001$). PH was not different between the groups in T1 but the best one was in TG compared to CG in T3 (flexibility $p=0.002$, walking, balance, curling-ups and Ruffier $p<0.0001$). TG is associated with more than four times less of caesarean and 4.5 hours less of labor time.
Conclusion. Strengthening exercises centered on the trunk reduce pain, increase QoL and PH in late pregnancy and at two months in the post-partum period.

3421 Board #326 June 2 2:00 PM - 3:30 PM
Pregnancy Physical Activity Beliefs and Attitudes in a Non-pregnant Population

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PURPOSE: The purpose of this study was to examine the attitudes and beliefs about pregnancy physical activity (PA) in non-pregnant individuals.

METHODS: Participants were non-pregnant individuals between the ages of 20 and 60 years and were recruited by word-of-mouth and social media, or through one of five doctor's offices located in the southeastern United States. 738 participants completed at least some of the survey and 454 have complete data. The survey consisted of 27 items in five sections: basic demographic information, PA over prior six months, agree/disagree questions regarding safety and efficacy of PA during pregnancy, importance of exercise and lifestyle for pregnant women, and safety of moderate or vigorous intensity PA for mother and offspring. For analysis, participants were dichotomized by age (20 to 40 years; 41-60 years), sex (male; female), and education (Bachelor's degree; no Bachelor's degree).

RESULTS: For age, the older group (age 41 to 60) was more likely to view pregnancy PA favorably ($p=0.001$ to 0.010). Females were more likely than males to view pregnancy PA positively ($p=0.007$ to 0.024). Participants with a college degree were more likely to agree that pregnant women can begin an exercise program during pregnancy ($p=0.047$) and benefit from moderate exercise ($p=0.017$), but were less likely to believe PA is safe for mother and baby ($p=0.000$ to 0.001).

CONCLUSIONS: Overall, participants who were older, female, and did not have college degrees viewed pregnancy PA more favorably.

F-65 Free Communication/Poster - Ultrasound and Spectroscopy Applications

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

3422 Board #327 June 2 2:00 PM - 3:30 PM
Associations Of DXA-derived Appendicular Lean And Fat-Free Adipose Tissue Mass With A Single Forearm Ultrasound Image

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Dual-energy x-ray absorptiometry (DXA) is used to assess appendicular lean soft tissue mass (aLM), however, the aLM measured by DXA contains non-skeletal muscle tissue components (fat-free adipose tissue, FFAT). These components, if not accounted for, could falsely inflate the aLM in individuals with a relatively high amount of adipose tissue mass. Ultrasound is an imaging technique used to estimate body composition. Recently, we developed prediction equations for estimating aLM, (which includes FFAT) from ultrasound-derived muscle thickness and the forearm ulna (MT-ulna) was the single best predictor. For sarcopenia screening, a single ultrasound measurement may be advantageous for community-based physical examinations. However, it is unknown whether DXA-derived FFAT can be predicted from the forearm ultrasound image. **PURPOSE:** To investigate the relationships between DXA-derived appendicular fat mass and forearm adipose tissue thickness (AT-forearm) measured by ultrasound and DXA-derived and ultrasound-predicted aLM in older adults.

METHODS: Two hundred fifteen older adults (91 men and 124 women) aged 60-79 had appendicular fat mass and aLM measured by the DXA as well as AT-forearm and MT-ulna measured by ultrasound. Appendicular FFAT was calculated based on the results of a previous study (Appendicular FFAT = appendicular fat mass/0.85 x 0.15). AT-forearm and MT-ulna were measured as the distance between the appropriate tissue

interfaces. aLM was estimated from MT-ulna using a previously published equation ($aLM = 4.89 \times MT\text{-ulna} \times \text{body height} - 9.15$). Pearson correlation coefficients were performed for all variables. Statistical significance was set at $p<0.05$. **RESULTS:** There was no significant difference between DXA-derived ($17.1 [SD 4.0]$ kg) and ultrasound predicted ($16.9 [SD 3.9]$ kg) aLM. The ultrasound predicted aLM was strongly correlated to DXA-derived aLM ($r=0.910$, $p<0.001$). In addition, DXA-derived appendicular FFAT was significantly correlated to AT-forearm ($r=0.680$, $p<0.001$).

CONCLUSIONS: Ultrasound forearm measurement correlates well with both aLM and FFAT. This one site measurement might be a quick and useful method for estimating muscle mass in older adults.

3423 Board #328 June 2 2:00 PM - 3:30 PM
Ultrasonic Imaging Before and After Bilateral Tenotomy in a Collegiate Basketball Player: A Case Study

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(No relationships reported)

Patellar tendinopathy is a debilitating condition that often occurs in athletes who participate in jumping sports, such as volleyball or basketball. Ultrasound imaging has previously been used as a diagnostic tool in identifying tendon morphology. However, previous research has not tracked the time course of patellar tendon morphology changes following tenotomy. **PURPOSE:** The purpose of this study was to track and quantify changes in tendon morphology after bilateral patellar tenotomy in a female collegiate basketball player. **METHODS:** A Division I female basketball player (height=1.9 m, weight=85 kg) with chronic bilateral patellar tendon pain was recruited for participation in the study. Longitudinal B-mode images were taken of the patellar tendon with a research-grade ultrasound machine (Verasonics Inc, Kirkland, WA, USA) and high frequency (5-12-MHz) linear transducer at a center frequency of 10 MHz. The subject performed all rehabilitation exercises as prescribed by the athletic trainer and returned for weekly imaging sessions. As secondary measures of recovery, perceived pain and knee function were evaluated using the Victorian Institute of Sport Assessment (VISA) scale which was completed at each visit. Tendon micromorphology was evaluated using a custom MATLAB code (MathWorks, Natick, MA, USA). A region of interest was manually selected from the images and a two-dimensional fast Fourier transform was performed. The peak spatial frequency radius (PSFR) parameter was used to assess the micromorphology of the tendon, where higher PSF values were associated with increased collagen organization.

RESULTS: At the time of abstract submission, the subject had completed two post-surgical visits. The average PSKR increased for both knees (right: 1.00 vs. 1.28; left: 1.07 vs. 1.54). There was a small increase in the total VISA score between visits (5 vs. 8). **CONCLUSION:** Ultrasonic imaging was used to characterize initial micromorphology changes in the patellar tendon following bilateral tenotomy. Preliminary results showed increased collagen organization and improved VISA scores. Future findings may suggest a correlation between self-reported measures of knee pain and function and tendon morphology.

3424 Board #329 June 2 2:00 PM - 3:30 PM
Diagnostic Ultrasound Imaging In Assessing Medial Elbow Joint Space In College Baseball Pitchers

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Athletes participating in overhead throwing sports such as pitchers, volleyball players, and javelin are prone to ulnar collateral ligament (UCL) injuries of the elbow. UCL sprains typically occur when the elbow is subjected to repetitive or sudden valgus stress causing the UCL to exceed its tensile limits. Recently, the use of musculoskeletal ultrasound (MSK) during a valgus stress exam of the UCL has gained great interest. **PURPOSE:**

To examine medial elbow joint space (MJS) opening changes during a constant valgus load to the UCL through MSK in collegiate baseball pitchers during 6 weeks of a competitive season.

METHODS:

Thirteen Division I college baseball pitchers with a mean age of 20.4 ± 1.45 yrs and body mass index of 24.56 ± 1.78 participated. Ultrasound images of the medial joint space on the participant's throwing arm were obtained using a GE LOGIQ E ultrasound unit. The participants were placed in a supine position with a wedge placed underneath their throwing hand to maintain their elbow angle at 30 deg. A hand held dynamometer was used to apply a 3 kg valgus force 20 cm distal to the medial epicondyle to maintain a constant 5 Nm valgus stress to each participant. The medial joint space of the elbow was imaged at the beginning of the spring baseball season

then 16 games or 6 weeks after baseline testing. Three images were taken during each session, where specific measurements from the apex of the trochlea to the apex of the ulna were taken.

RESULTS:

The MJS width increased approximately 15% from an initial baseline testing value of .49 cm±.06 to .56 cm±.02 after 16 games or 6 weeks [F(1,10)= 8.51, p=.015]. The covariates of total innings pitched [F(1,10) = 0.19 p = 0.68] and year of participation [F(1, 10) = 0.11 p = 0.75], were not significant factors in the change of MJS width over time.

CONCLUSIONS:

The results of this investigation demonstrate that MJS width and UCL integrity can be assessed accurately using diagnostic ultrasound during a valgus stress test. Moreover, these data indicate that total innings pitched during a season and year of participation did not have an influence on the MJS width. Further research is recommended to perform multiple imaging testing throughout the entire year (Fall and Spring seasons) to determine specific time points at which MJS width changes in collegiate baseball pitchers.

**3425 Board #330 June 2 2:00 PM - 3:30 PM
Assessing UCL Width during Valgus Load for College Baseball Pitchers using Ultrasound Imaging**

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Injuries to the Ulnar Collateral Ligament (UCL) of the elbow are common in overhead throwing athletes. A repetitive valgus force during the throwing motion places significant stress on the UCL. More research needs to be conducted to investigate new methods to assess potential thickening of the anterior bundle of the UCL in order to understand ligament changes that may occur throughout the season. **PURPOSE:** To examine the reliability of ultrasound imaging measurements of UCL width at 2 different anatomical locations using 5Nm valgus stress; and to determine if a difference in ligament width exists between the two measurements 4 weeks apart within the season.

METHODS:

Thirteen Division I college men's baseball pitchers participated with a mean age of 20.4 ± 1.45 SD) and body mass index (BMI) 24.56 ± 1.78 SD). Ultrasound images were obtained of the anterior band of the UCL on the participant's throwing arm using a GE LOGIQ E ultrasound unit with a linear probe at 12Mhz. Participants were placed in a supine position with a wedge placed underneath their forearm to maintain their elbow position at a 30 deg. flexion angle. A 5 Nm valgus stress was applied 20 centimeters distal to the medial epicondyle. Measurements at the mid substance and the apex of the trochlea were taken at the beginning of the baseball season and then again 4 weeks later. Three images were measured during each session.

RESULTS:

Intra-rater reliability as expressed by ICC (3, 3) was .929 (SEM= 0.18mm) & .935 (SEM= 0.20mm) for the apex of trochlea measurement site and .861 (SEM= 0.22mm) & .920 (SEM=0.16mm) for the mid-substance measurement site, indicating excellent intra-rater reliability. There was no difference between the measurements obtained on the two testing dates (Apex of trochlea mean width 2.90mm & 2.92mm; t= -.155; p ≥ 0.05) and (Mid-substance mean width 4.49 mm & 4.44 mm; t= .571; p ≥ 0.05)

CONCLUSIONS: Excellent intra-rater reliability was found at all four measurement sites. There was no significant difference in UCL width from the beginning of the season and one-month into the season. Further research is recommended to perform multiple imaging sessions throughout the year to determine the long term physiological effects of overhead throwing on the anterior band of the UCL and to study the connection between UCL width changes, tissue quality, and injury risk.

**3426 Board #331 June 2 2:00 PM - 3:30 PM
Epidemiological Study of Achilles Tendon Morphology Using Ultrasound Tissue Characterization Technology**

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(No relationships reported)

Ultrasound tissue characterization (UTC) imaging is a novel technology to objectively quantify tendon structural integrity. Previous UTC studies have primarily been performed in small, homogeneous samples, and varied in analysis parameters. No studies to date have examined a large, asymptomatic population.

PURPOSE: To characterize asymptomatic Achilles tendon (AT) structure in an adult population, identify factors that may be associated with tendon structure variation as measured by UTC, and provide a foundation for future research. **METHODS:** 575 asymptomatic subjects (male: 217, female: 291) were recruited. Each subject completed a medical history questionnaire and underwent UTC scanning of the right

AT. The motorized tracking device moved an ultrasound probe along the long axis of the AT capturing 598 transverse images at intervals of 0.2 mm over 12 cm. UTC algorithms quantified the stability of pixel brightness over every 17 contiguous images into four echotypes (ET): (I) aligned tendon bundles, (II) waving tendon bundles, (III) mainly fibrillar tissue, and (IV) mainly amorphous matrix. A region of interest (ROI) was selected from the calcaneus to the musculotendinous junction. Tendon borders were outlined manually in the transverse view at intervals no greater than every 25 frames (0.5 cm) across the ROI. Contours were interpolated to generate average percentages (%) of each ET for the total tendon volume. 67 subjects were excluded due to poor quality scans or not meeting inclusion criteria, resulting in 508 subjects in final analysis. **RESULTS:** Average ET % for the volume was: I-65.73% (SD±6.61, range 35.29-80.17), II-32.00% (SD±6.47, range 18.41-62.48), III-1.74% (SD±0.85, range 0.54-6.22), and IV-0.57% (SD±0.45, range 0.07-3.59). Differences between subgroups were compared and p-values <0.05 were considered significant. Higher % of ET I and lower % of ET II were associated with age 50-65 years old, male gender, African American race, and hypertension. Higher % of ET III was associated with age 50-65 years old, BMI>30, diabetes, and COPD. **CONCLUSION:** This work provides a baseline ET distribution that can be used in future AT research. We have shown numerous associations between tendon morphology and patient demographics/health that begin to help stratify differences in asymptomatic Achilles tendons.

**3427 Board #332 June 2 2:00 PM - 3:30 PM
Micro-vascular Blood Flow During Post-Occlusive Reactive Hyperemia Assessed By Diffuse Correlation Spectroscopy**

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PURPOSE: The purpose of this investigation was to determine if Diffuse Correlation Spectroscopy (DCS) provides a reproducible measure of micro-vascular blood flow during post-occlusive reactive hyperemia (PORH). Previous techniques utilized to assess forearm muscle blood flow include brachial artery blood flow and Near Infrared Spectroscopy (NIRS). DCS provides a novel ability to examine red blood cell (RBC) flux within the muscle microvasculature. We hypothesized that DCS would provide a reproducible measure of muscle microvasculature RBC flux during PORH.

METHODS: 7 healthy male subjects (25.9 ± 4 yrs) performed 3 trials of brachial artery PORH tests. The DCS probe was placed on the *flexor digitorum superficialis m.* of the cuffed arm and provided Blood Flow Index (BFI). Brachial artery blood flow was assessed using Doppler Ultrasound to provide time-averaged maximum velocity (TAMAX). Following a 10 min supine rest period baseline measurements were performed for 1 min at which time a pneumatic cuff was inflated to at least 250 mmHg for 5 minutes. Measurements continued to be made for the 5 min of occlusion and 3 min post cuff release. The subjects were given 10 min rest between trials.

RESULTS: The peak TAMAX of the brachial artery for PORH1, PORH2, and PORH3 occurred at 7.3 ± 3.4, 6.0 ± 2.4, and 6.4 ± 2.7 sec respectively (p=0.397). The peak in BFI for PORH1, PORH2, and PORH3 occurred at 25.6 ± 4.5, 26.4 ± 8.3, and 22.3 ± 3.5 sec respectively (p=0.311). The time to peak for TAMAX was significantly different from the time to peak in BFI (p<0.001).

CONCLUSIONS: Similar time to peak for BFI across trials indicates that the DCS provides a reproducible signal of muscle microvasculature blood flow during PORH conditions. We speculate that the significant difference between time to peak for TAMAX and BFI may be due to compliance between the brachial artery and the microvasculature.

F-66 Free Communication/Poster - Weight Control

Friday, June 2, 2017, 1:00 PM - 6:00 PM
Room: Hall F

**3428 Board #333 June 2 3:30 PM - 5:00 PM
Sugar-Sweetened Beverages And Short-duration Exercise On Glycemic Response And Subjective Appetite In Young Boys**

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PURPOSE: Sugar-sweetened beverage consumption is thought to be a contributor to weight gain through its effects on the control of food intake and glucose homeostasis. It has been suggested that energy from sugar-sweetened caloric beverages bypass

physiologic systems regulating food intake, leading to weight gain. Despite a lack of reported evaluation, short-duration exercise is promoted in schools as a means of achieving energy balance and glucose homeostasis. The purpose of the present study was to investigate the interaction between sugar-sweetened beverage consumption and short-duration exercise on glycemic response and subjective appetite in young boys. **METHODS:** Eight normal weight boys (age: 11.25 ± 0.7 years) consumed isovolumetric amounts (240mL) of either a commercial fruit drink or 1% chocolate milk, matched for available carbohydrates (25g) two hours after a standardized breakfast. The boys then exercised on a motorized treadmill at their ventilatory threshold or sat quietly for 15min, followed by 45min of quiet sitting. Subjective appetite and capillary blood glucose were assessed at baseline, and at 15 and 60min during the test condition. **RESULTS:** There was a beverage (fruit drink vs. chocolate milk) x test condition (exercise vs. rest) x time (0, 15, 60min) interaction for blood glucose response ($p < 0.01$). There was a main effect of beverage on glucose response ($p < 0.01$). Exercise increased subjective average appetite to 60min compared to quiet sitting ($p < 0.05$). **CONCLUSIONS:** Fifteen minutes of moderate-intensity exercise attenuates the rise in blood glucose following sugar-sweetened beverage consumption. Chocolate milk has the lowest glycemic response, which may be due its milk protein and fat content and effect on gut hormone release. Further investigations are required to determine whether increased subjective appetite following short duration exercise would result in greater next-meal food intake.

3429 Board #334 June 2 3:30 PM - 5:00 PM
Self-monitoring As A Predictor For Weight Loss In A Family-based Pediatric Obesity Treatment Program
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 (No relationships reported)

Family-based pediatric obesity treatment programs for children in the 95th-99th BMI percentile are suggested to be comprehensive and multidisciplinary to change behaviors and decrease weight. Self-monitoring (SM) has shown to be an effective strategy in child weight loss. **PURPOSE:** To determine if child and parent SM of weekly nutrition (NUTR), physical activity (PA), and body mass (BM) predict weight loss during a 12-week pediatric obesity treatment program. **METHODS:** 51 children (age: 9.8 ± 2.3 years, BMI percentile: 98.0 ± 1.3), 45 mothers (age: 41.5 ± 6.2 years), and 37 fathers (age: 41.5 ± 6.2 years) participated in 12 weekly healthy living education sessions. SM scores were determined as the number of weeks participants logged energy intake (SM-NUTR), monitored steps per day (SM-PA), and weighed-in (SM-BM) over the 12 weeks. A sum score (SM-SUM) of the three SM components was created. Stepwise multiple regression models were used to predict parent and child weight loss from SM scores. **RESULTS:** In 12 weeks, children lost $5.1 \pm 4.4\%$ of BM, mothers lost $5.3 \pm 8.0\%$ of BM, and fathers lost $8.2 \pm 4.7\%$ of BM. SM-SUM was 79% for fathers, 81% for children, and 88% for mothers. Table 1 represents Pearson correlation coefficients between percent body mass loss and self-monitoring scores.

Table 1. (* $p < 0.05$)	Child % BM loss	Mother % BM Loss	Father % BM Loss
SM-NUTR	$r = 0.33^*$	$r = 0.41^*$	$r = 0.49^*$
SM-PA	$r = 0.20$	$r = 0.36^*$	$r = 0.17$
SM-BM	$r = 0.13$	$r = 0.38^*$	$r = 0.15$
SM-SUM	$r = 0.34^*$	$r = 0.49^*$	$r = 0.36^*$

Stepwise multiple regression models suggested that Child's SM-SUM accounted for 19% of the variance in Child's % BM loss after 12 weeks ($R^2 = 0.19$, $p < 0.05$). Mother's SM-NUTR score ($R^2 = 0.47$, $p < 0.05$) and Child's SM-SUM score ($R^2 = 0.08$, $p < 0.05$) accounted for 55% of the variance in Mother's % BM loss ($p < 0.05$). Father's SM-NUTR score accounted for 29% of the variance ($R^2 = 0.29$, $p < 0.05$) in Father's % BM loss. **CONCLUSION:** SM-NUTR, SM-PA, and SM-BM all appear to play a role with family weight loss, with SM-NUTR being most influential. Continuation of self-monitoring post-intervention and its influence on weight loss should be examined.

3430 Board #335 June 2 3:30 PM - 5:00 PM
Effects Of Physical Exercise On The Modulation Of Aquaglyceroprotein 7 From Visceral Adipose Tissue
 Jorge Beleza, Sílvia Rocha-Rodrigues, Inês O. Gonçalves, António Ascensão, José Magalhães. *Faculty of Sports, University of Porto, Porto, Portugal.*
 (No relationships reported)

A role for aquaglyceroprotein 7 (AQP7) in the control of lipid accumulation in white adipose tissue (WAT) has been hypothesized; however limited information is available regarding the impact of physical exercise. **PURPOSE:** We aimed to analyze the role of voluntary physical activity (VPA) and endurance training (ET) on WAT AQP7 expression of HFD-fed rats. **METHODS:** Male Sprague-Dawleys rats were assigned into sedentary (S), VPA and ET groups fed an isoenergetic Lieber-DeCarli-liquid diet:

a standard diet (35% fat-derived Kcal) or a high fat-diet (HFD), (70% fat-derived Kcal), as follows: SS, SVPA, SET, HS, HVPA and HET, during 17 wks. VPA groups had free access to running wheel throughout the entire protocol. After 9 weeks of HFD, SET and HET animals were submitted to 8-wks of ET on treadmill while maintained dietary treatments. Plasma non-esterified fatty acid (NEFA), glycerol and insulin levels were determined and epididymal white adipose tissue (eWAT) was used to determine gene and protein expression of AQP7 and fatty acid translocase (FAT/CD36). Diet and exercise effects were performed using 2-way ANOVA. **RESULTS:** The relative caloric intake was constant between groups. HFD increased visceral adiposity index (9.0 ± 0.2 vs. 11.8 ± 0.4 ; $p < 0.0001$) and adipocyte area mean (3716.1 ± 301.4 vs. 5348.6 ± 471.5 ; $p < 0.001$), ET reduced these obesity-related anatomical features ($p < 0.001$). Both AQP7 and FAT/CD36 protein and gene expression remained unchanged after HFD regimen. VPA decreased plasma glycerol levels (12.6 ± 0.8 vs. 12.5 ± 0.6 ; $p < 0.001$) and eWAT AQP7 gene expression ($p < 0.001$) in S diet-fed animals and had no impact neither on plasma NEFA levels nor FAT/CD36 protein content. Eight-wks of ET decreased NEFA (SS vs. SET, 16.4 ± 0.5 vs. 12.0 ± 0.4 ; HS vs. HET, 14.7 ± 0.7 vs. 10.8 ± 0.7 , $p < 0.001$) and glycerol (SS vs. SET, 17.4 ± 0.7 vs. 12.5 ± 0.6 ; HS vs. HET, 15.6 ± 0.5 vs. 10.3 ± 0.9 ; $p < 0.001$) plasma levels. ET decreased gene and protein expression of AQP7 ($p < 0.001$) in eWAT in both diet types and increased FAT/CD36 gene ($p < 0.001$) in SET group and its protein expression ($p < 0.001$) in both diet types. **CONCLUSION:** Our data suggest that 8-wks of ET decreased AQP7 expression, which might play an important role preventing lipid overaccumulation in visceral adipose tissue of obese rats. Supported by: UID/DTP/00617/2013; POCl-01-0145-FEDER-016690

3431 Board #336 June 2 3:30 PM - 5:00 PM
Effects Of Intermittent Periods Of Severe Negative Energy Balance On Weight Maintenance During US Special Operations Forces Training
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 (No relationships reported)

Physically active individuals often fail to meet energy requirements during sustained periods of increased physical activity, resulting in negative energy balance. Failure to increase energy intake during periods of high energy expenditure may compromise body mass and subsequent performance. Whether individuals adequately restore body mass between intermittent periods of severe negative energy balance during long-term training is not well characterized. **PURPOSE:** To examine energy balance and changes in body mass during US Special Operations Forces (SOF) training. **METHODS:** Energy expenditure (EE, doubly labeled water), energy intake (EI, 24 h recalls), energy balance (EB, intake - expenditure) and body mass were measured in 22 US Marines (mean \pm SD, 25 ± 2 y, 86 ± 10 kg) during the 4 most physically demanding phases of a 261 d SOF training program [days 15-29 (I), 115-123 (II), 191-201 (III), and 243-261 (IV)]. **RESULTS:** EE was highest during phase II (6376 ± 712 kcal/d) compared to phase I (4011 ± 475 kcal/d), III (4189 ± 476 kcal/d), and IV (3735 ± 314 kcal/d) ($P < 0.05$). EI was lowest during phase I (300 ± 0 kcal/d) compared to phase II (2410 ± 338 kcal/d), III (2816 ± 488 kcal/d), and IV (2702 ± 738 kcal/d) ($P < 0.05$). EB was more negative during phase I (-3711 ± 475 kcal/d) and II (-3966 ± 776 kcal/d) compared to phase III and IV ($P < 0.05$). Body mass was lost during phases I, II, and IV, and the degree of body mass lost was equivalent between phase I ($6.5 \pm 1.5\%$; 5.6 ± 1.7 kg) and phase II ($5.8 \pm 2.0\%$; 4.9 ± 1.9 kg), and greater than phase IV. Initial body mass predicted the loss of body mass ($r = -0.67$, $P < 0.05$) during phase I. Body mass did not change during phase III. Body mass was restored before the start of each subsequent phase and was not different between the start (86.4 ± 9.8 kg) and end of the 261 d training (86.7 ± 9.0 kg). **CONCLUSION:** These data suggest that well-trained Marines adequately compensate EI to restore body mass between intermittent periods of severe negative EB. Supported by U.S. Army Medical Research and Materiel Command The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the views of the Army or the Department of Defense.

3432 Board #337 June 2 3:30 PM - 5:00 PM
Retrospective Analysis Of Weight Loss Relative To Protein Intake During Short-term Exercise Training In Women
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Reported Relationships: C.P. Earnest: Salary; Nutrabolt. Contracted Research - Including Principle Investigator; Catapult Health and Naturally Slim.

PURPOSE: To retrospectively examine the effects of circuit weight training (10-wk) in 663 sedentary, overweight/obese women (age $46 \pm y$, BMI 34.85 ± 6.17 kg/m²) on weight loss, anthropometry and indices of cardiovascular health relative to PRO ingestion.

METHODS. Eight exercise-training studies performed from 2002–2014 were examined relative to tertiles of PRO ingestion (Low, <0.8 g/kg/d; Moderate; >0.8–1.2 g/kg/d; High >1.2 g/kg/d). The Primary outcome is clinically significant weight loss (CSWL, 5%). Secondary outcomes include anthropometry and measures of cardiovascular health. Data were analyzed using GLM adjusted for age, study and respective baseline values. Chi-square and adjusted residual analyses were used to determine categorical differences.

RESULTS. Protein ingestion was: Low (n=278; 0.65 g/kg/d \pm 0.12; range 0.24–0.80), Moderate (n=225; 0.98 g/kg/d \pm 0.12; range 0.891–1.19) and High (142 (n=142; 1.66 g/kg/d \pm 0.42; range 1.20–3.28). Weight change was: Gained weight (12%; 1.01 kg, 95% CI, 0.24, 1.78), exhibited non-CSWL (50%; -1.81 kg, 95% CI, -2.04, -1.59) and achieved CSWL (39%; -7.17 kg (95% CI, -7.42, -6.92). Post-hoc assessment showed that High PRO consumers did not gain a significant amount of weight (0.70 kg, 95% CI, -0.42, 1.81), while Low (0.97 kg, 95% CI, 0.30, 1.64) and Moderate PRO consumers did (1.36 kg, 95% CI, 0.84, 1.89). No other significant differences were observed for weight loss or lean body mass relative to PRO tertiles. Interestingly, 57% of those consuming higher PRO (1.66 \pm 0.42 g/kg/d) achieved CSWL vs. ~33% in low (0.65 g/kg/d) and moderate PRO (0.98 g/kg/d \pm 0.12) consumers (*P*-for-trend, 0.001). Further comparison demonstrated that Low PRO consumers were significantly unlikely to achieve CSWL (*adjres* = -3.1), while those ingesting High PRO were significantly more likely to achieve CSWL (*adjres* = 4.9).

CONCLUSION. Despite the lack of difference for magnitude of weight loss between PRO groups, high PRO consumers were significantly more likely to achieve CSWL during a short exercise intervention consisting of resistance and aerobic training. Equally, higher PRO consumption may offset the magnitude of weight gain vs. lower PRO intakes if weight loss is not achieved.

Sponsor: Curves International

3433 Board #338 June 2 3:30 PM - 5:00 PM
Effect Of Fat-sugar Snacking, With And Without Exercise Training, On Body Composition And Cardiometabolic Fitness

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(No relationships reported)

PURPOSE: Diets high in fat and sugar have been implicated in the pathogenesis of obesity, diabetes and cardiovascular disease. Exercise aids in the prevention of weight/fat gain, and may prevent adverse cardiometabolic changes during periods of energy excess. We examined the interactions of fat-sugar snacking, with and without exercise training, on anthropometry, oral glucose tolerance and cardiorespiratory fitness in overweight and obese men. **METHODS:** Twenty-seven, healthy overweight/obese (BMI >25 kg/m²) men were fed a fat-sugar snack (2 donuts per day; ~600 kcal), 6 days/wk for 4 wks, while being asked to maintain their habitual diet. In addition, all participants were randomized to one of three groups: sedentary Control or isocaloric supervised exercise (250kcal/session, 4 days/wk for 4 wks): either moderate-intensity continuous training (MICT) (50% VO₂peak), or high-intensity interval training (HIIT) (90-95% peak heart rate). A two-way repeated measures ANOVA was used to assess changes in body composition, oral glucose tolerance and cardiorespiratory fitness between and within groups. **RESULTS:** Body weight (Pre: 96.0 \pm 7.7kg, Post: 97.4 \pm 7.9kg, *p*=0.002) and lean mass (Pre: 64.2 \pm 4.9kg, Post: 65.1 \pm 4.7kg, *p*=0.02) increased significantly in HIIT and were unchanged in MICT. Trends for an increase in body weight (Pre: 93.1 \pm 11.8kg, Post: 94.0 \pm 12.8kg, *p*=0.07) and lean mass (Pre: 61.1 \pm 5.9kg, Post: 61.8 \pm 6.5kg, *p*=0.11) were observed in Control. Fat mass was unchanged in control and MICT, with a trend for increase in HIIT (Pre: 28.3 \pm 5.3kg, Post: 28.9 \pm 5.3kg, *p*=0.11). Glucose AUC (mg/dl 120 min) during the 2-h OGTT improved significantly in MICT (Pre: 3,801 \pm 2,453, Post: 2,518 \pm 2584, *p*=0.01) and Control (Pre: 5,666 \pm 2826, Post: 4,214 \pm 2,194, *p*=0.002) with no change in HIIT. VO₂peak (L/min) increased significantly in both HIIT (Pre: 3.21 \pm 0.49, Post: 3.60 \pm 0.49) and MICT (Pre: 3.06 \pm 0.73, Post: 3.36 \pm 0.79) (*p*<0.001), with no change in Control. **CONCLUSIONS:** The addition of ~14,500 kcal of fat-sugar snacks in the form of donuts over a 4-week period was insufficient to induce deleterious changes in body composition in overweight/obese young men. Surprisingly, oral glucose tolerance was improved in Control. MICT may be preferable to HIIT during extended periods of snacking on foods comprised mainly of fat and sugar.

3434 Board #339 June 2 3:30 PM - 5:00 PM
Dose Response Effect of a Whey Protein on Appetite Profile, Energy Metabolism and Intake

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(No relationships reported)

PURPOSE: To determine the effects of high (HWP) and low whey protein (LWP) at breakfast [TM1] on appetite profile, thirst, energy metabolism and subsequent energy intake. **METHODS:** Seventeen healthy participants (age 27 \pm 7 y, BF 21.5 \pm 6.9%, BMR 1741 \pm 391 kcal/day) consumed one of three smoothies at breakfast on three separate days in randomized order. The energy intake from smoothies consisted of control (10% fat and 90% carbohydrate), LWP (20% whey protein, 10% fat and 70% carbohydrate) and HWP (40% whey protein, 10% fat and 50% carbohydrate), followed by an *ad libitum* lunch 3 hours later. Appetite profile was completed using a visual analog scale (VAS) before, at 0, 60, 120, and 180 minutes. Resting metabolic rate (RMR) 30 minutes before and thermic effect of a meal (TEM) at 45-60, 105-120, and 165-180 minutes were measured by indirect calorimetry to determine oxygen consumption (VO₂) and respiratory quotient (RQ). The accepted level of significance was set at *p* < 0.05. **RESULTS:** Energy intake at lunch was higher (*p* = 0.02) following control (770 \pm 289 kcal) compared to HWP (654 \pm 252 kcal) and LWP (671 \pm 217 kcal). Participants hunger, desire to eat, and perceived amount were significantly higher, whereas, satiety and fullness were lower after control compared to HWP and LWP. A significant difference over time was observed in thirst and cravings of sweet, salty savory and fatty, however there were no significant condition by time interactions. Additionally, a lower RQ (*p* < 0.001) and higher VO₂ (*p* < 0.001) was observed for HWP (4.3 \pm 0.6, 4.2 \pm 0.5, and 4.0 \pm 0.5 ml \cdot kg⁻¹ \cdot min⁻¹) compared to LWP (4.1 \pm 0.6, 3.9 \pm 0.5, and 3.5 \pm 0.5 ml \cdot kg⁻¹ \cdot min⁻¹) and control (4.0 \pm 0.6, 3.7 \pm 0.5, and 3.5 \pm 0.4 ml \cdot kg⁻¹ \cdot min⁻¹) at 45-60, 105-120, and 165-180 minutes, respectively. **CONCLUSION:** Breakfast with HWP and LWP were rated as more satiating coinciding with reduced subsequent energy intake at lunch. In addition, these results suggest a dose-response effect of whey protein on energy metabolism over 3 hours following breakfast.

3435 Board #340 June 2 3:30 PM - 5:00 PM
Sex Differences In Total Pyy And Glp-1 After Moderate-intensity Continuous And Sprint Interval Cycling Exercise.

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(No relationships reported)

Exercise is often used as a weight-loss strategy, however, exercise interventions are sometimes less effective in females than males for improving body composition. One possible explanation is that exercise affects appetite regulating hormones differently in males and females such that females increase post-exercise energy intake. Recently, sprint interval training was shown to reduce body fat in females despite relatively low energy expenditure during exercise. **PURPOSE:** To examine sex differences in circulating anorexigenic hormones and perceived hunger following an acute session of sprint interval training (SIT) and moderate-intensity continuous training (MICT). **METHODS:** Twenty-one active participants (11 females in early follicular phase) participated in 3 sessions in a randomized crossover design: 1) MICT, 30 min cycling at 65% VO₂max; 2) SIT, 6 x 30 sec "all-out" cycling sprints with 4 min recovery periods (27 min total); and 3) control (CTRL; no exercise). Participants arrived at the lab fasted and consumed a standardized breakfast 1 hour before exercise. Blood samples were collected pre-exercise, immediately and 90 min post-exercise for the measurement of total peptide tyrosine tyrosine (PYY) and glucagon-like peptide-1 (GLP-1). Subjective perceptions of hunger were assessed using a visual analogue scale before breakfast and before all blood draws. Hormone data were analysed as change in concentration from baseline. Changes in hormones and hunger were analysed using a 3 x 3 x 2 mixed factor (session x time x sex) repeated measures ANOVA. **RESULTS:** Increases in GLP-1 and PYY were greater during the MICT session (*P*<0.05) and SIT session (*P*<0.01) compared to CTRL. Total PYY increased more immediately post-exercise in males than females (*P*=0.030). GLP-1 increased only in females following MICT (*P*=0.034) and SIT (*P*=0.024) compared to CTRL. Perceived hunger was lower immediately post-MICT (*P*=0.016) and SIT (*P*=0.006) compared to CTRL, but there were no sex differences. **CONCLUSION:** Total PYY and GLP-1 appear to respond similarly to submaximal and supramaximal exercise, however, these results suggest they may respond differently to exercise in males and females over 90 min. The post-exercise hormonal response we observed in females would not be expected to create a compensatory increase in energy intake.

3436 Board #341 June 2 3:30 PM - 5:00 PM
12-Week Treadmill Program Elicits Low Energy Availability Without Changes in Serum Testosterone in Male Rats

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 (No relationships reported)

Male endurance athletes have been reported to have lower testosterone concentrations than their sedentary counterparts, which may have detrimental health effects including increased risk of musculoskeletal injury and fertility complications secondary to decreased sex hormone production. Cholesterol supplementation has been reported to increase serum sex hormones. **PURPOSE:** The purpose of this study was to investigate whether a treadmill endurance exercise program would cause exercise-induced reproductive dysfunction in male rats and assess the impact of increased dietary cholesterol on sex hormone levels. **METHODS:** Male Sprague-Dawley Rats (n=20) were randomly assigned to a control group (C) or an exercise training group (EX) that performed treadmill running 40 min/day, 6 days/wk for a duration of 12 wks. At study midpoint (wk 6), rats were randomized to receive either a High-Cholesterol (HC) Diet (n=10) or remain on standard purified diet (n=10). Fasting blood samples were collected at baseline, wk 6, and wk 12. Serum testosterone (T) and leptin were measured via ELISA. Serum lipids (TC, HDL, LDL, TG) were measured via clinical chemistry analyzer. Body weight (BW) and voluntary food intake (EI) were measured weekly. **RESULTS:** At end of wk 6, EX had significantly lower BW (494.3±34.7g versus 565.3±47.9g, p=0.001), mean daily EI (77.5±3.5 kcal versus 91.6±5.2 kcal, p<0.001), and serum leptin (90.8±40.1 pg/mL versus 635.7±225.6 pg/mL, p=0.001) in comparison to C. No difference was observed between EX and C in serum T (12.7±6.0 ng/mL versus 12.9±5.8 ng/mL). At end of wk 12, exercise groups (EX and EX+HC) had significantly lower BW (539.4±40.6g versus 645.1±60.7g, p<0.001), mean daily EI (81.7±2.9 kcal versus 87.8±1.9 kcal, p<0.01), and serum leptin (132.8±110.1 pg/mL versus 519.2±300.8 pg/mL, p=0.001) in comparison to C and C+HC. HC diet did not have significant impact upon serum T in comparison to standard diet (3.8±3.4 ng/mL versus 4.9±2.4 ng/mL). **CONCLUSIONS:** Despite low energy availability, exercise-induced reproductive changes may not occur in training programs <12 weeks. Lower EI observed in exercise groups despite higher energy expenditure may indicate that low energy availability in endurance-trained individuals may be inadvertent. Supported by American Egg Board Graduate Fellowship Research Grant

3437 Board #342 June 2 3:30 PM - 5:00 PM
The Effect of Increased Water Intake on Food Consumption

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Increased water consumption has potential to promote weight loss but previous interventions have been equivocal. **Purpose:** To examine the effects of hydration on energy intake at lunch and the remainder of the day. **Methods:** Ten males and 12 females attended 3 study sessions where they drank either 1, 3, or 4 bottles (500 ml) of water throughout the morning before lunch. Each participant was their own control (drinking one bottle), hydrated (three bottles), and overhydrated (four bottles). Food items were weighed and arranged on a tray in large portion sizes to allow for their desired amount of lunch intake. Participants rated hunger on a visual analog scale at three different time points before lunch and once after. When the participants selected to stop eating, food was reweighed to calculate caloric intake. Participants kept a food and beverage log for the remainder of the day. The detailed logs were then reviewed with the participant at the next visit and entered into the Nutritionist Pro software. Repeated-measures ANOVA determined if there was an effect between level of hydration and the amount of energy consumed at lunch and for the remainder of the visit day. **Results:** Hydration status, based on water consumed throughout the morning, significantly influenced energy intake for the remainder of the day. Hydrated males, males who drank three bottles of water throughout the morning, significantly increased energy consumed the rest of the day compared to when they were in the control group, 1686 ± 256 kcal vs. 990 ± 203 kcal (p=0.027). When energy intake at lunch was taken into account there was an effect of hydration status on daily energy intake. For women, energy consumed at lunch and the remainder of the day was not significant when compared with water intake (p=0.081 vs p=0.074, respectively). **Conclusion:** Drinking water throughout the morning had no effect on energy intake during lunch. Furthermore, energy intake was not suppressed even when 2L of water (4 bottles) was consumed over a 3.5-hour period. Males increased the amount of energy consumed for the remainder of the day when in the hydrated condition. Increased hydration may have adverse effects on energy intake due to the volume of water consumed prior to a meal.

3438 Board #343 June 2 3:30 PM - 5:00 PM
Effects of Moderate Consumption of Non-Nutritive Sweeteners on Glucose Tolerance and Body Composition in Rats

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Introduction: To combat the effects of excess energy intake on obesity and glucose intolerance, non-nutritive sweeteners (NNS) have been used as a replacement for more energy dense traditional sweeteners. However, limited research has been completed regarding the metabolic effects of moderate consumption of non-nutritive sweeteners. **Purpose:** The purpose of this study was to determine the effect of moderate consumption of NNS (aspartame and sucrose) on glucose tolerance and the insulin response to an oral glucose load, and on body composition in an animal model. **Methods:** Male Sprague-Dawley rats (N=30) were given aspartame (ASP, n=10, 8.5 mg/kg/day) or sucralose (SUC, n=10, 2.6 mg/kg/day) in drinking water, or untreated water as a control (n=10) for 6 weeks. In the morning, after overnight fasting, rats underwent an oral glucose tolerance test (2g/kg 50% dextrose w/v by gavage). Blood was obtained by tail clip; glucose was measured by glucose meter and insulin was measured by radioimmunoassay. Following euthanasia, lean mass and fat mass were determined by dual energy x-ray absorptiometry; epididymal fat pads were removed and weighed. **Results:** No significant differences were found between groups in area under the curve for glucose or insulin response to an oral glucose load. Significant differences in serum insulin were seen 15 minutes after the glucose load between both the ASP (0.72 ± 0.06 ng/mL vs 0.94 ± 0.08 ng/mL, p=0.035) and SUC group (0.72 ± 0.07 ng/mL vs 0.94 ± 0.08 ng/mL, p=0.048) compared with the control. While percent body fat was not different between groups, epididymal fat pad mass was significantly higher in the ASP group compared with the control group (5.50 ± 0.34 g vs 4.55 ± 0.19 g, p=0.042), while the ratio of trunk fat to total fat was significantly lower in the SUC group compared with controls (0.49 ± .02 vs 0.60 ± .14, p<0.01). **Conclusion:** Moderate consumption of aspartame or sucralose had no effect on percent body fat. Fifteen minutes following a glucose load, serum insulin was significantly lower in both NNS groups compared with the control, suggesting a potential suppression in insulin response. Both aspartame and sucralose altered body fat distribution. These results may have implications for addressing abdominal obesity.

3439 Board #344 June 2 3:30 PM - 5:00 PM
Evaluation of Weight Loss Advice from Pharmacists and Supplement Retailers

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Approximately half of adult Americans report the desire to lose weight and 17 million take dietary supplements for the purpose of weight loss. People may seek weight loss advice where dietary supplements are sold including pharmacies and retail shops. **PURPOSE:** The purpose of the study was to evaluate the effectiveness and safety of weight loss advice provided by pharmacists and retailers. A secondary purpose was to evaluate whether either recognized symptoms associated with serious cardiovascular concerns and if appropriate follow-up advice was given. **METHODS:** Two college-aged women of normal BMI individually visited 51 pharmacies and 22 retailers with a standardized script that included a desire to lose weight and the presentation of multiple cardiovascular disease symptoms including heavy chest, light-headedness, breathlessness, and a tingling jaw. Immediately upon departure, all pertinent advice given was recorded. **RESULTS:** Descriptive analyses revealed that only 47% of pharmacists and 9% of retailers suggested reducing energy intake and/or increasing energy expenditure for weight loss. Cardiovascular symptoms were correctly identified and directly addressed by 4% of pharmacists and 0% of retailers. Other interpretations of symptoms included asthma (n=4), dehydration (n=1), electrolyte imbalance (n=1), allergies (n=1), or vitamin deficiencies (n=1), but 75% of the time, symptoms were ignored entirely. Forty-nine percent of pharmacists and 100% of retailers recommended a total of 55 different supplements including diuretics, fat binders, and vitamins. Twelve percent of pharmacists and 95% of retailers recommended stimulants, which could be particularly harmful for a person with cardiovascular disease. **CONCLUSIONS:** Although pharmacists gave better weight loss advice than retailers with regard to both effectiveness and safety, both gave enough ineffective and unsafe advice that consumers should use extreme caution when interpreting weight loss advice from pharmacists and retailers.

3440 Board #345 June 2 3:30 PM - 5:00 PM
Awareness Levels of the Misuse of the 3500 Calorie Rule Predicting Long Term Weight Loss

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 (No relationships reported)

Recently, a new rule has been suggested to replace the 3500 calorie rule to predict long term weight loss (WL) but whether practitioners are aware of this is not known. **PURPOSE:** To assess the awareness of recent facts related to the misuse of the 3500 calorie rule for predicting WL and to determine whether awareness differs by certification status, a person's training level and their perceived WL knowledge. **METHODS:** Students (S), faculty (F), and professionals (P) [n = 352, 68% female, 31 ± 13.5 years] responded to an anonymous online survey sent via email lists and social media platforms. Each participant responded yes or no regarding their awareness of 8 statements focused on the misuse of the 3500 calorie rule, compensation that takes place with WL, the recommendation of a new rule, and the nonlinear nature of WL. Participants reported current exercise and nutrition certifications and were grouped as certified or not certified. They also reported their level of WL knowledge on a 5 point Likert scale and were divided into 2 groups for analysis: very good or excellent (EX) knowledge vs good, fair and poor (Poor) knowledge. Chi squared analyses were used to test for differences in the proportions of respondents who were aware of each statement between knowledge, certification, and training level groups. **RESULTS:** The % who were aware of WL statements was lower in S (p<0.05) and ranged from 26.1 - 61.8% for S, 19.4 - 93.5% for F and 19.7 - 84.5% for P. The lowest awareness for all groups was regarding the new rule to predict WL and did not differ between groups (26.1%, 19.4%, and 19.7% for S, F, and P, respectively; p=0.48). For 7 of 8 statements, more of those with EX self-reported knowledge had an awareness (30.4 - 83.0%) of WL statements than those with Poor knowledge (18.4 - 63.3%; p<0.05). For 4 of the 8 statements, more of those who were certified (71.7 - 82.8%) had an awareness of WL statements than those without a certification (54.4 - 65.0%; p<0.05). **CONCLUSIONS:** S were the least aware of the newest developments in the misuse of the 3500 calorie rule while F were the most aware, though awareness of some concepts were low for all. Awareness levels were highest in those who self-reported EX knowledge. Those with certifications had higher awareness levels of some WL concepts. More dissemination is needed to raise awareness of WL concepts.

3441 Board #346 June 2 3:30 PM - 5:00 PM
Assessment of the Relationship Between Macronutrient Intake and Browning of White Fat in Adult Males

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Research conducted in rodents and humans present conflicting results on the relationship between caloric intake and the browning of subcutaneous white adipose tissue (scWAT). For example, exercise combined with caloric restriction did not change browning indices measured from human scWAT samples. In another study, caloric restriction in mice resulted in the browning of both scWAT and visceral white adipose tissue. Few investigators, however, have examined the relationship between differences in macronutrient intake and browning processes of human scWAT. **PURPOSE:** The purpose of this study was to investigate the relationship between macronutrient intake and browning indices assessed from scWAT of healthy adult males. **METHODS:** Forty-six healthy adult males [age (years): 35.2±6.9, body mass index (BMI): 27.3±4.2 (kg/m²)] completed a 3-day dietary recall within one week, and had a scWAT biopsy done to assess the mRNA of uncoupling protein one (UCP1) - a direct measure of browning processes. mRNAs of peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α), peroxisome proliferator-activated receptor alpha (PPARα) and peroxisome proliferator-activated receptor gamma (PPARγ) that indirectly indicate browning processes of scWAT were also assessed. Carbohydrate (CHO), protein (PRO), and fat (FAT) intake data as a percentage of total caloric intake were used for analysis. Waist-to-hip ratio, body composition, and resting energy expenditure were also measured. **RESULTS:** Spearman's correlation coefficient revealed a moderate positive association between CHO and PPARγ (rho = 0.375, p = 0.01). CHO was also negatively associated with fat mass (assessed as a percentage of total body mass) (rho = -0.297, p = 0.04). No other significant associations were detected (p > 0.05). **CONCLUSIONS:** Carbohydrate intake as a percentage of total kilocalories was positively associated with PPARγ in scWAT from healthy adult males. It is, however, difficult to determine if the association between carbohydrate intake and

PPARγ indicates browning processes in scWAT given that the mRNA of UCP1 was not related to macronutrient intake. More research is needed to expand on these findings with the use of longitudinal intervention based studies.

3442 Board #347 June 2 3:30 PM - 5:00 PM
Liposomal Encapsulated Alpha-Lipoic Acid, Benfotiamine and Curcumin Prevent Overfeeding Mediated Increases in Waist Circumference

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PURPOSE: To determine if liposomal (L) encapsulated alpha-lipoic acid (0.5g), benfotiamine (0.5g) and curcumin (2.0g) (ABC) would prevent the unfavorable metabolic consequences of sedentary high-fat overfeeding in healthy young adults. **METHODS:** 29 young (18-30 years), healthy, physically active men and women were randomly assigned to ingest placebo (n=9), ABC (n=10), or L-ABC (n=10) twice daily for 28 days. Between days 22 and 28 all participants abstained from their normal regular exercise and consumed a high calorie, high fat diet. **RESULTS:** On Day 29, circulating alpha lipoic acid was greater (p<0.01) in L-ABC (412±73 ng/mL) compared with ABC (154±33 ng/mL). During the sedentary high fat overfeeding, dietary intake was not different (p>0.6) between groups (~3,400 kcal/day; ~50% from fat). Sedentary high fat overfeeding increased (P<0.05) waist circumference in the placebo (+2.7±2.7 cm) and ABC (+3.3±2.0) groups but not the L-ABC group (+0.7±2.7). The magnitudes of increase (p<0.05) in body mass (1.7±0.3 kg), fat mass (0.7±0.2 kg), and blood pressure (3±1 mmHg) and decrease (p<0.05) in insulin sensitivity (Matsuda Index: -2.9±0.9) after overfeeding were not different between groups (all p>0.5). **CONCLUSIONS:** Liposomal encapsulated alpha-lipoic acid, benfotiamine and curcumin: 1) promoted alpha-lipoic acid bioavailability; and, 2) prevented sedentary high-fat overfeeding mediated increases in waist circumference in usually active healthy young adults. These data may have important public health implications for periods of inactive overconsumption such as during seasonal celebrations.

3443 Board #348 June 2 3:30 PM - 5:00 PM
The Effect Of High-intensity Interval Exercise In Hypoxia On Appetite Regulations In Female Athletes

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PURPOSE: Effect of high-intensity interval exercise (HIIT) in hypoxia has been investigated recently. However, the effect of HIIT in hypoxia on appetite regulation among female athletes remains unclear. The present study aimed to determine the time-courses changes in appetite-regulating hormones, subjective feeling of appetite, and energy intake after HIIT in hypoxia in trained female athletes. **METHODS:** 15 female team sport athletes (age: 20.7 ± 0.2 years, height: 159.6 ± 1.7 cm, weight: 55.3 ± 1.4 kg, BMI: 21.7 ± 0.4) participated three trials on different days: either HIIT in hypoxia (HYP), HIIT in normoxia (NOR) or rest in normoxia (CON). We have collected data from 15 subjects, but three of 15 athletes were excluded for analyses (n = 12, age: 20.8 ± 0.2 years, height: 158.7 ± 1.9 cm, weight: 54.8 ± 1.3 kg, BMI: 21.8 ± 0.4) because the menstrual phase did not match among trials. Exercise trials (HYP, NOR) consisted of two successive sets of 8 repeated bouts of 6-s maximal sprint separated with 30-s rest. A 10-min rest was provided between sets. Blood sample were obtained to measure plasma acylated ghrelin, GLP-1 and other hormonal and metabolite concentrations before, immediately and 30 min after exercise. Time-course of changes of subjective feeling of appetite and fatigue were also measured following exercise. Energy and macronutrient intake during ad-libitum buffet test meal were evaluated 30 min after exercise or rest. **RESULTS:** Plasma acylated ghrelin concentrations were significantly decreased after exercise (P < 0.001), whereas a significant difference was not observed between HYP and NOR. Plasma GLP-1 concentrations were not altered significantly after exercise (P = 0.507), with no significant difference between HYP and NOR at any point (P = 0.242). Although absolute energy intakes in both HYP (634 ± 67 kcal) and NOR (597 ± 63 kcal) were significantly lower than CON (756 ± 63 kcal, P = 0.006), no significant difference was not observed between HYP and NOR. **CONCLUSIONS:** These results show that HIIT under hypoxic and normoxic conditions lowered plasma acylated ghrelin concentrations and energy intake, whereas these responses were not augmented by exposure to hypoxia during exercise.

3444 Board #349 June 2 3:30 PM - 5:00 PM

Unexpected Weight Gain Following Long Term Increased Mvpa Is Linked To Elevated Respiratory Quotient

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Purpose: Randomized controlled trials demonstrate that exercise alone, if completed in adequate amounts, will result in weight loss for most individuals but with large variation in amount. The purpose of the current study is to evaluate the role of respiratory quotient (RQ), which represents contributions in substrate oxidation of stored carbohydrates and fats, on weight change among young adults who increased their moderate-to-vigorous physical activity (MVPA).

Methods: Participants included 417 young adults; during the 12-month observation period, 114 participants increased their MVPA and were included in the subsequent analyses. Body composition was assessed via dual-energy X-ray absorptiometry, MVPA via arm-based activity monitor, self-reported energy intake (EI) via 24-hour dietary recalls, and RQ via indirect calorimetry; all were assessed every 3 months, except for RQ which was assessed every 6 months.

Results: Participants were classified according to 12-month weight change; weight loss (n=38; group mean±SD, -4.0±3.7 kg), weight maintenance (n=38; 0.3±0.8 kg), and weight gain (n=38; 2.9±1.4 kg). The weight maintenance and loss groups were subsequently combined. Between group analysis at baseline indicated no difference in body weight (P=0.13), fat mass (P=0.51), fat-free mass (P=0.29), MVPA (P=0.07), EI (P=0.8), or percent of carbohydrates in the diet (P=0.83). RQ was lower in the maintenance/loss group compared to the gain group (0.782 vs. 0.801, P=0.02). At 12-month follow-up, there was no between-group difference in MVPA (P=0.14), self-reported EI (P=0.83) or percent of carbohydrates (P=0.18). Total MVPA was significantly higher in the maintenance/loss group (103.7 vs. 78.1 min/day, P=0.05).

Linear modeling of fat mass change indicated a positive association with RQ at baseline (P=0.06) after adjustment for baseline values and changes in MVPA and EI.

Conclusion: These results suggest that resting substrate oxidation may explain the unexpected body weight responses following increases in physical activity. These findings support previous research, which suggests that lower levels of fat oxidation, independent of changes in energy intake and physical activity, contribute to changes in fat mass.

3445 Board #350 June 2 3:30 PM - 5:00 PM

Hypoxia-inducible Factor 2 Alpha Mediates Exercise-Induced Hypothalamic Glucose Sensing

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(No relationships reported)

PURPOSE: The hypothalamus controls the energy homeostasis integrating of hormonal and nutritional signals. In this context, glucose plays a critical role in the control of energy balance acting in specific hypothalamic neurons. It has been demonstrated that the lost selective of glucose sensibility in the hypothalamic neurons are related to the hyperphagia and obesity. Recently, the hypoxia-inducible factor 2 alpha (HIF2α) have emerged as regulated important in maintenance of glucose sensibility in hypothalamic neurons. In this context, the maintenance of neuronal HIF2α function can be considered a determinate strategy for maintenance of lean phenotype. At the same time, the physical exercise is considered a main contributor to the control of body weight and energy expenditure. Thus, sought evaluate the effects of physical exercise on HIF2α protein levels and on glucose sensibility in the hypothalamus of rodents.

METHODS: Physical exercise, Western blot and stereotaxic surgery were combined to explore HIF2α protein levels and hypothalamic glucose sensibility. The intracerebroventricular (ICV) injection of glucose was performed to measure the food intake and the quantification of HIF2α pathway in hypothalamus of both lean and obese (diet-induced obesity) male *Wistar* rats. For statistical analysis were used the ANOVA one-way.

RESULTS: We observed the reduction of hypothalamic glucose sensitivity in obese mice, which was accompanied by a lower protein expression of HIF-2α, as well as reduction of prolyl hydroxylases (PHDs) and ubiquitin E3 ligase PVH, product Hippel-Lindau (VHL) gene, when compared to the control group. Interestingly, we found that the exercise restored hypothalamic of HIF-2α expression and glucose sensitivity in obese rats.

CONCLUSIONS: Our preliminary results demonstrate that high-fat diet disrupts hypothalamic HIF-2α protein and affects the glucose sensitivity in neurons, contributing with hyperphagia. On the other hand, exercise increased HIF-2α protein levels in the hypothalamus and potentiated glucose sensitivity in obese rats, reducing the food intake.

3446 Board #351 June 2 3:30 PM - 5:00 PM

The Effects of a Clinical Outpatient Behavioral and Nutritional Intervention Program on Body Mass

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The prevalence of obesity has increased drastically over the past few decades in the United States. While a balanced nutrition and exercise program are suggested, more clinical-based treatments may be implemented (i.e., bariatric surgery and behavioral/nutritional interventions). Behavioral/nutritional intervention programs have been shown to be successful at decreasing body mass in overweight and obese individuals. However, further research needs to be conducted to determine the most successful behavioral and/or nutritional intervention for overweight and obese individuals.

PURPOSE: The purpose of this study was to assess the effects of a clinical outpatient behavioral/nutritional intervention on body mass in overweight and obese individuals.

METHODS: Forty-eight overweight (n=2) and obese (n=46) males (n=17) and females (n=29) [56 (13) yrs., height 1.70 (0.10) m., body mass 120.55 (33.83) kg, and BMI 41.45 (8.55) kg/m²] participated in this 15 week study. Participants self-selected one of two meal plans, offered through Healthy Management Resources, Decision Free or Healthy Solutions. The Decision Free meal plan required the consumption of 500-800 kilocalories per day through a minimum of five shakes or three shakes and two entrees. The Healthy Solutions meal plan required the consumption of 1,200 to 1,400 kilocalories per day through a minimum of three shakes, two entrees and five servings of fruits and vegetables. Both meal plans required regular physical activity of at least 2,000 kilocalories per week. Body mass was measured weekly. **RESULTS:** An independent samples t-test found no significant changes in body mass between the two meal plans. A paired samples t-test showed a significant decrease in the Decision Free meal plan pre- [125.71 (32.50) kg] vs. post-body mass [105.49 (27.01) kg] (t=11.688, p<.001) and the Healthy Solutions diet pre [115.40 (35.06) kg] vs. post-body mass [98.55 (29.88) kg] (t=12.452, p<.001). **CONCLUSIONS:** The results of this study support past research and suggests that behavioral and nutritional interventions are effective strategies for reducing body mass.

3447 Board #352 June 2 3:30 PM - 5:00 PM

Do Weight Concerns Put Female Prisoners at Risk for Re-Offending?

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Incarceration and substance abuse are two of the largest public health issues in America. Substance abuse is prevalent (80%) among imprisoned women; particularly stimulant use (e.g., methamphetamine) due to its appealing side effects including weight loss and increased energy. Ironically, newly abstinent from stimulant-type drugs during incarceration, metabolic activity and appetite suppression are removed and women experience significant amounts of unwanted weight. **PURPOSE:** Examine female prisoner's body weight, perceived weight concerns, and weight loss behaviors as risk factors for re-offending. **METHODS:** Prior to participation in a health and body image program, 364 female inmates completed questionnaires to assess drug history and weight concerns/behaviors. Height, weight and body fat (4-site skinfolds) were assessed and body mass index (BMI) calculated. **RESULTS:** Prisoners were adult (age=37.8±10.2y) and 83% were overweight or obese (BMI=30±5.8 kg/m²; body fat = 30.9±5.2%). Physical activity (PA) was low, with 29% self-reporting being sedentary and 19% reporting that most days they did no PA. Use of unhealthy weight loss methods were high, with participants reporting 'sometimes', 'often' or 'very-often' to the following behaviors: tobacco smoking (43%), methamphetamine (40%), energy drinks (36%), energy supplements (36%), diet pills (32%), starvation (19%), laxative use (12%), diuretics (10%), vomiting (9%) and enemas (4%). Overall, 60% of participants were concerned about weight gain in recovery, 45% were concerned that gaining weight could trigger a relapse, and 36% were concerned about using drugs

to lose weight after leaving treatment. **CONCLUSIONS:** Female prisoners were typically overweight or obese and used risky behaviors to manage weight, which may increase their risk of re-offending. Poor weight management behaviors, combined with a lack of PA, in this vulnerable and underserved population leads to “self-medication” to lose weight, which may lead to life-threatening eating disorders and other compensatory behaviors. Health, PA, nutrition and healthy body image programs are warranted in this population.

3448 Board #353 June 2 3:30 PM - 5:00 PM

Association Between Health-related Quality Of Life And Weight Loss, Fitness, And Physical Activity

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Weight loss is associated with improved health-related quality of life (HRQOL); however, it is important to know whether change in physical activity or fitness that also occurs during the weight loss process influences this relationship.

Purpose: This study examined the associations between change in HRQOL and weight loss, fitness, and physical activity in response to a 12 month behavioral weight loss intervention.

Methods: Participants (N=280; Age=45.1±7.9 years, BMI=32.3±3.9 kg/m²) engaged in a 12-month behavioral weight loss intervention program. Participants were randomized to a reduced calorie diet (DIET), diet plus a moderate dose of physical activity (MOD-EX), or diet plus a high dose of physical activity (HIGH-EX). All groups received weekly in-person intervention sessions for months 1-6, with combined in-person and telephonic sessions for months 7-12. Diet was prescribed at 1200-1800 kcal/day. MOD-EX was prescribed physical activity that progressed to 150 min/wk with HIGH-EX progressed to 250 min/wk. Weight, fitness, physical activity, and HRQOL were assessed at 0 and 12 months.

Results: There was significant ($p<0.05$) weight loss at 12 months (-10.2 ± 7.9 kg; $-11.1\pm 7.8\%$), with no significant difference between intervention conditions. HRQOL, measured by the SF-36, also significantly improved across 12 months ($p<0.05$), with no significant difference between intervention conditions. Change in HRQOL was associated with change in weight ($r=-0.35$, $p<0.001$), percent weight change ($r=-0.39$, $p<0.001$), change in fitness ($r=0.29$, $p<0.001$), and change in physical activity ($r=0.21$, $p<0.001$). While somewhat diminished after controlling for change in fitness, the correlation between change in weight ($r=-0.25$, $p<0.001$) and percent change in weight ($r=-0.29$, $p<0.001$) remained significant. A similar pattern was shown when controlling for change in physical activity ($r=0.34$, $p<0.001$; $r=0.38$, $p<0.001$).

Conclusions: Weight loss across a period of 12 months is significantly associated with improved HRQOL in adults who are overweight or obese. It appears that change in fitness and physical activity partially mediate these associations. Thus, it appears that weight loss interventions should target improved fitness and physical activity to maximize improvements in HRQOL.

Supported by: NIH (R01 HL103646)

G-08 Highlighted Symposium - The Role of Exercise in Neuroplasticity: Intervention to Manage Stress and Promote Well-Being

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 201

3460 **Chair:** Erica M. Taylor, FACSM. *Delaware State University, Dover, DE.*

(No relationships reported)

3461 **Co-Chair:** Steven J. Petruzzello, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.*

(No relationships reported)

3462 June 3 9:10 AM - 9:40 AM

Keynote - Integrating Stress, Cognition, and Emotion in Exercise Interventions

Brandon L. Alderman. *Rutgers University, New Brunswick, NJ.*
(No relationships reported)

3463 June 3 9:40 AM - 9:55 AM

The Relation of Fitness and Life Stress on the Temporal Dynamics of Cognition in Older Adults: Evidence from the P3 and Lateralized Readiness Potentials

Christopher J. Brush, Brandon L. Alderman. *Rutgers University, New Brunswick, NJ.*

(No relationships reported)

A large and consistent body of evidence supports a relationship between aerobic fitness and cognitive function. Alternatively, it is well known that stress and adverse life events impact brain structure and function, and may produce enduring alterations in cognition and behavior. It remains unclear, however, whether fitness moderates the relationship between life stress and cognition. The majority of studies examining the relationship between fitness and cognitive function have relied on behavioral performance measures, while the influence of fitness on select temporal aspects of information processing remains less well known. Given the considerable variation in age-related cognitive decline, it may be important to investigate the relationship of fitness with discrete information processing stages, which may aid in future intervention development. **PURPOSE:** The purpose of this study was to examine the relationship between aerobic fitness and different stages of information processing in older adults using the P3 and lateralized readiness (LRP) event-related potentials (ERPs). A secondary aim was to determine whether fitness moderates the relationship between stressful life experiences and stimulus evaluation (P3) or motor preparation (LRP) processes. **METHODS:** 48 older adults (aged 40-70 yrs) completed an aerobic fitness test following a cognitive assessment with the recording of ERPs using electroencephalography. P3 and LRP components were elicited by a modified oddball task and were used to index stimulus evaluation and motor-preparatory cognitive processes. Measures of life stress were collected using the Holmes-Rahe and Cohen perceived stress scales. **RESULTS:** Reaction time measures and P3 difference waves support previous research indicating differences in stimulus evaluation speed between high-fit and low-fit older adults, $ps < .05$. Higher perceived stress was also associated with a reduction in P3 amplitude and a delay in P3 latency, $ps < .05$, but not moderated by fitness. **CONCLUSION:** These findings indicate that fitness is associated with preserved cognitive processing that occurs as early as stimulus evaluation. Future research may focus on earlier ERP components (e.g., sensory ERPs) to document the precise temporal relationship between fitness and cognition.

3464 June 3 9:55 AM - 10:10 AM

Effects of Exercise on Neurocardiac Responses to a Sad Mood Induction in MDD

Peter J. Ehmann, Brandon L. Alderman. *Rutgers University, New Brunswick, NJ.*

(No relationships reported)

Chronic exposure to stressful life events is known to increase vulnerability for major depressive disorder (MDD). Thus, it is critical to identify healthy lifestyle behaviors and interventions that may decrease stress and help cope with adversity, especially among those at high risk for MDD. Previous research has demonstrated that an acute bout of exercise can buffer psychological stress, as indicated by improved positive affect and attenuated cardiovascular reactivity to laboratory stressors. However, the effects of acute exercise on a sad mood induction have received less attention and the

underlying mechanisms have yet to be explored. Preliminary evidence suggests that respiratory sinus arrhythmia (RSA) responses elicited during a sad mood induction, as opposed to a more traditional laboratory stressor, predict symptomatic improvement in currently depressed individuals. **PURPOSE:** To determine the effect of a single bout of moderate-intensity aerobic exercise on affective and neurocardiac responses to a sad film induction. **METHODS:** Using a within-subjects design, 40 young adults (20.1 ± 1.8 yrs) with (or high symptoms of depression; $n=20$) and without MDD ($n=20$) completed a 30-min session of exercise or a sedentary control condition in counterbalanced order on two separate days. After a 15-min recovery period, neurocardiac function was assessed during a 3-min sad film induction. Pre-ejection period (PEP) and RSA measures were derived using impedance cardiography and served as proxies of sympathetic and parasympathetic activity, respectively. Affective valence and perceived activation were also assessed at 5-min intervals throughout each session. **RESULTS:** Individuals with MDD demonstrated more robust RSA withdrawal during the sad film following exercise relative to the control condition, $p < .05$. Importantly, RSA reactivity to the sad film following exercise was similar in individuals with MDD to typical responses among nondepressed control subjects, $p > .05$. **CONCLUSION:** These findings suggest that exercise may serve as a protective factor preceding exposure to stress in individuals at risk for MDD. Future trials investigating the antidepressant effect of exercise should aim to establish predictive biomarkers of exercise treatment response.

3465 June 3 10:10 AM - 10:40 AM

Keynote - Exercise as a Neurobehavioral Therapy for Improving Cognitive Control and Attention in Major Depressive Disorder

Ryan Olson. *University of North Texas, Denton, TX.*

(No relationships reported)

June 3 10:40 AM - 11:00 AM

Overall Discussion

G-14 Thematic Poster - Biomechanics of Prolonged Running

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 403

3492 **Chair:** Allison H. Gruber. *Indiana University Bloomington, Bloomington, IN.*

(No relationships reported)

3493 Board #1 June 3 9:00 AM - 11:00 AM

Effects of a Submaximal 30-Minute Run on Peak Tibial Acceleration in Novice Runners

Max R. Paquette¹, Kris Camelio¹, Douglas W. Powell¹, Allison H. Gruber². ¹University of Memphis, Memphis, TN. ²Indiana University, Bloomington, IN. (Sponsor: D.S. Blaise Williams III, FACSM)

Email: mrpquette@memphis.edu

(No relationships reported)

Peak positive tibial acceleration (PTA) immediately following foot strike during running is greater in runners with a history of tibial stress fracture. PTA does not increase over the course of a 20min run at lactate threshold pace (i.e., moderate effort) in highly trained runners. However, injury incidence in novice runners is higher, which may suggest that novice runners do not have the control strategy to prevent PTA from increasing over a prolonged run. **PURPOSE:** To assess the effects of a prolonged submaximal run on PTA in novice runners. **METHODS:** Male ($n = 2$) and female ($n = 8$) novice runners (24 ± 5 yrs; 1.69 ± 0.12 m; 70.7 ± 15.6 kg; 24.5 ± 3.8 kg/m²) who had been training for less than two years and ran on average at least 16km per week completed a 30min treadmill run at a self-selected speed equivalent to a rate of perceived exertion using the Borg scale between 10-13. A 3D accelerometer (480Hz, PCB Piezotronics, USA) used to measure PTA immediately following foot strike was attached to the distal anteromedial aspect of the right tibia along its longitudinal axis. Sagittal plane foot contact angle and ankle angle were also computed using 3D motion capture data (240Hz, Qualisys, Sweden). Data from five consecutive steps were collected after four (start), 15 (middle) and 30 min (end) of the prolonged run. A one-way repeated measures ANOVA was used to assess a main effect of time on PTA ($p \leq 0.05$). *Post-hoc* paired t-tests were used to compare mean differences among time points. Cohen's *d* effect sizes were used to assess effect magnitudes. **RESULTS:** PTA was not different among time points ($p = 0.87$). PTA was unchanged between time points during the prolonged run (start: 3.58 ± 1.43 g; middle: 3.67 ± 1.09 g; end: 3.60 ± 1.47 g). Both foot

contact angle and ankle angle at foot strike were unaffected by the run ($p > 0.05$). **CONCLUSION:** Our data suggest that PTA does not change over the course of submaximal prolonged run in novice runners. This finding is similar to unchanged PTA during a 20min moderately intense run in trained runners. These findings appear to indicate that, independent of running experience, PTA is unaffected by prolonged running. Changes in lower extremity motion and stiffness over prolonged runs of different lengths and intensities may alter active shock attenuation mechanisms and have different impacts on PTA on novice runners.

3494 Board #2 June 3 9:00 AM - 11:00 AM
Lower Extremity Mechanical Energy Distribution Does Not Change Following A High-intensity Run
 Michael P. McNally, Margaret E. Raabe, Ajit MW Chaudhari, FACSM. *The Ohio State University Wexner Medical Center, Columbus, OH.*
 Email: michael.mcnally@osumc.edu
 (No relationships reported)

Fatigue during running decreases the body's ability to attenuate shock during impact, which may increase overuse injury risk. Muscles may assist in the attenuation of shock, and fatigue may induce redistribution in energy absorption during a single leg landing from the ankle to hip, but it is unknown whether there is a change in how joints function to dissipate energy after a high-intensity run. **PURPOSE:** To determine the effect of a high-intensity run on lower extremity energy distribution during running. **METHODS:** Ten experienced male runners, running 30+ minutes at least three times per week participated in this study. Optical motion capture was used to assess overground running mechanics at preferred running speed prior to completing a high-intensity run. A high-intensity training run was then performed at 80% of estimated $\dot{V}O_2$ max for 30 minutes, or until participants were unable to continue. Running mechanics were assessed again within 20 minutes of completing the run at the same preferred speed observed prior to the training run. Joint powers for the dominant leg hip, knee, and ankle were calculated, and net joint work and total joint work from initial contact to the end of weight acceptance were calculated and normalized to body mass. Repeated measures ANCOVA were used to assess time x joint interactions for net joint work and total joint work, with rating of perceived exertion at the end of the run included as a covariate. Statistical significance was set *a priori* at $p < 0.05$. **RESULTS:** There were no time x joint interaction effects from pre to post run in either net joint work (Hip: -0.087 vs. -0.095 J/kg; Knee: -0.384 vs. -0.366 J/kg; Ankle: -0.362 vs. -0.346 J/kg; $p = 0.198$) or total joint work (Hip: 0.175 vs. 0.160 J/kg; Knee: 0.452 vs. 0.446; Ankle: 0.365 vs. 0.348; $p = 0.282$). There were also no main effects of time for both net and total joint work ($p = 0.849$ and 0.075). **CONCLUSIONS:** No changes were observed in mechanical energy dissipation by the lower extremity joints after a 30-minute high-intensity run, indicating that lower extremity muscle function while running at a self-selected speed may not be affected by general fatigue. Self-selected running may not be intense enough to elicit changes, so further research should be performed to determine the effect of running at higher intensity on muscle function.

3495 Board #3 June 3 9:00 AM - 11:00 AM
Hip Neuromechanics In Women With And Without Previous Iliotibial Band Syndrome During A 30-minute Run
 Eric Foch¹, John W. Westbrooks¹, Clare E. Milner, FACSM².
¹Central Washington University, Ellensburg, WA. ²Drexel University, Philadelphia, PA. (Sponsor: Clare E. Milner, FACSM)
 Email: eric.foch@cwu.edu
 (No relationships reported)

Gluteus medius muscle activity during running may be associated with atypical hip adduction exhibited by women with previous iliotibial band syndrome (ITBS). **PURPOSE:** To determine if hip neuromechanics are different during a 30-minute run between women with and without previous ITBS. **METHODS:** Twelve women between the ages of 18 and 45 participated as part of an ongoing investigation. Women with previous ITBS ($n = 6$; age 29.8 (7.6) yrs; height 1.68 (0.07) m; mass 61.3 (7.6) kg; preferred pace 2.8 (0.5) $m \cdot s^{-1}$) were matched with controls (23.5 (5.5) yrs; 1.63 (0.07) m; 57.1 (7.6) kg; 2.7 (0.7) $m \cdot s^{-1}$). Gluteus medius muscle activity was recorded via a surface electrode during a maximal voluntary isometric contraction (MVIC). Three-dimensional marker trajectories and muscle activity were collected during a 30-minute treadmill run at preferred pace. Gluteus medius muscle activity during running was normalized to the MVIC trial for analysis. Hip angles were computed via joint coordinate systems. A moving root-mean-square created electromyography envelopes from gluteus medius muscle activity. Due to small sample size, data were analyzed using descriptive statistics with moderate effects considered clinically meaningful (≥ 0.50). **RESULTS:** Peak gluteus medius activation during the MVIC trial was less in the ITBS group compared to controls (ITBS: 0.14 (0.04) mV; Controls: 0.19 (0.10) mV; $d = 0.72$). However, women with previous ITBS had greater gluteus medius muscle activation compared to controls during the first and last minutes of the run (Table 1). Frontal plane hip kinematics were similar between groups.

Table 1: Variables of interest at minute one and minute 30 between runners with previous ITBS and controls (CON) (mean (standard deviation)); d is effect size (ES).

	Time	Group		ES
	Min	ITBS	CON	d
Peak hip adduction (degrees)	1	13.6(3.0)	13.5(2.4)	0.06
	30	14.3(3.7)	13.5(3.4)	0.23
Hip adduction excursion (degrees)	1	2.7(2.0)	3.5(1.9)	0.43
	30	3.8(3.1)	4.5(1.3)	0.32
Pre-heelstrike gluteus medius activation (%MVIC)	1	80.4(19.7)	62.0(28.4)	0.76
	30	93.9(36.9)	63.7(25.2)	0.97
Weight acceptance gluteus medius activation (%MVIC)	1	96.5(13.3)	74.6(25.6)	1.13
	30	96.4(7.7)	72.2(26.4)	1.42

CONCLUSION: Runners with previous ITBS had weak hip abductors but similar peak hip adduction angle to controls. The ITBS group activated their hip abductors more to achieve the same hip adduction angle as controls.

3496 Board #4 June 3 9:00 AM - 11:00 AM
The Effect of Compression Tights on Muscle Vibration and Energy Expenditure during a High-Intensity Run
 Hannah Harris, Margaret E. Raabe, Michael P. McNally, Ajit M.W. Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*
 Email: harris.2169@osu.edu
 (No relationships reported)

BACKGROUND: Compression garments are believed to provide performance benefits to runners. It has been shown that wearing these garments leads to reduced muscle vibrations during running and jumping. However, little research has investigated performance benefits that result from a reduction in muscle vibration. It has been proposed that the reduced muscle vibrations may lead to increased performance through a reduction in energy expenditure. **PURPOSE:** Investigate the effect of compression tights on muscle vibration and change in energy expenditure during an endurance run. **METHODS:** Twenty healthy experienced male runners participated. Participants ran at 80% $\dot{V}O_2$ max speed, previously estimated from an incremental treadmill procedure. Vibration data was collected using a passive marker motion capture system. The peak amplitude of muscle vibrations (axial direction) was calculated 150ms after foot strike for the quadriceps, hamstrings, gastrocnemius, and tibialis anterior muscles. A run was then performed on a treadmill at the same speed for 30 minutes or until voluntary exhaustion. Participants' heartrate (HR) was recorded in 5-min increments during the run and energy expenditure (EE) was estimated using the model: $EE (kcal/min) = 3.56 - 0.0136(\text{weight}) + 0.00189(\text{HR})(\text{weight})$. The percent change in EE over the course of the run was analyzed. This protocol was repeated on two separate days, one with running shorts and one with high compression tights (20-25 mmHg). The order of conditions was randomly assigned. **RESULTS:** Paired two-sided t-tests revealed significant difference in muscle vibrations between the running shorts and tights conditions (quads: 15.9±5.2 mm vs 7.6±2.5 mm, $p < 0.0001$), with significantly less muscle vibration in the tights condition for all muscle groups except for the hamstrings (7.6±3.6 mm vs 7.2±2.2 mm, $p = 0.70$). However, there was no significant difference found in the percent increase in EE (9.4±6.1% vs 10.1±5.0%, $p = 0.43$) from the start to end of the run. **CONCLUSION:** Compression tights significantly reduced muscle vibration during running but had no effect on energy expenditure during an endurance run. Future work should investigate other performance variables that may be affected by wearing compression tights to better understand possible performance benefits.

3497 Board #5 June 3 9:00 AM - 11:00 AM
The Effect of Cushioned Insoles on Tibial Acceleration During Running
 Anisa Rohilla, Natalie Turner, Jake Glazer, Ryan Smith, Dimitrios Katsavelis. *Creighton University, Omaha, NE.*
 (Sponsor: Joan M Eckerson, FACSM)
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 (No relationships reported)

Background: Running through fatigue has been found to place an excessive amount of stress to lower extremities that may increase the risk of overuse injuries. Cushioned insoles are suggested to help attenuate shock and reduce impact forces caused by running. **Purpose:** To investigate the effect of implementing cushioned insoles on subjects before and after a fatigue protocol run to determine whether the insoles significantly lessened impacts. **Methods:** Four male college students (age = 22.8± 4yr; weight = 80.2± 5kg; height = 187.3± 3cm) participated in the study. The participants

were tested three times over a period of three weeks. During the first visit, lactate threshold speed (LTS) was assessed via blood samples (7.8 ± 5 mph). During the second and third visits participants were randomly assigned to undergo incremental treadmill tests with and without insoles. The incremental runs included two rounds of seven 30-second bouts at stages -20% below to +40% above the LTS, with a 20 minute run at LTS in between the two trials. A triaxial accelerometer that was placed at each subject's dominant tibial plateau recorded acceleration before and after the 20m run. Tibial acceleration (TA), stride length and frequency were calculated through Matlab. **Results:** A two way repeated ANOVA (2 fatigue states by 2 insoles conditions) showed that there was a main effect of state ($p=0.003$) and a main effect of insole condition ($p<0.001$), as well as an interaction ($p=0.044$). Post hoc analysis revealed that TA was significantly lower during the non-fatigue control run with insoles when compared to the other conditions. Over the course of both pre- and post-fatigue incremental tests, stride length and frequency did not change. **Conclusion:** The findings indicate that insoles are an effective way to reduce tibial acceleration during running, but to a greater extent in the absence of fatigue (22% vs. 13%).

3498 Board #6 June 3 9:00 AM - 11:00 AM

Influence Of Step Rate Control On The Metabolic Demands Of Running In A Lower-body Positive Pressure Treadmill

Brendan J. Rickert. *Sacred Heart University, Fairfield, CT.*
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(No relationships reported)

Lower-body positive pressure treadmills (LBPP-TM) artificially reduce body weight (BW) allowing individuals to run with reduced load and metabolic demand. Previous reports document that temperospatial mechanics are significantly altered as BW levels are reduced. Specifically, step length (SL) is longer and step rate (SR) is reduced. If a runner modifies SR in the LBPP-TM they can maintain normative temperospatial mechanics, however, the influence on metabolic demand is unknown. **PURPOSE:** To investigate the relationship between the degree of unloading and oxygen consumption (VO₂) when SR is maintained. **METHODS:** Eighteen competitive runners (8M; 20.3 ± 1.8 yrs; 59.9 ± 7.8 kg) granted informed consent and completed a VO₂ peak test on the LBPP-TM and two separate trials consisting of a 30-min continuous run at 65% VO₂ peak. Each continuous run started with a 10-min familiarization segment at 100% BW before four 5-min segments at 100, 90, 80, and 70% BW. In a counter-balanced design, SR was controlled in one trial as runners matched a digital metronome (DM) set to their SR recorded during the familiarization run. VO₂ was collected over the last two-minutes of each segment. Hi-speed video (210 Hz) was recorded for each trial and SR subsequently determined. All dependent variables were compared using repeated-measures ANOVAs with Bonferonni post hoc testing (SPSS Statistics 23). **RESULTS:** There was a significant main effect of BW level ($F(2,4,41.4)=81.3, p<0.01$) and DM ($F(1,17)=45.1, p<0.01$) on SR. SR was significantly reduced at 90, 80, and 70% BW as compared to the 100% BW condition ($p<0.05$) when runners could self-select their cadence. There was a significant main effect of BW level ($F(1,3,22.9)=105.6, p<0.01$) and DM ($F(1,17)=6.6, p<0.05$) on VO₂. **CONCLUSION:** At all BW levels, runners were able to successfully match their SR with a DM set to their normal SR at 100% BW (178.1 ± 9.9 steps/min). While running with a self-selected SR at 70% BW, runners displayed both a significantly lower SR (168.5 ± 9.9 steps/min) and lower VO₂ as compared to when they were forced to match their SR to a DM. As BW level is reduced, VO₂ is significantly reduced whether SR is self-selected or matched to normal SR but the self-selected SR produced the greatest VO₂ reductions indicating that runners adjust temperospatial mechanics for improved economy.

G-15 Thematic Poster - High Intensity Training

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 101

3499 **Chair:** John P. Porcari, FACSM. *University of Wisconsin - La Crosse, La Crosse, WI.*
(No relationships reported)

3500 Board #1 June 3 9:00 AM - 11:00 AM

Acute Physiological Responses of Very Short versus Standard Sprint Interval Training (SIT) protocols

Stefano Benitez Flores¹, Arilson F. M. de Sousa¹, Erick Carlos da Cunha Totó¹, Thiago Santos Rosa¹, Sebastián Del Rosso¹, Carl Foster, FACSM², Daniel Alexandre Boulosa¹. ¹*Universidade Católica de Brasília, Brasília, Brazil.* ²*University of Wisconsin - La Crosse, La Crosse, WI.*
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(No relationships reported)

Sprint Interval Training (SIT) is characterized by supramaximal "all-out" efforts of 10-30s, and promotes cardiometabolic and musculoskeletal adaptations. Given that peak power output, a key stimulus for aerobic adaptations, can be achieved during the first seconds of a sprint, it is possible that a very short SIT protocol (i.e., 5 s) can lead to similar adaptations compared to longer efforts. **PURPOSE:** To compare the physiological and mechanical responses of two different SIT protocols [(SIT with 20s efforts (SIT20s) vs. SIT with 5s efforts (SIT5s)]. **METHODS:** Eight males (VO_{2max} = 45.9 ± 3.7 mL/kg/min, age = 25.3 ± 3.6 yr) participated. VO_{2max} was measured in the 1st session. In the 2nd and 3rd sessions two different SIT protocols were completed in randomized order: SIT20s (4 × 20s with 2 min of recovery) and SIT5s (16 × 5s with 24 s of recovery). Both SIT sessions had the same load (7.5 % body mass), lasted 12 min, and had the same work-to-rest ratio. During SIT sessions, the following parameters were recorded: oxygen consumption (VO₂), heart rate (HR), respiratory exchange ratio (RER), energy expenditure (EE), post-exercise lactate (LA), peak power (PP), mean power (MP), rate of fatigue (RF), total work (TW), and OMNI-cycle scale RPE (Omni-cycle RPE). **RESULTS:** Mean VO₂, HR, and total EE were higher in SIT5s [37.61 ± 1.45 vs. 26.89 ± 1.21 mL/kg/min ($P=0.000$), 156 ± 11 vs. 141 ± 14 bpm ($P=0.021$), and 102 ± 9 vs. 73 ± 7 Kcal ($P=0.000$), respectively]. LA and RER were higher in SIT20s [16.4 ± 2.5 vs. 14.6 ± 2.6 mmol/L ($P=0.032$), 1.46 ± 0.6 vs. 1.19 ± 0.7 ($P=0.000$), respectively]. MP and TW were higher in SIT5s [735.5 ± 72.8 vs. 595.6 ± 57.4 W ($P=0.001$), and 56.6 ± 5.6 vs. 47.3 ± 4.4 kJ ($P=0.02$), respectively]. No significant differences were found between protocols in PP [911.4 ± 60.5 vs. 909.1 ± 88.5 W ($P=0.937$), for SIT5s and SIT20s, respectively]. RF was higher in SIT20s than in SIT5s [54.7 ± 5.9 vs. 39.4 ± 9 % ($P=0.001$)]. Omni-cycle RPE at 10 min recovery was lower in SIT5s [3.5 ± 1.7 vs. 4.75 ± 1.5 ($P=0.038$)]. **CONCLUSIONS:** Despite similar PP between protocols, the short SIT protocol (5s efforts) elicited greater cardiorespiratory responses, higher mechanical strain, and a lower fatigue and glycolytic activation when compared to the standard SIT protocol.

3501 Board #2 June 3 9:00 AM - 11:00 AM

Training Status Affects The Physiological Response To A Single Bout Of High Intensity Functional Training

Yuri Feito, FACSM, Michael Giardina, Danielle Brown, Brandi Price. *Kennesaw State University, Kennesaw, GA.*
(No relationships reported)

Although the cardiometabolic effects of high intensity training are well established, little evidence surrounds physiological changes occurring as a result of a high intensity functional training (HIFT) session. Even though previous studies have linked experience with performance, experience alone does not imply greater skill. **PURPOSE:** To examine the physiological response of a HIFT workout among individuals with different competitive levels. **METHODS:** Sixty-six participants (30.8 ± 7.3 y; 172.4 ± 9.1 cm; 76.2 ± 13.6 kg) with at least six-months of HIFT experience and different levels of ability and skill were tested. Ability and skill level was determined by the benchmark workout "Fran" [Novice (Nov), N=26; Intermediate (Int), N=22; Advance (Adv), N=18]. All participants underwent aerobic capacity testing to examine peak levels of oxygen consumption (VO_{2peak}), heart rate (HR_{peak}), respiratory exchange ratio (R_{peak}), and blood lactate (Lt_{peak}). A week later, the same variables were measured (VO₂; HR; R; Lt) during a 15-min HIFT based workout. **RESULTS:** Analysis of variance revealed significant group differences in VO_{2peak} (Adv = 50.1 ± 5.4 , Int = 46.1 ± 4.9 , Nov = 43.8 ± 6.6 mL/kg/min; $p<0.001$) and Lt_{peak} (Adv = 12.6 ± 2.5 , Int = 11.5 ± 3.3 , Nov = 9.9 ± 3.2 mmol/L; $p=0.010$). Similarly, during the HIFT workout, advance athletes had the highest VO₂ of the three groups (Adv = 39.7 ± 3.1 , Int = 37.4 ± 4.1 , Nov = 35.0 ± 5.6 mL/kg/min; $p=0.006$). However, intermediate athletes had the highest Lt concentration during the HIFT workout (Adv = 9.2 ± 1.6 , Int = 11.2 ± 1.5 , Nov = 9.6 ± 2.7 mmol/L; $p=0.008$). When we compared performance of the HIFT workout, Advance athletes performed significantly better

than the Intermediate and Novice athletes (304±25, 258±26, 212±29 repetitions, respectively; $p < 0.001$). Regression analysis revealed experience was the greatest predictor of performance in this 15-min HIIT workout ($r^2 = 0.658$, $p < 0.001$).

CONCLUSIONS: These data support the notion that individuals with different training levels respond differently to a specific HIIT workout. Further studies should continue to explore these differences among athletes with different training levels.

3502 Board #3 June 3 9:00 AM - 11:00 AM
Effects Of High-intensity Functional Circuit Training On Motor Function And Exercise Motivation: A Randomized-controlled Trial

Jan Wilke, Stefanie Kaiser, Daniel Niederer, Tobias Engeroff, Lutz Vogt, Winfried Banzer, FACSM. *Goethe University Frankfurt, Frankfurt am Main, Germany.*
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 (No relationships reported)

PURPOSE: Only a small share of the world population meets current physical activity guidelines, which recommend regular engagement in endurance, strength, and neuromotor exercise. As lack of time has been reported to constitute a major cause of inactivity, multidimensional methods with short training duration might be a promising alternative to classical, volume-oriented approaches. This randomized-controlled trial aimed to examine the effects of a high-intensity functional circuit (HIFCT) training program on motor function and motivation to exercise in healthy, untrained adults. **METHODS:** 25 inactive participants (26±5 yrs, 9♂) were randomly allocated to two groups. The intervention group (HIFCT, $n = 15$) 3x/wk performed functional exercises incorporating complex whole-body movements (e.g. Squats, Step-Ups, Burpees) in a circuit format. The 15 min workouts were composed of repetitive 20s all-out bouts with 10s breaks. In the comparison group (moderate aerobic exercise, MAE) the participants walked 3x/wk for 50 min at moderate intensity (progressively increased from 50 to 60% of the individual heart rate reserve). Motor outcomes, measured prior to and after the six-week intervention, were cycling capacity (maximum work load), dynamic maximum strength (leg and shoulder press), postural control (force plate), and jump capacity (reactive strength index, counter-movement jump, single leg hop for distance). Motivation to exercise was assessed using the self-concordance index. Systematic group differences were detected with the Mann-Whitney-U-test ($\alpha = .05$). **RESULTS:** In comparison to MAE, HIFCT increased maximum leg strength (difference of relative median pre-post changes between groups: 6%), shoulder strength (8.4%), and cycling workload (6.5%; $p < .05$). No differences were found for postural control and jump capacity ($p > .05$). Although not statistically significant, there was a tendency for increased self-concordance following HIFCT ($p < .1$). **CONCLUSION:** Despite considerably shorter training duration, HIFCT enhances motor function in healthy untrained adults more effectively than MAE. It might moreover be better suited to motivate inactive people to engage in regular activity. Further research should thus investigate long-term adherence to the program and its effectivity in other settings.

3503 Board #4 June 3 9:00 AM - 11:00 AM
Strength and Power Acute Responses to Suspension Training

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Suspension Training (ST) is a form of resistance training aiming at improving strength, endurance, coordination, flexibility, power, and core stability. Although ST is thought to elicit higher muscle activations than traditional exercises, only limited information is available on its acute effects on strength and power performances. **PURPOSE:** To evaluate strength and power acute responses after group ST in relation to gender. **METHODS:** 32 college students (16 M, 16 F; Age: 25.8±3.9 years; Body Mass: 65.8±11.2 kg; Height: 166.9±8.9 cm; BMI: 23.5±2.4 kg/m²) volunteered to participate in the study. Before (PRE) and after (POST) a 45-min ST group session, Squat (SJ) and Countermovement (CMJ) Jumps were performed on a portable force plate, while lower limb Maximum Voluntary Contraction (MVC) at 90° angle isometric knee extension and grip strength (HG) were measured in preferred and non-preferred limbs through a piezoelectric force transducer and a hydraulic hand dynamometer, respectively. ANOVA for repeated measures was used to evaluate differences ($p < 0.05$) in relation to gender and experimental session. **RESULTS:** As expected, M always showed highest strength and power values ($p < 0.02$). In the POST condition, no significant improvements were found for HG, with best performances ($p < 0.02$) emerging for the preferred limb (M-PRE: 429.3±31.2N; M-POST: 445.7±30.2N; F- PRE: 254.1±12.6N;

F- POST: 256.4±13.5N) with respect to the non-preferred one (M-PRE: 399.4±16.2N; M-POST: 407.6±28.6N; F-PRE: 231.7±15.9N; F-POST: 236.1±18.1N). For MVC, only F showed differences between limbs ($p < 0.02$), with highest values in the preferred leg (PRE: 238.8±15.1N; POST: 246.9±20.1N) and lowest in the non-preferred one (PRE: 222.4±19.9N; POST=230.9±14.5 N). After the session, M only showed improvements ($p < 0.02$) in CMJ (PRE: 32.3±1.8cm; POST: 33.7±1.7cm) and MVC for the non-preferred leg (PRE: 276.1±16.6N; POST: 292.4±24.1N), while no differences emerged for SJ. **CONCLUSIONS:** Results shown that ST is a form of exercise useful to maintain and improve acute strength and power performances, in particular in male subjects. ST could be added in warm-up programs for sports where strength and power are key components.

3504 Board #5 June 3 9:00 AM - 11:00 AM
The Effects Of 4-weeks Hiit And Continuous Based Training On The Incidence Of Plateau At Vo2max And The Anaerobic Capacity

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 (No relationships reported)

PURPOSE: The plateau at VO_{2max} has been attributed to the size of the finite anaerobic capacity which has previously been shown as a trainable parameter. Therefore the purpose of this study was to assess the effects of 4-weeks HiIT or continuous training on the incidence of plateau at VO_{2max} and the anaerobic capacity. **METHOD:** Following Institutional ethics approval $n = 30$ physically active adolescents agreed to participate (age, 17.2 ± 1.2 yrs; height, 173.7 ± 8.9 cm; mass, 67.7 ± 14.0 kg; VO_{2max} , 47.3 ± 7.9 ml·kg⁻¹·min⁻¹). They were assigned to 3 matched groups, high-intensity intermittent training (HiIT), continuous training (CET) and a no-training control group (CG), based on maximally accumulated oxygen deficit (MAOD) scores. HiIT completed 8 x 20s sprints at 170% W- VO_{2max} with 10s recovery 3 times a week for 4-weeks, CET completed 30min cycling at 70% W- VO_{2max} (70 rpm) 3 times per week for 4-weeks. Pre and post training VO_{2max} , MAOD, cardiac output (Q), HR were assessed using breath-by-breath analysis and exercising on an electronically controlled cycle ergometer. Additionally blood glucose, blood lactate and key haematological parameters were assessed. Plateau criteria was determined as $\Delta VO_2 \leq 1.5$ ml·kg⁻¹·min⁻¹ over the final 60s of the VO_{2max} trial. **RESULTS:** HiIT increased MAOD from 37.4 ± 10.7 to 41.9 ± 9.6 ml·kg⁻¹ ($P = 0.029$) while there was no change in either CG or CET. ΔVO_2 during final 60s of the VO_{2max} test showed no change for HiIT or CET following 4-weeks of training, while total exercise time increased by 13.2s for HiIT ($P = 0.004$) and 15.6s CET ($P = 0.036$) with no change for CG. VO_{2max} showed no change for HiIT but increased from 47.9 ± 7.7 ml·kg⁻¹·min⁻¹ to 51.5 ± 10.0 ml·kg⁻¹·min⁻¹ ($P = 0.015$). Q_{max} decreased by 2.0 ± 2.2 l·min⁻¹ following HiIT ($P = 0.019$) coupled with an increase in a- $VO_{2diffmax}$ of 2.5 3.4 ml/100ml⁻¹ ($P = 0.042$) while for CET there was no change in either Q_{max} or a- $VO_{2diffmax}$. HiIT also showed a significant increase in HCO₃⁻ post training ($P = 0.002$) with no change in either CG or CET. **CONCLUSIONS:** These data suggest that 4-weeks of HiIT training was sufficient to induce a large increase in the finite anaerobic capacity but could not show any effect on the incidence of plateau at VO_{2max} . It is thus concluded that the plateau is not simply a product of anaerobic energy provision but a more complex psychobiological component.

3505 Board #6 June 3 9:00 AM - 11:00 AM
Sex Specific Cardiovascular And Metabolic Responses To High-intensity Exercise On An Elliptical Cross-trainer

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 (No relationships reported)

High-intensity interval exercise (HIIT) has been shown to elicit greater cardiovascular and metabolic responses compared to moderate continuous aerobic exercise. However, the acute responses to HIIT between males and females using a novel elliptical cross-trainer have not been reported. **PURPOSE:** To investigate the cardiovascular and metabolic response of 3 HIIT protocols using a novel device. **METHODS:** Six males (M) (81.5 ± 8.1 kg; 1.79 ± 0.1 m) and six females (F) (59.6 ± 6.7 kg; 1.64 ± 0.1 m) between 19-28 years of age volunteered. Following written consent, each participant performed three different HIIT protocols in a randomized order: 10 bouts of 30/30 sec, 30/60 sec, and 30/90 sec work-to-rest ratios for a total duration of 10, 15, and 20 min, respectively. Protocols were separated by at minimum of 24 hours. Oxygen consumption (VO_2) and heart rate (HR) were collected continuously and monitored during each exercise protocol. Blood lactate (BLA), energy expenditure (EE) rating of perceived exertion (RPE), and watts (W) were also collected during the exercise

protocols. Separate 2 (sex) X 3 (protocol) repeated measures ANOVA techniques (SPSS v22; $p < 0.05$) with post hoc analysis were applied to examine differences. **RESULTS:** There was no effect of protocol. However, a significant effect of sex, although not found for BLA and $\dot{V}O_2$, was observed for RPE ($M=17 \pm 2.0$, $F=16 \pm 1.5$; $F=5.453$, $p=.034$), W ($M=165 \pm 33W$, $F=137 \pm 24W$; $F=7.519$, $p=.021$), HR ($M=168 \pm 16bpm$, $F=181 \pm 5bpm$; $F=14.218$, $p=.002$) and EE ($M=11.2 \pm 1.7kcal \cdot min^{-1}$, $F=9.0 \pm 1.5 kcal \cdot min^{-1}$; $F=11.638$, $p=.004$); peak W also differed by sex ($M=674.5 \pm 147W$, $F=420 \pm 61W$; $F=18.291$, $p=.002$). There were no sex by protocol effects. **CONCLUSION:** Our 1:1, 1:2, and 1:3 work-to-rest HIIT bouts, which held work constant at 30 sec, did not elicit a change in cardiovascular or metabolic responses. However, there were sex specific differences for 4 variables; this is most likely explained by physiological and training differences between the men and women in this study. Future studies and exercise programs should consider sex differences during HIIT training when developing exercise protocols.

3506 Board #7 June 3 9:00 AM - 11:00 AM

The Effect of High-Intensity Interval Training and Intermittent Fasting on Body Composition in Apparently Healthy Women

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Women are less likely to meet physical activity recommendations with a "lack of time" as the most commonly reported barrier to meeting the recommendations. High-intensity interval training (HIT; short bursts of high-intensity activity followed by low intensity rest periods) is a form of exercise that elicits similar cardiorespiratory responses as continuous training with less total energy expenditure required and a shorter time commitment. HIT has been found to increase whole-body insulin sensitivity and improve overall body composition. Alternate day fasting elicits similar improvements in body composition as HIT.

PURPOSE: To examine the effect of HIT and alternate day fasting versus HIT alone on body composition in women.

METHODS: HIT was performed 3 days per week in 20 minute sessions; one day led by an instructor; two days performed at home using the study YouTube channel. Suggested exercise intensity was determined from baseline fitness levels. Participants in the HIT only group were instructed to eat a well-balanced breakfast each morning prior to the exercise sessions. The HIT+fasting group was instructed to fast for a total of 12 hours, three days per week. The fast began 10.5 hours prior to exercise (primarily overnight) and lasted at least 30 minutes after exercise. Body composition (weight, BMI, body fat percent, waist, hip, thigh, and arm circumference) was assessed at baseline and post-intervention.

RESULTS: Hip circumference significantly reduced in the HIT+fasting group (40.5 ± 3.1 to 39.4 ± 1.3 ; $p=0.041$). Weight and waist circumference decreased non-significantly in the HIT+fasting group (158.5 ± 31.2 to 145.3 ± 13.3 , $p=0.11$; 31.6 ± 3.5 to 30.6 ± 2.1 , $p=0.402$). Body fat percent reduced non-significantly in the HIT only group (27.4 ± 4.5 to 25.5 ± 5.5 ; $p=0.461$).

CONCLUSIONS: HIT resulted in significant and non-significant beneficial body composition changes in apparently healthy women. This exercise mode provides an alternative to long duration exercise, and a way to combat the "lack of time" barrier, while still achieving similar benefits as those achieved from continuous training. The combination of HIT and alternate day fasting in women requires further investigation, specifically the metabolic and cellular effects of fasting and training in women and the resulting effects on body composition.

3507 Board #8 June 3 9:00 AM - 11:00 AM

Psychological Impact Of 8-week CrossFit And Non-CrossFit Training Programs

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(No relationships reported)

Introduction CrossFit utilizes both high-intensity aerobic training and resistance training using functional multi-joint movements such as squats, deadlifts, clean, snatch, and overhead press. There has been much debate over the safety, effectiveness and level of difficulty of CrossFit training for the general population. **Purpose** This study aimed to compare perceived difficulties of an 8-week CrossFit or non-CrossFit exercise regimen. **Methods** The non-CrossFit exercise group (N=13) participated in three days of exercise consisting of mobility and functional movements, cardiovascular endurance training and a resistance training circuit each week for eight weeks. The CrossFit exercise group (N=13) integrated cardiovascular training into their resistance training program by completing a maximum number of repetitions in a given time period. Each week an online survey was sent to each participant to complete. Mean values were calculated for each question and a paired sample t-test was used to compare the

responses between groups. **Results** Difficulty of the workouts was perceived as more difficult in the non-CrossFit group than the CrossFit group (3.22 ± 0.56 , 2.49 ± 0.51 , $p < 0.001$, respectively). CrossFit participants rated level of soreness higher than the non-CrossFit group (2.36 ± 0.37 , $p=0.002$). The CrossFit group rated better sleep quality than the non-CrossFit group (2.23 ± 0.17 , $p < 0.001$). **Discussion** A previous study found that perceived exertion and pain is more dependent on the load than the type of muscular contraction. The current study contradicted this finding as the CrossFit group used greater loads, but their perceived difficulty was less than the non-CrossFit group. The CrossFit group rated their perceived pain levels as higher than the non-CrossFit group, which supports previous research, and is possibly due to using greater loads. **Conclusion** Based on the findings of this study and findings of previous research, use of greater loads may lead to greater perceived pain levels while flexibility and mobility training may lead to greater perceived difficulty.

G-16 Thematic Poster - Muscle Physiology

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
Room: 304

3508 **Chair:** Peter Hosick. *Montclair State University, Montclair, NJ.*

(No relationships reported)

3509 Board #1 June 3 9:00 AM - 11:00 AM

Mechanomyographic Responses to Blood Flow Restricted, Fatiguing Isometric Muscle Actions

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Blood flow restriction (BFR) during low intensity resistance exercise (LIRE) has been shown to increase activation of lower body musculature. It is unclear if this is due to increases in motor unit recruitment (MU) or firing rate. Mechanomyography (MMG) has been used to investigate motor unit recruitment (MMG amplitude) and motor unit firing rate (MMG frequency).

PURPOSE: To use MMG to investigate the neuromuscular effects of BFR in the lower body during LIRE.

METHODS: Ten males (age = $27.1 \pm 3.1y$; height = 177.6 ± 6.2 cm; mass = 86.9 ± 13.0 kg) performed 3 knee extensor maximal voluntary isometric contractions (MVIC) with the right limb. Occlusion (OCC) was then applied to the right thigh using a KAATSU master unit while two sets (set 1 = 30 ± 7.96 repetitions; set 2 = 13.7 ± 11.29 repetitions) of repeated 5-second isometric knee extensions at 30% of peak torque were performed. Each set was performed to fatigue, defined as the inability to reach 30% of MVIC torque, with 2-seconds rest between repetitions. The same procedure was repeated during a second visit without occlusion (NONOCC), while matching the number of repetitions per set to the first visit. An accelerometer was used to collect MMG data from the vastus lateralis during the MVICs and both sets. Prior to data analysis, repetitions were normalized as percentages (25%, 50%, 75% and 100%) of total repetitions completed, and MMG data were normalized to the values from MVIC testing.

RESULTS: For MMG frequency, a significant 3-way interaction between set (2), condition (2) and percent repetitions (4) ($p=0.046$) was found. Follow-up tests revealed no interaction or main effects for set 1 ($p > 0.05$), and no interactions for set 2. When collapsed across percent repetitions, MMG frequency was lower for OCC (0.837 ± 0.045) than for NONOCC (1.116 ± 0.099) during set 2 ($p=0.046$). For MMG amplitude, there was a significant condition by set interaction ($p=0.023$). MMG amplitude was higher for the OCC condition (0.754 ± 0.187) than for the NONOCC condition during set 2 (0.481 ± 0.163 ; $p=0.001$). MMG amplitude during set 1 (0.599 ± 0.179) was lower than set 2 (0.754 ± 0.187 ; $p=0.042$) for OCC.

CONCLUSION: OCC exhibited lower levels of MMG frequency and higher values for MMG amplitude. This suggests that higher MU recruitment, rather than firing rate, was responsible for increased muscle activation during BFR.

3510 Board #2 June 3 9:00 AM - 11:00 AM
Inhibitory Feedback During Fatiguing Contractions Is Similar In Males and Females.
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 (No relationships reported)

Whether an inhibitory feedback mechanism explains sex-related discrepancies in muscular fatigue is unclear. **PURPOSE** To examine sex-related differences in the influence of inhibitory sensory feedback during fatiguing contractions. **METHODS** A fatigue task was performed by 20 subjects (7 males and 13 females; 18-30 years), which consisted of 1) baseline assessments; 2) a 20-s sustained maximum voluntary contraction (MVC) while blood flow to the shank was occluded; 3) a 20-s MVC performed 3 minutes after the fatiguing task, while blood flow remained occluded; and 4) a 5-s MVC performed 3 minutes after blood flow was returned. Force of the ankle dorsiflexors and EMG of the tibialis anterior were monitored during all contractions. Maximal M-waves were recorded from the tibialis anterior via stimulation of the peroneal nerve prior to and immediately following each contraction. **RESULTS** No significant differences were observed between males and females for baseline measures of MVC ($p=0.72$), EMG ($p=0.44$), or M-wave amplitude ($p=0.40$) or latency ($p=0.37$). The 20-s contraction resulted in a significant reduction in MVC force ($p=0.001$), which was similar between males and females ($p=0.35$). MVC force remained reduced following 3 minutes of rest while blood flow was occluded, but returned to baseline when blood flow was restored ($p=0.18$). EMG amplitude remained similar at all time points of the experiment ($p=0.11$). The amplitude of the M-wave was similarly reduced ($p=0.001$) in men and women ($p=0.60$) at the end of the fatiguing contraction, increased following rest with blood flow occluded ($p=0.03$), and returned to baseline following the return of blood flow ($p=0.210$). M-wave latency did not change significantly at any time point ($p=0.11$). **CONCLUSION** These results indicate the importance of peripheral feedback during fatigue for both men and women and suggest that a potential oxidative advantage for women is eliminated during a time of high oxidative stress. Without this advantage similar feedback mechanisms are likely present during occlusion.

3511 Board #3 June 3 9:00 AM - 11:00 AM
Time-Related Changes in Firing Rate Behavior is Partially Explained by Potentiation
 Jonathan D. Miller, Trent J. Herda, Michael A. Trevino, Adam J. Sterczala, Anthony B. Ciccone. *University of Kansas, Lawrence, KS.*
 (No relationships reported)

PURPOSE: To determine the effects of age and influence of twitch force potentiation on motor unit (MU) firing rate behavior during steady force contractions. **METHODS:** Twenty young (YG) individuals (10 men and 10 women, mean \pm SD age = 22.5 ± 2.7 years, mass = 75.4 ± 16.7 kg) and 9 aged (AG) individuals (4 men and 5 women, age = 61.9 ± 2.5 years, mass = 77.8 ± 16.6 kg) participated in this study. A resting twitch was evoked immediately prior to and following a 50% maximum voluntary contraction (MVC) in which the targeted force was held for 12 s. Absolute difference scores were calculated between pre- and post-50% MVC twitch forces (ΔTF) (highest 0.005 s) and then normalized to pre-50% TF (ΔTF_{NORM}) for each subject. Mean firing rate (MFR) vs. recruitment threshold (Rec Thresh) relationships were analyzed for each subject during the first, median, and last 0.5 second of the steady force portion of the 50% MVC. The slopes and y-intercepts of these relationships were regressed against time to determine time-dependent changes in MU firing rate behavior. The slopes and y-intercepts of these relationships (MFRT_{SLOPE} and MFRT_{INT}) were used for subsequent analysis. Independent samples t-test were performed on ΔTF , MFRT_{SLOPE} and MFRT_{INT} to determine potential differences between YG and AG. Correlations were performed for MFRT_{SLOPE} and MFRT_{INT} vs. ΔTF_{NORM} . **RESULTS:** ΔTF was greater ($P < 0.001$) for YG (0.619 ± 0.258 N) than AG (0.311 ± 0.150 N). MFRT_{SLOPE} was greater ($P = 0.036$) for YG than AG (YG = 0.013 ± 0.016 pps/%MVC/s, AG = 0.003 ± 0.010 pps/%MVC/s), however, MFRT_{INT} was not significantly different between groups ($P = 0.070$). MFRT_{SLOPE} was directly correlated with ΔTF_{NORM} ($P = 0.003$, $r = 0.529$) while MFRT_{INT} was inversely correlated to ΔTF_{NORM} ($P = 0.003$, $r = -0.523$). **CONCLUSIONS:** The slopes and y-intercepts of the MFR vs. Rec Thresh relationship were changing in a time dependent manner to a greater extent for YG than AG. The slopes became less negative and the y-intercepts were reduced over time suggesting an increase in firing rates of higher-threshold MUs in conjunction with a decrease in the firing rates of lower-threshold MUs. The ΔTF_{NORM} accounted for part of the variance in these recruitment-related differences in firing rate behavior at steady force.

3512 Board #4 June 3 9:00 AM - 11:00 AM
Simultaneous Measurement of Perfusive and Diffusive Oxygen Transport During Incremental Forearm Exercise
 Shane M. Hammer, Andrew M. Alexander, Kaylin D. Didier, Joshua R. Smith, Jacob T. Caldwell, Shelbi L. Sutterfield, Carl J. Ade, Thomas J. Barstow, FACSMM. *Kansas State University, Manhattan, KS.*
 (No relationships reported)

Muscle oxygen uptake (VO_2) is comprised of perfusive and diffusive oxygen transport. Few techniques demonstrate the ability to measure both components of VO_2 simultaneously within the same volume of tissue. It has previously been shown that quadriceps microvascular blood flow during cycling exercise establishes a plateau at approximately 60% peak work rate (WR_{peak}), while muscle deoxy-[Hb+Mb] and total-[Hb+Mb] have been shown to plateau at 80-90% WR_{peak} . **PURPOSE:** The purpose of this study was to simultaneously measure perfusive and diffusive oxygen transport in the same volume of tissue during incremental forearm exercise. We hypothesized that any plateau in muscle blood flow index (BFI) would occur at the same work rate as plateaus in deoxy-[Hb+Mb] and total-[Hb+Mb]. **METHODS:** 17 subjects (age: 22.6 ± 3.1) completed an incremental handgrip exercise test to task failure. Muscle oxygenation and BFI of the flexor digitorum superficialis were measured continuously using near-infrared and diffuse correlation spectroscopy (DCS), respectively. The incremental test consisted of 2 min of baseline followed by 3 min at 1W and then a 1W increase every 2 min until task failure. During the last 10s of each stage subjects stopped exercise to obtain motion artifact-free DCS measurements. Deoxy-[Hb+Mb] and total-[Hb+Mb] were averaged over the last 10s of exercise and BFI was averaged during the subsequent 10s of rest for each stage. **RESULTS:** Deoxy-[Hb+Mb] and total-[Hb+Mb] plateaued in nearly all subjects ($n=16$; $n=15$). There was no difference between deoxy-[Hb+Mb] and total-[Hb+Mb] in the work rate at which plateaus occurred (59.8 ± 21.4 and $67.9 \pm 15.8\%$ WR_{peak} , respectively). The plateaus in deoxy-[Hb+Mb] and total-[Hb+Mb] were significantly correlated ($r=0.70$, $p<0.01$). A plateau in BFI was observed in 7 subjects ($53.1 \pm 9.3\%$ WR_{peak}), which was significantly lower than the plateaus in total-[Hb+Mb] and deoxy-[Hb+Mb] (both $p<0.05$) but was significantly correlated with the plateau in deoxy-[Hb+Mb] ($r=0.78$, $p<0.05$). 3 subjects showed a break up in BFI near end exercise; the remaining responses were approximately linear. **CONCLUSIONS:** In contrast to our hypothesis, BFI did not consistently exhibit a plateau and, when present, it occurred sooner in the incremental protocol than did the plateaus in deoxy-[Hb+Mb] and total-[Hb+Mb].

3513 Board #5 June 3 9:00 AM - 11:00 AM
Evaluation Of ES-induced Fatigue In Relation To Muscle Size And Fiber Recruitment: A Pilot Study
 Maria Vromans, Pouran D. Faghri, FACSMM, Magdalena Wegrzyniak, Sarina Moghadam. *University of Connecticut, Storrs, CT.* (Sponsor: Pouran D. Faghri, FACSMM)
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Electrical stimulation (ES) has been used to strengthen muscles in athletic training and rehabilitation programs. ES is an effective stimulus to increase muscle force by evoking contraction via the application of electrical current. However, fast neuromuscular fatigue development limits its application in the clinical setting. The rapid fatigue onset has been attributed to differences in ES parameters and motor unit (MU) recruitment pattern compared to voluntary contractions. **PURPOSE:** To evaluate the ES intensity needed to generate predetermined force in two muscles of varying size and fiber type (proportion of type I and type II fibers) during isometric contractions, as well as to investigate the fatigue characteristics and time to fatigue under these conditions. **METHODS:** ES-induced fatigue was initiated in the small, type I abductor pollicis brevis (APB) and large, type II vastus lateralis (VL) muscles of three healthy individuals (mean age: 22.33 ± 2.36 years). ES was delivered at three frequencies (10, 30, 50Hz) in randomized order, with a duty cycle of 4s on/4s off, pulse duration of 300 μ s, and stimulation intensity level required to achieve an initial tetanic force equal to 25% of the pre-fatigue MVC. ΔMVC values, required intensity, and %drop in force during ES were compared between APB and VL. **RESULTS:** ΔMVC values were relatively low, though higher in the VL with no apparent association to frequency (VL mean ΔMVC : 10Hz = 16.8N; 35Hz = 28.3N; 50Hz = 6.0N, APB mean ΔMVC : 10Hz = -4.0N; 35Hz = 0.32N; 50Hz = 2.38N). ES at 10Hz requires a higher intensity to achieve 25%MVC force than at 35Hz or 50Hz for both the APB (mean intensity: 10Hz = 20.3mA; 35Hz = 17mA; 50Hz = 15.3mA) and VL (mean intensity: 10Hz = 54mA; 35Hz = 46.7mA; 50Hz = 46.7mA). The %drop in force was greatest at 50Hz (APB = 21% drop; VL = 18% drop), then 35Hz (APB = 17.5% drop; VL = 19.9% drop), then 10Hz (APB = 14.75% drop; VL = 16.35% drop) at the first quartile of time to fatigue, while the second quartile values were consistent among frequencies.

CONCLUSIONS: Fatigue is a major limiting factor for application of ES in sports injury and rehabilitation. Muscles with different fiber type composition respond differently to stimulation frequencies and fatigue development. These differences should be considered when developing treatment plans. Supported by NSF EFRI 1332329.

3514 Board #6 June 3 9:00 AM - 11:00 AM
High Threshold Motor Units Are Eventually Recruited During Low Force Efforts to Volitional Fatigue

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There is disagreement in the literature regarding the magnitude of relative loads necessary to optimize muscle hypertrophy. Most recommend loads of 60-80% of 1 RM, while others demonstrate similar increases with loads as low as 30% 1 RM, as long as volitional fatigue is reached.

PURPOSE: To use a deterministic model of individual motor unit and whole muscle fatigue to evaluate MU recruitment during low and high relative force efforts to volitional fatigue.

METHODS: Our deterministic model predicts the forces and force capacities of 120 motor units, and the whole muscle, for the full range of excitations. We estimated: relative force, excitation threshold, initial firing rate, maximum firing rate and excitation adaptation of each MU. During sustained, constant force contractions, we calculated the required excitation level to meet the force demand, and monitored the instantaneous levels of each variable listed above, to determine force and force capacity changes in each active MU and the whole muscle over 0.1 s intervals. The model provided very good estimates of endurance times for intensities ranging from 15% to 90% MVC, compared to published values.

RESULTS:

The model predicted endurance times of 509.0 s and 14.4 s at 20% and 80% MVC, respectively, at which time all MUs were recruited for both intensities. The 20% MVC condition resulted in larger relative decreases in strength (i.e. 'fatigue') for all 120 MUs. At the endurance time for the 20% condition, fatigue was 6.4%, 81.8%, 7.4% and 54.3% for the lowest MU (#1), middle MU (#60), and highest threshold MU (#120) and average MU, respectively. In contrast, at the endurance time for the 80% condition, fatigue was 0.2%, 2.3%, 3.8% and 4.3% for MUs 1, 60, and 120, and average MU, respectively. Excitation adaptations resulted in decreases in firing rates for all motor units, relative to initial maximum rested values.

CONCLUSION:

The 20% MVC endurance trials resulted in the eventual recruitment of all MUs and > 10-fold greater average fatigue for the MU population compared to the 80% MVC condition. Therefore, low intensity contractions, sustained to volitional fatigue, may provide more challenge to the motor unit population, and a more profound overall stimulus for muscle hypertrophy, compared to high intensity contractions.

3515 Board #7 June 3 9:00 AM - 11:00 AM
Muscle Specific Endurance of the Lower Back Erectors using Electrical Twitch Mechanography

Kevin K. McCully, FACSM¹, Caio Morales¹, Sahil V. Patel¹, Max Green², T. Bradley Willingham¹. ¹University of Georgia, Athens, GA. ²UGA-AU Medical Partnership, Athens, GA.
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Reported Relationships: K.K. McCully: Intellectual Property; Infared Rx, Inc. Consulting Fee; Novartis. Ownership Interest (Stocks, Bonds); Infared Rx, Inc. Employee of an ACCME Defined Commercial Interest; Infared Rx, Inc.

Lower back pain is a common symptom that may be associated with skeletal muscle dysfunction. **PURPOSE:** This study evaluated the endurance of the lower back muscles in healthy participants using accelerometer-based Mechanomyography (aMMG). **METHODS:** Surface electrodes and a tri-axial aMMG device were placed on the belly of the erector spinae muscles along the T11-L1 vertebrae. Current levels that evoked visible and tolerable twitch contractions were used. The muscles were stimulated for 3 minutes each at 2, 4, and 6 Hz. An endurance index (EI) was calculated as the maintenance of acceleration at the end of each stage of stimulation relative to the peak acceleration. Subjects (N=7) were tested on two separate days to assess reproducibility. Muscle oxygenation (HbO₂) was measured with near infrared spectroscopy (NIRS) during stimulation and during a maximal isometric back extension to induce complete ischemia for signal calibration (N=5). EI was measured in the wrist flexor and vastus lateralis muscles for comparison. **RESULTS:** EI for the erector spinae muscles were 70.3 + 13.4%, 32.6 + 8.4%, and 19.2 + 6.2 % for 2, 4, 6 Hz, respectively. The coefficients of variation were 9.8%, 13.9%, and 20.3% for 2, 4, 6 Hz, respectively. EI values for the erector spinae were significantly lower than EI values for the arm and the leg (all comparisons, p < 0.05). HbO₂ values for the

erector spinae were 86.4 + 10.9 % at rest, and 77.2 + 15.5%, 84.3 + 14.1%, and 84.1 + 18.9% for 2, 4, 6 Hz, respectively. **CONCLUSION:** EI is a reproducible method of assessing muscle endurance of the lower back erector muscles that is not related to low oxygen levels. The erector spinae muscles have lower muscle endurance relative to limb muscles. :

3516 Board #8 June 3 9:00 AM - 11:00 AM
Clinical Assessment Of Muscle Endurance

Thomas B. Willingham, Kevin McCully, FACSM. University of Georgia, Athens, GA. (Sponsor: Kevin McCully, FACSM)
 (No relationships reported)

Evaluation of muscle endurance is important for many clinical populations. **PURPOSE:** Evaluate the utility of a clinical assessment of muscle endurance that uses twitch electrical stimulation and accelerometer-based mechanomyography (aMMG). **METHODS:** Twenty healthy participants (9 males; 11 females) and three participants with multiple sclerosis (MS) were tested. Muscle twitch acceleration was measured using an accelerometer placed over the surface of the muscle. The relationship between acceleration and torque was measured during twitch stimulation of the vastus lateralis muscle. Muscle endurance of the forearm and gastrocnemius was measured during 9 minutes of twitch electrical stimulation, in three stages (3min/stage) of increasing frequency (2Hz, 4Hz, and 6Hz). Endurance Index (EI) was calculated as the percent of acceleration at the end of each stimulation stage relative to the peak acceleration. Oxygen saturation was measured using near-infrared spectroscopy. **RESULTS:** Acceleration correlated with torque during twitch electrical stimulation of the vastus lateralis (mean R²= 0.96±0.04; p<0.05). Measures of EI reproducibility were CV= 2.49±3.67% for the 2Hz stage, CV= 7.36±8.11% for the 4Hz stage, and CV= 4.30±3.09% for the 6Hz stage. EI was significantly higher in the gastrocnemius at the 4Hz (EI =96.1±2.9%) and 6Hz (EI =95.5±2.03%) stages compared to the forearm (4Hz: EI =87.1±9.3%; 6Hz: EI =68.3±17.6%) in healthy controls (p<0.01). Muscle oxygen saturation was not reduced during stimulation of the forearm (72.6±9.8% at 2Hz, 73.2±11.6% at 4Hz, and 71.0±12.5% at 6Hz) compared to baseline (74.3±15.1%; p>0.1). Participants with MS had significantly lower gastrocnemius muscle endurance at the 2Hz (EI =83.6±10.2%), 4Hz (EI =57.2±5.1%), and 6Hz (EI =20.6±8.7%) stages compared to healthy controls (p<0.01). **CONCLUSION:** Muscle endurance as measured by twitch electrical stimulation and aMMG has the potential to evaluate endurance in various muscles and clinical populations.

G-17 Thematic Poster - Vascular Function

Saturday, June 3, 2017, 9:00 AM - 11:00 AM
 Room: 404

3517 Chair: Bryan Taylor. University of Leeds, Leeds, United Kingdom.

(No relationships reported)

3518 Board #1 June 3 9:00 AM - 11:00 AM
Peripheral Vascular Pulsatility in Heart Failure Patients with Continuous Flow Centrifuge and Axial Left Ventricular Assist Devices: The Effect of Pump Speed.

Jay R. Hydren, Andrew C. Kithas, Soung Hun Park, Omar Wever-Pinzon, Craig H. Selzman, William H. Perry, Camila A.S. Vargas, Stavros G. Drakos, Russell S. Richardson. University of Utah, Salt Lake City, UT.

(No relationships reported)

Current continuous flow left ventricular assist devices (LVAD) decrease peripheral vascular pulsatility, which may contribute to side effects such as bleeding, thrombotic events and orthostatic intolerance. **PURPOSE:** To investigate the impact of manipulating LVAD pump speed, documented as revolutions per minute (RPM), on peripheral (brachial artery) pulsatility index (PI) in 20 heart failure patients implanted with a HeartWare (HVAD, n = 10) or HeartMateII (HMII, n = 10) LVAD. **METHODS:** Doppler ultrasound blood velocity in the brachial artery was recorded at baseline and 3 minutes after altering RPM, at three different RPM settings above and below baseline (60 RPM increments for HVAD and 200 for HMII). Brachial PI was calculated for each cardiac cycle by dividing the difference between minimum and maximum blood velocity by the time averaged mean blood velocity. LVAD device pulsatility indices that are used clinically were also recorded: maximal blood velocity (V_{max}) and minimum blood velocity (V_{min}) (HVAD) and HMII PI (HMII). Relationships were evaluated using multilevel linear modeling with random intercepts and data are reported as mean±SE. **RESULTS:** Baseline RPMs were 2509±44 (HVAD) and 9220±75 (HMII). Brachial PI changed significantly across the range of LVAD RPM speeds tested (HVAD: 360; HMII: 1200), from 2.3±0.6 to 4.1±0.9 with the HVAD and from 1.8±0.6 to 3.6±1.0 with the HMII, with no differences in brachial PI between

device across relative pump speed stages. Specifically, a 180 RPM decrease of the HVAD resulted in a 0.9 ± 0.1 (37±4%) increase in brachial PI and a 600 RPM decrease in the HMII resulted in a 0.8 ± 0.1 (38±3%) increase. These reductions in pump speed resulted in an ~20.0% fall in LVAD power consumption and a reduction in device reported blood flow of ~9%. Brachial PI correlated with HVAD_{HW}V_{max} and HVAD_{HW}V_{min} ($r = 0.45$ and $r = -0.31$, respectively), and HMII device_{HMI}PI ($r = 0.73$), suggesting device derived indices of PI provide a fair to good linear prediction of peripheral vascular pulsatility. **CONCLUSION:** Reducing HVAD or HMII LVAD pump speed within a clinically acceptable outpatient range yields a measurable and potentially clinically and physiologically meaningful change in peripheral vascular pulsatility, accompanied by substantial power savings.

3519 Board #2 June 3 9:00 AM - 11:00 AM
Postural Induced Changes in Plasma Volume Inversely Influences Plasma Nitrite Concentration in Humans

Luke Liddle¹, Chris Monaghan¹, Luke C. McIlvenna², Mia C. Burleigh¹, David J. Muggerridge³, Chris Easton¹. ¹University of the West of Scotland, Hamilton, United Kingdom. ²Victoria University, Melbourne, Australia. ³University of Strathclyde, Glasgow, United Kingdom. (Sponsor: Professor Yannis Pitsiladis, FACSM)
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(No relationships reported)

Moving from a supine to a standing position typically reduces plasma volume (PV) and while this increases the concentration of some molecules in the blood, the effect on plasma nitrate [NO₃⁻] and nitrite [NO₂⁻] has not been reported. **PURPOSE:** To determine the change (Δ) in PV, [NO₃⁻] and [NO₂⁻] while lying supine, sitting, standing, and following short-duration exercise. **METHODS:** Fourteen participants (9 male, age 27 ± 4 yr, body mass 71 ± 11 kg) completed two trials. The first was conducted with no dietary intervention (control; CON) and the second was preceded by ingestion of 3 x 70 ml of NO₃⁻-rich beetroot juice the day before and 2 x 70 ml two hours before the trial (BR; total of ~31 mmol NO₃⁻). Both trials comprised 30 min lying supine followed by 2 min of standing, 2 min of sitting, and then 5 min of cycling at 60% of the age-predicted maximal heart rate. Repeated blood samples were collected to allow measurements of haemoglobin and haematocrit in whole blood and plasma [NO₃⁻] and [NO₂⁻] by chemiluminescence. The Δ PV was calculated using the Dill and Costill formula. **RESULTS:** Following the supine phase, PV increased from baseline in both trials (CON $\Delta 12.6 \pm 10.3$ %; BR $\Delta 12.5 \pm 7$ %, both $P < 0.01$) and then decreased upon standing (CON $\Delta -5.2 \pm 3.8$ %, $P < 0.01$; BR $\Delta -4.0 \pm 3.5$ %, $P = 0.02$), sitting (CON $\Delta -10.1 \pm 3.7$ %; BR $\Delta -6.4 \pm 3.6$ %, both $P < 0.001$) and following exercise (CON $\Delta -18.1 \pm 5$ %; BR $\Delta -15.5 \pm 3.4$ %, both $P < 0.001$). Plasma [NO₃⁻] levels at baseline were 120 ± 49 nM and 357 ± 129 nM in CON and BR, respectively. Plasma [NO₃⁻] decreased from baseline after lying supine in both trials (CON 77 ± 30 nM; BR 231 ± 92 nM, both $P < 0.05$) before increasing during standing (CON 109 ± 42 nM; BR 297 ± 105 nM, both $P < 0.001$) and sitting (CON 131 ± 43 nM; BR 385 ± 125 nM, both $P < 0.002$). Plasma [NO₂⁻] remained elevated following exercise in the CON trial (125 ± 61 nM, $P < 0.05$) but was not different to the 30 min supine value in the BR trial. There were no statistical differences in [NO₃⁻] between measurement points in either condition (all $P > 0.05$). **CONCLUSIONS:** Plasma [NO₃⁻] changes in the opposite direction to PV during changes in posture, both in the presence and absence of prior dietary NO₃⁻ supplementation. Given that [NO₂⁻] offers the best approximation of nitric oxide bioavailability, researchers must be cognisant of these outcomes when designing and interpreting dietary NO₃⁻ research.

3520 Board #3 June 3 9:00 AM - 11:00 AM
Effects of Prior Aerobic Exercise on Flow Mediated Dilation Responses to Prolonged Sitting in Healthy Men

Robert M. Duguid, Craig W. Berry, Kevin D. Ballard. *Miami University, Oxford, OH.* (Sponsor: Helaine Alessio, FACSM)
Email: duguidrm@miamioh.edu
(No relationships reported)

Prolonged sitting is common in modern society and has recently been shown to impair vascular endothelial function (VEF) in healthy men. Conversely, a single bout of aerobic exercise improves VEF. **PURPOSE:** The objective of this study was to examine the acute effects of a single bout of aerobic exercise on VEF responses to prolonged sitting. **METHODS:** Eleven healthy men [21.2 ± 0.6 yr; BMI = 24.7 ± 1.0 kg/m²; maximal oxygen consumption (VO₂max) = 49.9 ± 5.1 ml/kg/min (mean \pm SE)] participated in two randomized 3 hours sitting trials preceded by a single bout of continuous treadmill exercise (45 min at 65% VO₂max) (EX) or 45 min of quiet rest (REST). Exercise intensity was confirmed via open-circuit spirometry during the first 15 min of exercise. Superficial femoral artery flow-mediated dilation (FMD) was measured by high-resolution ultrasonography after an overnight fast (Pre), 1 h following EX (or REST) (Post), and at 1 hour intervals during a 3 hour prolonged sitting challenge. Participants were monitored by study personnel to ensure minimal

lower extremity movement during the sitting challenge. Two-way repeated-measures ANOVA and Bonferroni post-hoc tests were used to evaluate differences within and between groups. **RESULTS:** Participants completed the 45 min of treadmill exercise at 65.6 ± 1.2 % VO₂max (range = 60.9-72.6%). Resting femoral artery diameter and FMD responses (2.7 ± 0.6 % and 2.6 ± 0.5 % for EX and REST, respectively) did not differ between trials at Pre. No time or trial effects were detected for resting arterial diameter ($P \geq 0.28$). Compared with Pre, participants' FMD responses decreased at 1, 2, and 3 hours of prolonged sitting ($P < 0.05$) when preceded by REST, whereas FMD responses were unaffected when prolonged sitting was preceded by EX ($P \geq 0.33$). In the REST trial, resting shear rate decreased at 3 hours ($P < 0.05$) relative to Pre. Resting shear rate was unaffected in the EX trial ($P \geq 0.09$). **CONCLUSION:** These preliminary findings suggest that a single bout of aerobic exercise prevents the decline in FMD induced by 3 hours of prolonged sitting in healthy men. Future studies should examine differences due to sex, age, disease status, and exercise modality on VEF responses to prolonged sitting.

Supported by College of Education, Health, and Society Seed Grant.

3521 Board #4 June 3 9:00 AM - 11:00 AM
Comparison Of Blood Flow Characteristics Before, During, And After High-intensity Interval And Moderate-intensity Continuous Exercise

Brett B. Baughman, Stephanie D. Gagnon, Janie C. Unkefer, Kaiti A. Freeberg, Patricia Benedict, Brandon J. Sawyer. *Point Loma Nazarene University, San Diego, CA.* (Sponsor: Glenn A. Gaesser, FACSM)
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(No relationships reported)

PURPOSE: A comparison of blood flow characteristics in the brachial artery during high-intensity interval exercise (HIIE) and moderate-intensity continuous exercise (MOD) has not been conducted. Also, the acute effects of these exercise protocols on measures of vascular reactivity are not fully understood. **METHODS:** Sixteen healthy males (Age: 23 ± 3 years, BMI: 25.5 ± 3.0) completed HIIE (10, 1 min intervals at 90-95% of HR_{max} with 1 min of recovery between) and MOD (30 min at 70% of HR_{max}) on a cycle ergometer. Brachial artery diameter and blood flow measurements were made before, during and after exercise via high-resolution ultrasound. **RESULTS:** During exercise there were no differences in artery diameter but antegrade velocity (HIIE: 17.96 ± 6.14 cm/sec, MOD: 21.73 ± 8.11 cm/sec, $P = 0.02$) and antegrade shear rate (HIIE: 170.83 ± 55.51 sec⁻¹, MOD: 203.50 ± 76.09 sec⁻¹, $P = 0.04$) were higher during MOD compared to HIIE. Retrograde velocity (HIIE: -7.67 ± 2.79 cm/sec, MOD: -5.50 ± 2.04 cm/sec, $P < 0.01$) and retrograde shear rate (HIIE: -73.82 ± 28.37 sec⁻¹, MOD: -51.48 ± 19.77 sec⁻¹, $P < 0.01$) were of greater magnitude during HIIE compared to MOD. Baseline artery diameter decreased after HIIE ($P = 0.04$), but not after MOD ($P = 0.19$). Peak diameter after occlusion decreased with MOD ($P = 0.04$), but not with HIIE ($P = 0.80$). Minimum diameter during cuff occlusion decreased after HIIE ($P = 0.02$) and marginally decreased after MOD (Pre: $P = 0.06$). No acute changes were seen with flow-mediated dilation (FMD) or low-flow mediated constriction (L-FMC) within either group. The composite end-point of vascular reactivity (COM) increased after HIIE (Pre: 5.64 ± 3.21 , Post: 8.57 ± 3.16 %, $P < 0.01$) but not MOD ($P = 0.56$). Exercise x time interactions were observed for COM ($P = 0.02$), peak diameter ($P = 0.05$), and a trend for FMD (HIIE-Pre: 5.44 ± 4.11 , Post: 7.58 ± 5.99 % vs. MOD-Pre: 6.3 ± 2.89 , Post: 4.2 ± 5.75 %, $P = 0.09$). **CONCLUSION:** We observed more positive shear stress during MOD and more negative during HIIE. These differences in exercise shear stress during exercise may result in more vascular reactivity after HIIE compared to MOD as well as potentially explain differences observed in the chronic adaptations to these distinct exercise protocols.

3522 Board #5 June 3 9:00 AM - 11:00 AM
Eccentric Exercise And Microvascular Function: Protective Role Of Dietary Nitrate And Antioxidants?

Ryan G. Larsen¹, Jens M. Thomsen¹, Rogerio P. Hirata¹, Jens B. Frøkjær², Thomas Graven-Nielsen¹. ¹Aalborg University, Aalborg, Denmark. ²Aalborg University Hospital, Aalborg, Denmark.
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(No relationships reported)

Exercise involving eccentric contractions results in reduced muscle function. Blood oxygen level dependent (BOLD) MR imaging has demonstrated slowed microvascular reactivity in eccentrically exercised tibialis anterior (TA) muscle. While the mechanism is unclear, exercise-induced inflammation and oxidative stress may reduce nitric oxide (NO) bioavailability, and consequently slow microvascular reactivity. **PURPOSE:** To test the hypotheses that ingestion of dietary nitrate or antioxidants preserve microvascular reactivity following eccentric exercise. **METHODS:** Thirty young men and women were randomized into three groups, who ingested a single dose of: i) beetroot juice (BR, 8.4mmol NO₃⁻), ii) antioxidants (AO, Vitamin C and E, alpha-lipoic acid), or iii) placebo (PLA, fruit juice) at 46 hours after an exercise protocol. The

protocol consisted of eccentric contractions of the TA in one leg, while the contralateral leg served as control. At baseline, and 48h after eccentric exercise, participants were positioned in a 3T magnet, and BOLD images were acquired bilaterally in TA muscle during i) brief maximal contractions (MVC), and ii) cuff occlusion (5 min, 260mmHg) to monitor the hyperemic responses. The time-to-peak (TTP, s) of the hyperemic response was used as an index of microvascular reactivity. Data were analyzed using mixed model, three-way (Leg, Group, Session (0h, 48h)) repeated measures ANOVA. **RESULTS:** The ANOVA revealed leg-by-session interactions for TTP following brief MVCs and cuff occlusion ($P < 0.001$), with no main or interaction effects of group. Specifically, 48h after eccentric exercise, TTP (MVC) was prolonged in all groups compared with baseline (BR: 8.6 ± 1.0 vs. 10.9 ± 1.0 s; AO: 8.4 ± 0.4 vs. 10.1 ± 0.4 s, PLA: 9.0 ± 0.9 vs. 11.0 ± 0.8 s), with no changes in control leg. Similarly, 48h after eccentric exercise, TTP (cuff) was prolonged in all groups compared with baseline (BR: 45.5 ± 4.7 vs. 68.6 ± 7.7 s; AO: 36.8 ± 5.7 vs. 54.5 ± 8.5 s, PLA: 42.1 ± 6.4 vs. 68.1 ± 7.1 s), with no changes in control leg. **CONCLUSION:** Ingestion of BR and AO do not preserve microvascular reactivity after eccentric exercise, indicating that elevated oxidative stress and lower NO bioavailability do not contribute to altered microvascular function after eccentric exercise. Supported by Danish Ministry of Culture grant.

3523 Board #6 June 3 9:00 AM - 11:00 AM
Endothelium-Dependent Vasodilation following Bikram Yoga Practiced in Hot and Thermoneutral Conditions
 Stacy D. Hunter, Jitanan Laosiripisan, Ahmed Elmenshawy, Hirofumi Tanaka, FACSM. *University of Texas at Austin, Austin, TX.* (Sponsor: Hirofumi Tanaka, FACSM)
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 (No relationships reported)

Bikram (hot) yoga is a style of hatha yoga practiced at 40.5°C with 40-60% relative humidity. We have previously documented improvements in endothelium-dependent vasodilation with a Bikram yoga intervention in middle-aged adults. Presently, it is not known whether the effect of hot yoga on endothelial function might be attributed to the yoga postures or the heated environment. **PURPOSE:** The purpose of this investigation was to determine the effects of Bikram yoga performed in standard heated conditions and in a thermoneutral environment on endothelium-dependent vasodilation. **METHODS:** Fifty-two sedentary but apparently healthy adults aged 40-60 years were randomly assigned to one of three groups: Bikram yoga practiced at 40.5°C ($n=19$); Bikram yoga practiced at 23°C ($n=15$); or sedentary time-control ($n=19$). The 12-week yoga intervention consisted of 3 weekly 90-minute Bikram yoga classes. The time control group was instructed to maintain current lifestyle patterns for the study duration. Body composition was determined via dual energy x-ray absorptiometry (DXA). Endothelium-dependent vasodilation was measured noninvasively using brachial artery flow-mediated dilation (FMD) after 5 minutes of blood flow occlusion. **RESULTS:** Age, anthropometric variables, lipid, glucose, and triglyceride concentrations and brachial artery FMD were not different among the three groups at baseline. Body fat percentage declined ($p < 0.01$) and LDL-cholesterol concentration tended to decline ($p = 0.09$) only in the hot (40.5°C) yoga group. Brachial artery FMD increased ($P < 0.05$) in both yoga groups. There were no significant changes in any outcome variables in the time control group. **CONCLUSIONS:** Bikram yoga practiced at hot/humid and thermoneutral conditions produced similar improvements in endothelium-dependent vasodilation in healthy, middle-aged adults. However, the addition of the heat/humidity led to further improvements in body composition. This study was funded by Pure Action, Inc. Austin, TX, USA

3524 Board #7 June 3 9:00 AM - 11:00 AM
Greater Aortic Hemodynamic Responses to Muscle Metaboreflex Activation in Older Adults with Prediabetes than Diabetes
 Arturo Figueroa, FACSM, Salvador J. Jaime, Stacey Alvarez-Alvarado, Sarah A. Johnson, Neda S. Akhavan, Negin Navaei, Shirin Pourafshar, Bahram H. Arjmandi. *Florida State University, Tallahassee, FL.*
 (No relationships reported)

PURPOSE: Wave reflection measures (augmentation pressure [AP] and index [AIx]) are similarly increased in adults with type 2 diabetes (T2D) and prediabetes (PRET2D) suggesting high cardiovascular risk. An exaggerated blood pressure (BP) response to muscle metaboreflex activation induced via post-exercise muscle ischemia (PEMI) following isometric handgrip exercise has been reported in patients with T2D. The purpose of this study was to examine the wave reflection responses to PEMI in adults with PRET2D and T2D.

METHODS: Aortic hemodynamics were obtained using pulse wave analysis at rest and during PEMI following isometric handgrip at 30% of maximal voluntary contraction in adults (age, 59.7 ± 6.3 y) with PRET2D ($n=12$) and T2D ($n=12$). **RESULTS:** Vascular parameters were similar at rest. Aortic systolic BP (PRET2D $\Delta 42 \pm 13$ mmHg vs. T2D $\Delta 31 \pm 10$ mmHg, $P < 0.001$ for both), pulse pressure (PRET2D

$\Delta 22 \pm 9$ mmHg vs. T2D $\Delta 13 \pm 10$ mmHg, $P < 0.001$ and $P < 0.01$, respectively) and AP (PRET2D $\Delta 13 \pm 5$ mmHg vs. T2D $\Delta 9 \pm 5$ mmHg, $P < 0.001$ for both) responses to PEMI were greater ($P < 0.05$) in PRET2D compared with T2D patients. The aortic diastolic BP, AIx, AIx adjusted at 75 bpm, and time to reflection responses to PEMI were similar in PRET2D and T2D.

CONCLUSIONS: Our findings show that aortic hemodynamic responses to exercise-related metabolites are exaggerated in PRET2D. These findings suggest that an increased left ventricular afterload during muscle metaboreflex activation may contribute to augment cardiovascular risk in adults with PRET2D.

G-18 Clinical Case Slide - Cervical Spine

Saturday, June 3, 2017, 9:00 AM - 10:40 AM
 Room: 406

3525 **Chair:** Joseph Ihm, FACSM. *Rehabilitation Institute of Chicago, Chicago, IL.*
 (No relationships reported)

3526 **Discussant:** Scott Laker. *University of Colorado, Denver, CO.*
 (No relationships reported)

3527 **Discussant:** Matthew Sedgley. *MedStar Ortho and Sports Medicine, Ellicott City, MD.*
 (No relationships reported)

3528 June 3 9:00 AM - 9:20 AM
Reoccurring Neck Injury in a College Football Player
 Brian Toedebusch, Brian Davis, FACSM. *University of California - Davis, Sacramento, CA.*
 (No relationships reported)

HISTORY: A 20-year-old male community college football defensive end developed left shoulder paresthesia during a game. He was tackling an opponent and his head was forced into a left lateral rotation. After this, he developed immediate paresthesia in the left upper trapezius and upper deltoid. He was evaluated on the side line by medical staff and removed from the remainder of game. Symptoms resolved within the next two days, and he returned to competition. Two weeks later, he again had his head forced into a left lateral rotation during a tackle. Paresthesia immediately returned in the left upper trapezius and upper deltoid. However, this time pain was increased and had onset of a burning sensation. After sideline evaluation, he was removed from competition. Following the game, he continued to have severe burning pain. He was sent to a local emergency department and ultimately released home. Paresthesia resolved over the next five days, but he was not cleared to return to competition.

PHYSICAL EXAMINATION: There was no deformity to the neck or upper extremity. No cervical or left shoulder tenderness to palpation. His range of motion in the left glenohumeral joint was full. Strength was full throughout the entire left upper extremity. Sensation to light touch was diminished in the left upper trapezius and upper deltoid, but normal throughout the remainder of the upper extremity. Deep tendon reflexes were 2+ in bilateral biceps, brachioradialis, and triceps. Spurling's test was positive on the left.

DIFFERENTIAL DIAGNOSIS: 1. Upper trunk brachial plexopathy 2. Cervical radiculopathy 3. Cervical stenosis **TEST AND RESULTS:** 1. Cervical spine anterior-posterior, lateral and flexion-extension radiographs: No fracture or destructive change, disc spaces preserved, no pathologic movement 2. Cervical Magnetic Resonance Imaging: Left paramedian/foraminal disc protrusion at C3-4 resulting in moderate left foraminal stenosis and displacement of left C4 nerve root. No spinal canal stenosis or ligamentous injury. **FINAL WORKING DIAGNOSIS:** Left C4 radiculopathy **TREATMENT AND OUTCOMES:** 1. Orthopaedic spine referral determined to treat with non-operative management 2. Physical therapy for cervical strengthening, flexibility, and traction 3. Currently being withheld from competition with undetermined return to play date

3529 June 3 9:20 AM - 9:40 AM
Differential Diagnosis of Quadriplegia in an Otherwise Healthy Adult Male by a Physical Therapist
 Megan Krueger, Eric Reyes. *Harris Health System, Houston, TX.*
 Email: megan.krueger@harrishealth.org
 (No relationships reported)

HISTORY: A 52-year-old male was referred to Physical Therapy (PT) by his primary care physician for progressive quadriplegia related to suspected peripheral neuropathy (PN). The patient was healthy and active until two years prior when

he began experiencing weakness and paresthesias in both hands. This progressed to his right lower extremity, then all four extremities, and by the time of the PT evaluation, the patient was no longer able to stand. He also endorsed several episodes of bladder incontinence, constipation, and painful muscle spasms. He was scheduled for imaging of the spine and a follow-up with his physician in two months. Review of the medical record revealed that the patient was evaluated by a physical therapist nine months prior. His presentation then was consistent with the working diagnosis of PN. However, a sinister diagnosis was suspected due to the involvement of all four extremities without risk factors for polyneuropathy. At that time, no further steps were taken as the patient did not follow up in clinic.

PHYSICAL EXAMINATION: The patient presented in a wheelchair, though was unable to propel or stand without assistance due to significantly worsening weakness. Neurologic exam revealed several upper motor neuron signs including hypertonicity and hyperreflexia. This presentation was no longer consistent with the working diagnosis of PN (see table).

Cognition	Normal
Cranial Nerves	Normal
Motor	Positive for proximal quadriparesis*
Sensation	Positive for impaired arms/legs/saddle distribution
Tone	Positive for hypertonicity and muscle spasms*
Reflexes	Positive for hyperreflexia and clonus*
Gait & Balance	Unable to stand/ambulate*
Coordination	Normal
* denotes red flag	

DIFFERENTIAL DIAGNOSIS:

1. Cervical spine stenosis with myelopathy
2. Space occupying lesion in cervical region
3. Progressive motor neuron disease

TESTS AND RESULTS:

Cervical/Thoracic spine MRI: 12.4 cm intradural intramedullary mass from C5 to T5, likely related to multiple tumoral cystic areas, with syrinx from T3 to T4

FINAL DIAGNOSIS:

Intradural intramedullary ependymoma extending from C5 to T5 with associated syrinx

TREATMENT AND OUTCOMES: Based on the examination and presence of multiple red flags, the physical therapist referred the patient to the Emergency Department for further evaluation.

3531 June 3 9:40 AM - 10:00 AM

17 yo Football Player with Central Cord Syndrome after Negative Initial Neck Exam

Hersch Bhatia¹, Teri McCambridge². ¹University of Maryland, Baltimore, MD. ²Towson Sports Medicine, Baltimore, MD.
(No relationships reported)

HISTORY: A 17 year old HS football receiver was injured when he sustained a hit from the opposing safety. Reported mechanism by opposing player was shoulder to head impact. He fell to the ground in the prone position. He was immediately evaluated on the field by the nearby opposing athletic trainers. He had no LOC, no neck pain on the field, and he denied tenderness to palpation. He complained of having the wind knocked out of him. He reported that he got hit in the back of the leg and it felt odd. He had an ACL brace on his right knee. Care was transitioned to his team athletic trainers. He was turned supine and his helmet was removed. Afterwards, his right arm was noted to be in an awkward position. He could not move his arms or his legs. He had good sensation but had tingling in his upper and lower extremities. He had no prior history of weakness, neck pain, or concussion. His neck was immobilized. He regained motion in the upper extremity, but continued to demonstrate weakness in grip strength. He could not move his lower extremity. On EMS arrival he was spine boarded, and then taken to the ED for further management. **PHYSICAL EXAMINATION:** He was AO x 3. He had no tenderness over the cervical spinous processes and paraspinal muscles. He had normal sensation of his bilateral extremities. After being turned supine and having his helmet removed, he developed weakness of his upper and lower extremities, but no sensory deficit. Respiratory and Cardiovascular exams were normal. **DIFFERENTIAL DIAGNOSIS:**

1. Central Cord Syndrome
 2. Anterior Cord Syndrome
 3. Posterior Cord Syndrome
 4. Brown-Sequard Syndrome
 5. Concussion
 6. Intracranial Hemorrhage
 7. Acute disk herniation
 8. Epidural Hematoma
 9. Syringomyelia
- TEST AND RESULTS:** CT Head, XR C, T, L spine: No fracture or bleed MR C-spine: Congenital stenosis of the spinal canal, with endplate osteophytes/protrusions moderately narrowing the spinal canal to 8 mm at C3-4, with expansile T2 signal suggestive of edema within the cervical spinal cord at C3-4 levels. **FINAL/WORKING DIAGNOSIS:** Traumatic Cervical Myelopathy superimposed on Congenital Stenosis of Spinal Canal **TREATMENT AND OUTCOMES:** 1. Immobilization with Miami J Collar 2. Admitted to the hospital for observation. 3. Sensory and strength deficits improved during stay. 4. Transferred to an intensive inpatient activity based rehabilitation facility.

3532 June 3 10:00 AM - 10:20 AM

Neck Injury

Özlem G. Ülger¹, Aynur Demirel¹, Mehmet Yorubulut². ¹Hacettepe University, Ankara, Turkey. ²Acibadem Hospital, Ankara, Turkey.
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(No relationships reported)

HISTORY: A 34-year-old woman has severe neck and radiating pain to left arm applied to our clinic. Two years ago she had strain and she used myorelaxative drugs and felt better. When she performing heavy weights in bench press position at the gym, she felt pain suddenly both neck and left arm.

PHYSICAL EXAMINATION: Paravertebral and shoulder muscle spasm were palpated. Cervical compression and distraction tests were positive. Vertebral artery test, Adson and Roos test were negative. There was no limitation in range of motion. There was strength (20%) and sensorial deficit (hypoesthesia in C3-C4-C5 dermatomes).

DIFFERENTIAL DIAGNOSIS

- Cervical disc herniation
- Peripheral nerve entrapment

TEST AND RESULTS

Cervical Joint T1 and T2 MRI:

- Left posterolateral foraminal extrude herniation (C5-C6 level, herniation volume decreased from 4.5 mm to 3 mm, intervertebral disc height increased from 3.6 mm to 3.9 mm. Regression was seen in this level)
- Right posterolateral protrusion (C4-C5 level, there was no change in herniation thickness and disc height)

FINAL/WORKING DIAGNOSIS:

Cervical disc herniation

TREATMENT AND OUTCOMES

- 15 sessions of Physiotherapy programme which included Non-invasive Spinal Decompression, manual therapy applied.
- Physiotherapist guided spinal stabilization exercise applied (4 months follow-up)
- After therapy strength and sensorial problems resolved.

3533 June 3 10:20 AM - 10:40 AM

Sternoclavicular Injury - Rugby Union (15-players-a-side)

Victor Lopez Jr¹, Richard Ma², Douglas E. James³, Michael S. Wilinski⁴, Answorth A. Allen⁵. ¹Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY. ²Missouri Orthopaedic Institute & Thompson Laboratory for Regenerative Orthopaedics, Columbia, MO. ³State University of New York Medical Center (Downstate), Brooklyn, NY. ⁴Lake Erie College of Osteopathic Medicine, Bradenton, FL. ⁵Hospital for Special Surgery, New York, NY. (Sponsor: Robert C. Cantu, FACSM)
Email: drvictorlopezjr@gmail.com
(No relationships reported)

HISTORY: A 19-year-old men's college Rugby-15s winger collapsed during match play. The player had no impact with another player, dizziness and no loss of consciousness. A medical history revealed the player had sustained a right clavicular injury in a previous match 25 days prior to this incident. Where he complained of right shoulder pain, after impacting the ground with a multi-player tackle. The player had presented to an Urgent Care facility after that injury and provisionally diagnosed with shoulder sprain -vs- pectoralis strain, placed in arm-sling and sent home on oral analgesics. Right shoulder radiographs at Urgent Care visit were read as normal. **PHYSICAL EXAM:** Exam in ED revealed slurred speech, and complaints of localized pain and tenderness on right medial clavicle. Right sternoclavicular joint pain on palpation. Limited upper extremity range of motion secondary to pain, no facial droop, decreased left sided upper and lower extremity sensation, reflexes and strength. Symmetrical radial pulses with brisk capillary refills. **DIFFERENTIAL DIAGNOSIS** 1. Cervical Neck Injury 2. Stroke 3. Fracture Clavicle 4. Rib Fracture 5. Scapular Fracture 6. Sternal Fracture **TEST AND RESULTS:** Chest anterior-posterior radiographs: -abnormal right SCJ MRI Brain no contrast: -Large area/acute infarction. Mass effect of right lateral ventricle. No hydrocephalus. Midline shift 1-2mm. CT brain no contrast: -Right MCA infarction with right frontal/parietal lobes, insular cortex, thalamus, caudate nucleus, external/external capsule, and lentiform nucleus. -Mass-effect on the right lateral and third ventricles. Increased midline shift 8mm. No hydrocephalus. Carotid Duplex: -Arteries bilaterally, normal velocities/waveforms. CT chest: -Right clavicular head dislocated posterior to the sternum, in the superior mediastinum. Subperiosteal hematoma around proximal right clavicle. **FINAL/WORKING DIAGNOSIS:** Missed posterior sternoclavicular joint dislocation with brachiocephalic artery compromise leading to hemiparesis **TREATMENT AND OUTCOMES:** 1. Surgical Emergency. Often missed on radiograph. 2. Open repair of

brachiocephalic artery, right clavicular reduction/SCJ capsulorrhaphy with hamstring tendon allograft. 3. Patient recovered with left sided hemiparesis. No return to sport. Sponsor: NOCSAE.org

G-19 Clinical Case Slide - Medical Issues II

Saturday, June 3, 2017, 9:00 AM - 10:40 AM
Room: 402

3534 **Chair:** Holly J. Benjamin, FACSM. *University of Chicago, Chicago, IL.*
(No relationships reported)

3535 **Discussant:** Sourav Poddar. *University of Colorado Health Sciences Center, Denver, CO.*
(No relationships reported)

3536 **Discussant:** Natalie Voskanian. *UCSD Sports Medicine, San Diego, CA.*
(No relationships reported)

3537 June 3 9:00 AM - 9:20 AM
Primary Amenorrhea and High Triad Risk: The Reluctant Runner

Andrea Kussman, Aurelia Nattiv, FACSM. *University of California Los Angeles, Santa Monica, CA.* (Sponsor: Aurelia Nattiv, FACSM)
Email: akussman@mednet.ucla.edu
(No relationships reported)

History:

A 19 year-old collegiate runner presented to her pre-participation exam with primary amenorrhea and a high female athlete triad risk score placing her in the "no clearance" range for participation. She denied intentionally restricting her caloric intake, purging behaviors, or psychiatric disorders.

Physical Exam:

BMI 17.4. Blood pressure 100/60. Heart rate 56. No acne, hirsutism, or oral lesions. Lanugo present. Minimal secondary sexual development.

Differential Diagnosis:

Hypothalamic hypoestrogenic primary amenorrhea

Physiologic delay of puberty

Gonadal dysgenesis

Androgen insensitivity syndrome

Mullerian agenesis

PCOS

Isolated GnRH deficiency

Results:

-Total T3 61*

-Free T4 6.0

-LH 0.9*

-FSH 4.0*

-Estradiol <12*

-DHEA 1830

-TSH 0.57

-CMP normal

-Vitamin D 42

-Total testosterone 12

-Urine pregnancy test negative

DXA Z scores: total body 0.7, total hip 0.3, femoral 0.8, spine 0.3

*indicates abnormal

Final working diagnosis:

Female athlete triad with primary amenorrhea due to hypothalamic hypoestrogenism.

Treatment and Outcomes:

The athlete was provisionally cleared. Although very reluctant, with the support of her coach, she signed a contract which required her to meet at regular intervals with the team dietitian, physician, and psychologist, and included weekly weigh-ins. Goal and minimum weights were established, with lower weekly mileage permitted at lower body weight. She established care with a psychologist but did not engage during sessions and discontinued. Labs from the spring: estradiol <12, FSH 3.8, LH 0.9, BUN 23, AST 49, low T3, and normal prolactin, TSH, T4, and 17-alpha-OH progesterone. Transdermal hormonal treatment was considered to maintain BMD, but the patient refused. She sustained bilateral tibial stress reactions in May, 2016. She blamed her stress reactions on the weight that she had been required to gain.

Upon return in the fall, the triad risk score remained high with a further decline of BMI to 17.2, and still no menarche. The athlete was placed back on contract. She remains

resistant to meeting with the psychologist, but continues to see the dietitian and team physician. She narrowly cleared her minimum weight requirement (restricting her training to 30mi/week). Free T3 was 53.6 and total T3 was 59 suggesting ongoing low energy state. She remains provisionally cleared.

3538 June 3 9:20 AM - 9:40 AM

Proximal Muscle Weakness in 10-year-old Female Gymnast

Peter Waller, David Lessman, Philip Skiba. *Advocate Lutheran General Hospital, Park Ridge, IL.*
Email: pwaller189@gmail.com
(No relationships reported)

History:

A 10-year-old gymnast initially presented with three weeks of right hamstring pain, and was started on a home exercise program. After 4 weeks without improvement, the patient was started on a program of formal physical therapy. After ten weeks of therapy, the patient began to develop core muscle weakness and right anterior hip pain, and reported an inability to walk more than a mile without limping. She went on to develop similar pain with stair climbing, as well as activities of daily living. Shortly thereafter, the patient began to complain of quadriceps weakness and thoracic back pain.

Physical Examination:

Afebrile. Muscle strength 4/5 with bilateral shoulder elevation and abduction. Strength 5/5 with elbow flexion and extension. Bilateral hip flexor strength 3/5. Sensation intact in upper and lower extremities bilaterally. Deep tendon reflexes 2+ bilaterally. Scaly erythematous rash on each side of nose. Erythema present across knuckles bilaterally.

Differential Diagnosis:

1. Juvenile Dermatomyositis
2. Polymyositis
3. Viral myositis
4. Lupus Erythematosus

Tests and Results:

Labs: CPK: 524 H, AST: 75 H, ALT: 32 H, ESR: 18 wnl, Aldolase 11 H, CRP <0.3 wnl, LDH Total 317 H

X-Ray: 3V of bilateral hips-No acute fractures, subluxation, or dislocations.

MRI Pelvis: Diffuse intramuscular edema, predominantly involving gluteal muscles. Consistent with myositis.

Final Working Diagnosis: Juvenile Dermatomyositis

Treatment and Outcomes:

1. Patient admitted to outside hospital, and patient started on daily prednisone, weekly methotrexate, and hydroxychloroquine.
2. Patient started on IV methylprednisolone weekly, and monthly IVIG infusion by rheumatology
3. Evaluation at NIH Myositis Clinic. Recommended increasing IVIG dosing and pulse doses of IV steroid with every IVIG infusion.

3539 June 3 9:40 AM - 10:00 AM

Not All Headaches Are Concussion Related

Jennifer Oberstar. *University of Minnesota, Minneapolis, MN.*
(Sponsor: Steven Stovitz, FACSM)
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(No relationships reported)

HISTORY: A 13-year-old soccer player was struck in the back of the head by a soccer ball. She was diagnosed with a concussion without loss of consciousness. Concussion symptoms improved over ten days, but mild headache and fatigue persisted. Her ImPACT scores were at or above baseline. She completed her soccer season. One month later, she began cross country and reported exertional headaches with running. The certified athletic trainer reduced her training to the point of exercise biking. Upon evaluation at the clinic for shortness of breath and abdominal pain, the patient was treated for exercise-induced asthma and constipation. She was started on an albuterol inhaler, polyethylene glycol, and ranitidine. At a three month follow-up, the patient reported abdominal pain despite taking ranitidine twice daily. She was diagnosed with dyspepsia and irritable bowel syndrome at gastroenterology. Ultimately, she was unable to complete her cross country season. Six months later, the patient started training for nordic skiing and now presents with escalating headaches. Her mother believes that the patient was having concussion symptoms again due to the patient's irritability, dizziness, nausea, and return of headaches upon pushing herself at a recent nordic ski meet. She was unable to get out of bed and appeared depressed. Nine months post-concussion, neurosurgery was consulted for work-up of exertional headaches. She was later evaluated by psychiatry for anxiety.

PHYSICAL EXAMINATION: Examination revealed Body Mass Index: 21.04, HEENT: PERRLA, EOMI. NECK: no masses LUNGS: clear CV: RRR GI: hard stool palpated in the LLQ

DIFFERENTIAL DIAGNOSIS:

1. Post-concussion syndrome

2. Exertional headaches
 3. Thyroid disease
TEST AND RESULTS:
 T3 TOTAL: 106
 T4 TOTAL: 4.6
 THYROID STIMULATING HORMONE: 52.57
 MRI/MRA/MRV:
 -Conspicuous enlargement of the adenohypophysis, concern for possible pituitary hyperplasia
 -No vascular abnormalities detected
FINAL/WORKING DIAGNOSIS:
 1. Hashimoto's autoimmune thyroiditis with secondary pituitary enlargement
 2. Depression and Anxiety
TREATMENT AND OUTCOMES:
 1. Evaluated by pediatric neurosurgery, endocrinology, neurology, psychiatry.
 2. Started on levothyroxine 50mcg po daily for 3 months.
 3. Three years later, the patient is enrolled in several AP courses and joined the robotics team.

3540 June 3 10:00 AM - 10:20 AM

Heat Illness- Running

José J. Correa, Anita M. Rivera-Brown, FACSM, William F. Micheo, FACSM. *University of Puerto Rico School of Medicine, San Juan, Puerto Rico.*
 Email: jjcorrea@coqui.net
 (No relationships reported)

HISTORY: A 14 year-old highly competitive runner presented to our sports medicine clinics one week after collapsing during his first 10 km race in a hot and humid climate. His goal was to achieve a time similar to adult elite runners. He felt dizzy but did not want to slow down. At 8 km he was seen disoriented and stumbling and soon after collapsed. He was taken unconscious to a local ER, where IV hydration was given. After ~25 min he regained consciousness but was disoriented and irrational. He did not remember having collapsed or transport to the ER. After ~two hours he was alert and felt better, and was discharged. Upon arrival to his home he showered with cold water. He reported a mild sore throat the day before and leg pain after the race.

PHYSICAL EXAMINATION: Normal vital signs (BP: 116/68; HR: 68 bpm), alert, does not remember details of race. Normal cardiovascular, pulmonary, musculoskeletal and neurological exam.

DIFFERENTIAL DIAGNOSIS:

1. Syncope associated to dehydration
2. Syncope associated to hypoglycemia
3. Rhabdomyolysis
4. Syncope associated to exertional heat stroke

TEST AND RESULTS:

In ER: According to the athlete's parents: his blood pressure was low, body temperature was not measured nor any blood analysis performed. He was discharged with a diagnosis of "dehydration".

Two days after discharge from ER his primary care physician ordered urinalysis and CBC: Blood and protein trace in urine; Blood glucose=84 mg/dL; Creatinine=0.94 mg/dL; Na⁺= 142 and K⁺= 4.7 mmol/L; AST: 1,923 and ALT: 1,996 U/L. CK was not ordered.

At 9 days: AST: 100 and ALT: 424 U/L; CK ordered but not done.

At 16 days: AST: 55 and ALT: 170 U/L; CK=151 U/L

Five weeks after discharge from ER: Heat Tolerance Test (running outdoors @ 12.8 to 13.8 km/hr in 32°C, 75% RH). Test stopped at 40 min when T_{re}= 39.3°C. HR=145-173 bpm. Sweat rate=1.8 L/h; Fluid replaced=16% Dehydration=1.9%; Rating of hot/overheated= 8 and thirst= 8 (0-10 scale).

FINAL/WORKING DIAGNOSIS:

Exertional heat stroke related to inadequate heat acclimatization.

TREATMENT AND OUTCOMES:

1. Allowed to swim and run in cool environment after 2 weeks at reduced pace but no running in the heat for 5 weeks.
2. Recommendations about proper hydration and gradual heat exposure to acclimatize to heat.
3. Referred to sports psychologist.
4. Repeat heat tolerance test for clearance to compete in the heat.

3541 June 3 10:20 AM - 10:40 AM

Gastrointestinal - Track and Field

Katherine Langley, Jocelyn Gravlee. *University of Florida, Gainesville, FL.*
 Email: langleykj@ufl.edu
 (No relationships reported)

HISTORY: A collegiate track athlete presented with a two-day history of nausea, non-bloody, non-bilious vomiting, bloating, inability to tolerate PO, and waves of sharp,

crampy abdominal pain. He denied fevers, chills, diarrhea, sick contacts, or recent NSAID or alcohol use. His last bowel movement was two days prior. He endorsed a history of similar symptoms due to constipation that resolved with a laxative suppository. He was evaluated the previous day and noted to have mild epigastric and RLQ tenderness. He was able tolerate PO after Zofran ODT and discharged with strict return precautions. Surgical history includes laparoscopic right sports hernia repair with mesh, open right adductor tenotomy, and umbilical hernia repair in 2014 and left adductor tenotomy in 2016.

PHYSICAL EXAMINATION:

Afebrile, normotensive, bradycardic.

Appears uncomfortable.

Abdomen soft. Bowel sounds present. Epigastric tenderness to palpation. Voluntary guarding. No rebound.

DIFFERENTIAL DIAGNOSIS:

1. Gastritis
2. Constipation
3. Ileus

TEST AND RESULTS:

Abdominal radiographs showed gaseous small bowel distension in a non-obstructive pattern with a large amount of stool in rectal vault. He received IV fluids, glycerin suppository, and a Fleet enema with no bowel movement but recurrent emesis. Repeat Fleet enema, 4 mg IV Zofran, and additional IV fluids were given. On re-examination he had worsening abdominal tenderness and guarding. He was transferred to the ED and the differential diagnosis was broadened to include small bowel obstruction and intraabdominal perforation. On arrival to the ED he was in distress with significant bilateral lower quadrant tenderness, rebound, and guarding. CT abdomen and pelvis showed a high-grade distal small bowel obstruction with moderate wall edema along distal ileum with concern for vascular compromise.

FINAL/WORKING DIAGNOSIS:

Small bowel obstruction related to prior sports hernia repair

TREATMENT AND OUTCOMES:

1. Emergently to OR for exploratory laparotomy.
2. Intraoperatively found to have herniation of distal ileum through peritoneum in RLQ inferior to prior mesh placement for sports hernia repair. Herniated loop of bowel non-viable with chronic ischemic changes and stricture requiring 30 cm resection and ileoileostomy.
3. Uneventful post-operative course.
4. Return to sport pending.

G-26 Free Communication/Poster - Beyond the Bounds Category!

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
 Room: Hall F

3554 Board #1 June 3 8:00 AM - 9:30 AM

Photographic Method for Measuring Body Composition by Level of Physical Activity Level in Adults

Amber Kinsey, Howard W. Wiener, Ligaj Prahdan, Olivia Affuso, FACSM. *University of Alabama at Birmingham, Birmingham, AL.* (Sponsor: Olivia Affuso, FACSM)
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 (No relationships reported)

Our laboratory has previously shown that photographic methods can be used to accurately measure body composition in adults. Given the limitations of the body mass index (BMI) for assessing obesity status across different levels of physical activity (PA), we wanted to test our method to see if there were any differences in the prediction of body fatness by level of PA in a diverse sample of women and men.

PURPOSE: To examine the performance of a photographic method to estimate body composition amongst adults that differ in PA status.

METHODS: Our sample consisted of 723 black and white adults (women: n= 309, age, 39.4 ±14.4 years, height 163.2 ± 6.1 cm, weight 74.5 ± 19.5 kg, BMI 27.9 ± 7.0 kg/m²; men: n= 414, age, 40.4 ±14.6 years, height 175.8 ± 6.9 cm, weight 84.7 ± 18.0 kg, BMI 27.4 ± 5.5 kg/m²). Self-reported PA level was classified as low, moderate or high. Body fat percentage was measured with dual energy x-ray absorptiometry (%BFDXA) and predicted with digital photographic methods (%BFPHOTO). The photographic method measures pixel volume and body shape to predict body volume. The regression model to predict %BFPHOTO included age, sex, race, BMI, body volume and body shape. Pearson correlations between %BFDXA and %BFPHOTO were calculated for each level of PA.

RESULTS: There was a strong positive correlation between %BF_{DXA} and %BF_{PHOTO} for all levels of physical activity in black women (low, r = 0.89, p <0.0001; moderate: r = 0.91, p <0.0001; high: r = 0.86, p <0.0001) and white women (low, r = 0.83, p <0.0001; moderate: r = 0.82, p <0.0001; high: r = 0.71, p <0.0001). Similarly,

strong positive correlations between %BF_{DXA} and %BF_{PHOTO} at all PA levels were observed in black men (low: $r = 0.80, p < 0.0001$; mod: $r = 0.84, p < 0.0001$; high: $r = 0.79, p < 0.0001$) and white men (low: $r = 0.85, p < 0.0001$; moderate: $r = 0.80, p < 0.0001$; high: $r = 0.70, p < 0.0001$).

CONCLUSIONS: The determination of body fat percentage from digital photographs was strongly correlated with DXA measurements in black and white women and men regardless of physical activity status. Photographic methods may be a viable, cost effective alternative for the assessment of body composition.

Supported by NIH Grant R01HL107916, T32DK062710, and P30DK056336

3555 Board #2 June 3 8:00 AM - 9:30 AM

Cannabis Use And Neurological Disease: An Alternative Therapy To Improve Neurological Disability?

John Harvey Kindred¹, Kaigang Li¹, Nathaniel B. Ketelhut¹, Felix Proessl¹, Brett W. Fling¹, William R. Shaffer², Thorsten Rudroff, FACSM¹. ¹Colorado State University, Fort Collins, CO. ²Banner Health, Greeley, CO. (Sponsor: Thorsten Rudroff, FACSM)

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(No relationships reported)

Medicinal cannabis use has a long history. Despite this fact current federal regulations greatly restrict research into the medicinal uses of cannabis, although this sentiment is changing. **PURPOSE:** To investigate cannabis use parameters in people with neurological diseases. **METHODS:** An anonymous online survey was created using modified neurological assessment questionnaires, Guy's Neurological Disability Scale and Nottingham Health Profile, and posted to the National Multiple Sclerosis Society and Michael J. Fox Foundation websites. The survey also included measures of past/current cannabis use, fatigue (Fatigue Severity Scale), balance confidence (Activities of Balance Confidence), physical activity (International Physical Activities Questionnaire), pain (visual analogue scale), and spasticity. The survey was available online from 15 Feb 2016 to 15 Oct 2016. **RESULTS:** There were a total of 637 records with 52% (n = 326) men and 48% (n = 311) women (mean: age 57 SD 13; BMI 27 SD 5.7). Forty-three percent (n = 277) reported currently using cannabis, although 57% (n = 158) do not have a state medical marijuana card. Smoking was the most common method of use (79%, n = 213). Among the cannabis users 75% (n = 204) have been using for > 1 year and 48% (n = 131) are using 7 days a week. Most, 85% (n = 231), felt that cannabis at least moderately improved their symptoms. Medicinal purposes (74%, n = 200) were reported as the reason for use and 60% (n = 164) stated a reduction in the use of other medications due to cannabis. Of the non-users 75% (n = 265) have considered using cannabis to help manage their disease symptoms, and 97% (n = 344), said they would use cannabis if scientifically shown to help ease disease burden. There appears to be no difference in physical activity participation between the cannabis users and non-users (t-tests: $p > 0.128$). **CONCLUSIONS:** A large proportion of neurological patients are currently using cannabis to treat their disease and/or symptoms. Current medical knowledge on the benefits and consequences of both short- and long-term cannabis use are unknown in this population. It is imperative to establish the effects of cannabis so that physicians and patients can make the most informed decisions about whether adding cannabis to the current pharmacological regiment is both effective and safe.

3556 Board #3 June 3 8:00 AM - 9:30 AM

Identifying Politically Motivated Medical Withdrawals From International Competition

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(No relationships reported)

The IOC and many international federations (IF) have clear regulations prohibiting participants in sanctioned events from refusing to compete against athletes from other countries for political, cultural or religious reasons. Failing to abide by these regulations can result in significant penalties for the offending athletes and their federations. However, being injured or ill provides plausible deniability for those committed to not competing for political purposes.

PURPOSE: To explore the use of quantitative analysis to uncover patterns of medical withdrawal from competitions that indicate systematic abuses of medical waivers for political purposes.

METHODS: Demographic information (number of participants, event, country) was compiled from the official entry and results lists of the Federation Internationale d'Escrime (FIE) for 1.5 competition seasons 2014-2016 for 3 countries (Iran (IRI), Kuwait (KUW), Saudi Arabia (KSA)) anecdotally reported to be systematically avoiding competing against Israel (ISR) by using medical withdrawals.

RESULTS: Athletes from the three countries had a total of 623 competition exposures during the observation period (IRI: 279 vs. other nations; 4 vs. ISR; KUW: 239 vs. other nations; 6 vs. ISR; KSA: 101 vs. other nations; 3 vs. ISR). For IRI there was

100% (279) participation against non-ISR opponents but 0% (0/4) participation against ISR athletes. KUW had 99% (233/235) participation against non-ISR athletes and 0% (0/6) against ISR. KSA had 100% (98/98) against non-ISR and 0% (0/3) for ISR.

CONCLUSIONS: Although it is not reasonable to determine the legitimacy of requests for medical withdrawal from competition on a case-by-case basis in instances where non-medical motivation may be involved, it is possible to identify systematic abuses of medical exemptions through data analyses. To reaffirm the integrity of sports competition and the independence of medical care, it is incumbent on the IOC and IFs to investigate suspect action using available entry and withdrawal data and move to hold non-conforming nations accountable.

3557 Board #4 June 3 8:00 AM - 9:30 AM

Application of Environmental Sensors to a Military Combatives Training Environment

Tyler F. Rooks, Katie P. Logsdon, B. Joseph McEntire, Valeta Carol Chancey. U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

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(No relationships reported)

Timely and accurate identification is important for effective concussion management and has implications for extended return-to-play/duty timelines. An environmental sensor (ES) for measuring head impact events is one method for timely identification of a potential concussion. Civilian ESs were used in the Modern Army Combatives Program (MACP). Each course has its own instructional requirements with varying levels of direct head impact or inertial loading possibilities, and protective equipment requirements. The training environment, drills, and equipment limited the ES evaluated to specific form factors including: (1) adhesive-mounted and (2) headband or skullcap worn. **PURPOSE:** Characterize ES performance in MACP. **METHODS:** Students were instrumented with multiple ES types during combatives drills to record head impact events. Human factors and environmental issues were recorded. The students were videotaped during the drills to visually identify head and body impact events. The drills were recorded from multiple views and all videos were time synchronized. **RESULTS:** The ESs used were dependent on the drill type and the required protective equipment for the drill. During a Level 1 drill, the video analysis identified 26 to 41 impacts per student with the ES recording 30 to 35 impacts. Peak linear accelerations (PLA) for all students ranged from 4.9 to 162.1 G. One student, required to wear headgear, had a maximum linear acceleration of 67.3 G (compared to 162.1 and 117.5 G for students with no headgear). For the Level 2 drills, video analysis identified between 90 to 271 impacts per student per day with the ES recording 78 to 239 impacts per student per day. PLA ranged from 4.3 to 158 G. For the Level 3 drills, video analysis identified between 10 to 76 impacts per student per day with the ES recording 44 to 191 impacts. PLA ranged from 1.6 G to 220.6 G. Human factors issues identified included sensor mounting, stability, and the need for a properly sized skullcap. For skullcap/headband use, protective headgear was required to keep the cap in place. None of the ESs evaluated were compatible with grappling drills. **CONCLUSION:** Both form factors are usable, though not perfect, in the MACP; further development is required. The ES data variance shows that ESs cannot yet be used as a diagnostic standard for likelihood of concussion.

3558 Board #5 June 3 8:00 AM - 9:30 AM

Assessment Of The Relationship Between Body Composition And Bioavailability Of Diclofenac Sodium In Healthy Volunteers

Andreia Naves¹, Valden Capistrano Júnior², Maria Elisabete Amaral de Moraes². ¹VP Research Institute, São Paulo, Brazil. ²Federal University of Ceará, Ceará, Brazil.

(No relationships reported)

PURPOSE: The objective of this study was to evaluate the relationship between body composition and pharmacokinetics of diclofenac sodium formulation in healthy volunteers.

METHODS: This was a cross-sectional study. Twenty-four healthy subjects (age range: 18-42 years) received 50 mg of sodium diclofenac single oral dose. Hematologic and biochemical analysis and body composition (bioelectrical impedance method) were obtained before and after the admission of the study. The pharmacokinetics was evaluated by high performance liquid chromatography coupled to mass spectrometry. Relationships between pharmacokinetics and body composition were assessed with simple Pearson correlations. Student's t-test was used for continuous variables and type 1 error was set at $p < 0.05$.

RESULTS: There were significant inverse correlation between area under the concentration time curve from time 0 to 24h (AUC₀₋₂₄) and lean mass ($r = -0.4917, p = 0.0147$), intracellular water ($r = -0.4406, p = 0.0312$), extracellular water ($r = -0.4964, p = 0.0136$) and basal metabolic rate ($r = -0.5033, p = 0.0122$); between area under the concentration time curve from time 0 to infinity (AUC_{inf}) and lean mass ($r = -0.4908, p = 0.0149$), intracellular water ($r = -0.4401, p = 0.0314$), extracellular water ($r = -0.4946,$

p=0,0140) and basal metabolic rate (r=-0,5023, p=0,0124); and between maximum concentration (Cmax) observed and lean mass (r=-0,7290, p<0,0001), intracellular water (r=-0,6750, p=0,0003), extracellular water (r=-0,7519, p<0,0001) and basal metabolic rate (r=-0,7505, p<0,0001).

CONCLUSIONS: The results showed that low values of AUC0-24 e AUC0inf were associated with greater values of lean mass body, intracellular water, extracellular water and basal metabolic rate. The optimization of diclofenac dose based on these parameters can avoid doses of errors in prescribing, optimization of treatment outcome and minimize side effects.

3559 Board #6 June 3 8:00 AM - 9:30 AM

Reaction Time Assessment of Sickle Cell Anemia Children

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(No relationships reported)

Children with Sickle Cell Disease (SCD) may have had brain damage throughout childhood that lead in neuropsychomotor changes, such as an increase in reaction time (RT). An evaluation of RT can aid in the early detection of increased brain information processing speed. This capability is of fundamental importance for full child development and can be assessed by tests such as psychometric tests and motor skills tests or computer games. In this study, the assessment was performed using an easy to handle toy-like device, developed for this purpose in Arduino platform. **PURPOSE:** To evaluate the RT in children with sickle cell anemia (SCA), using simple reaction time (SRT) and choice reaction time (CRT) tests. **METHODS:** The 46 participants, 24 SCA group (9,41±1,97 yrs) and 22 healthy children of control group (CON) (8,33±1,54 yrs), were subject to the tests SRT and CRT developed on Arduino platform. Children had to trigger the fastest response possible button, after seeing the luminous stimulus. The Arduino was programmed to generate random light stimuli, according to the purpose of each test, as well as the capture, transfer and register the data of motor responses on the computer via Bluetooth. **RESULTS:** SRT was significantly higher (p<0.01) in children with SCA (747,80 ± 523,58 ms) when compared to CON (364,48 ± 90,66 ms). In SCA group the SRT (478,06 ± 114,03 ms) was significantly lower when compared with the CRT (747,80 ± 523,58 ms). **CONCLUSIONS:** Children with SCA have a higher CRT than children without the disease.

3560 Board #7 June 3 8:00 AM - 9:30 AM

Evaluating the Science for Physical Activity Policy

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(No relationships reported)

The 2018 Physical Activity Guidelines Advisory Committee (PAGAC) will provide independent recommendations based on current scientific evidence to aid the federal government in the development of the second edition of the *Physical Activity Guidelines for Americans* (PAG). **PURPOSE:** To describe the analytic frameworks and systematic literature reviews used by the PAGAC to evaluate the science and develop evidence-based conclusions and recommendations for its Advisory Committee Scientific Report (Report). **METHODS:** The U.S. Department of Health and Human Services (HHS) contracted a systematic literature review to evaluate and synthesize published, peer-reviewed physical activity literature. The approach is designed to maximize transparency, minimize bias, and ensure systematic reviews are relevant, timely, and high quality. The PAGAC's first task was to develop and prioritize research questions. The highest priority questions were those with potential for the greatest public health impact (Table 1). Each question will be evaluated using de novo systematic reviews, high-quality existing systematic reviews, meta-analyses, and reports, or a combination of approaches. **RESULTS:** The output from the literature review is an evidence portfolio summarizing the findings for each question. The Committee will grade each question as strong, moderate, limited, or grade not assignable. During a series of public meetings, subcommittees will review and deliberate on their conclusions, implications, and research recommendations in order to come to consensus. Analytic frameworks and search strategies for initial questions and information discussed during the first three public meetings will be presented. **CONCLUSIONS:** HHS will use the Report, along with agency and public comments,

to develop the second edition of the PAG. This edition will provide updated science-based advice on how physical activity can help promote health and reduce the risk of chronic disease.

Subcommittee Topic	Subcommittee Lead	Priority Areas
Aging	Loretta DiPietro, PhD, MPH, FACSM	PA and risk of injury due to fall
Brain Health	Kirk Erickson, PhD	PA and brain function (cognition)
Cancer – Primary Prevention	Anne McTiernan, MD, PhD, FACSM	PA and cancer incidence
Cardiometabolic Health and Weight Management	John Jakicic, PhD	PA and weight gain prevention
Exposure	William Kraus, MD, FACSM	PA and all-cause and CVD mortality
Individuals with Chronic Conditions	David Buchner, MD, MPH, FACSM	PA and all-cause mortality in cancer survivors
Promotion of Physical Activity	Abby King, PhD	Effective PA interventions
Sedentary Behavior	Peter Katzmarzyk, PhD	Sedentary behavior and all-cause mortality
Youth	Russell Pate, PhD, FACSM	PA and health outcomes in youth under age 6

3561 Board #8 June 3 8:00 AM - 9:30 AM

Updating The Physical Activity Guidelines For Americans: Priority Topics And Research-Related Issues

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(No relationships reported)

The U.S. Department of Health and Human Services (HHS) expects to issue a second edition of the *Physical Activity Guidelines for Americans* (PAG) in 2018 to provide updated evidence-based guidance on the types and amounts of physical activity that offer substantial health benefits. **PURPOSE:** To present the topics, priority questions, and research-related issues being reviewed by the 2018 Physical Activity Guidelines Advisory Committee (PAGAC) and to show how selected topics have evolved since 2008. **METHODS:** Seventeen nationally recognized experts were asked to review the current evidence regarding physical activity and health and provide a summary of their findings to the federal government to inform the update of the PAG. In July 2016, the PAGAC formed nine subcommittees corresponding to key topic areas to review in this process. The PAGAC has identified key research questions to be addressed through systematic reviews and will evaluate the evidence, ultimately submitting a Scientific Advisory Report to HHS. **RESULTS:** The subcommittees include: Aging, Brain Health, Cancer, Cardiometabolic Health and Weight Management, Exposure, Individuals with Chronic Conditions, Promotion of Physical Activity, Sedentary Behavior, and Youth. Similar to the 2008 PAGAC, some subcommittees will address specific health outcomes (e.g., What is the relationship between physical activity and cancer incidence?) or populations (e.g., What is the relationship between health indicators and physical activity for children younger than six years old?). Other subcommittees will explore the health impact of differing exposures such as sedentary behavior or higher intensities of physical activity. Across the topic areas the PAGAC has identified several research-related issues that require particular attention (e.g., reconciling self-report and device-measured physical activity data). **CONCLUSION:** The PAGAC is charged with reviewing the available scientific evidence, considering public comments, and ultimately submitting a comprehensive scientific report to HHS. While clear topics and questions have been established, key research issues will need to be addressed during this process in order to produce a report that best informs public health guidelines.

3562 Board #9 June 3 8:00 AM - 9:30 AM

Promotion Of Nutrition Care By Australian Fitness Businesses: A Website Analysis

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(No relationships reported)

Purpose Fitness professionals are well placed to simultaneously facilitate improvements in physical activity and dietary behaviours. However, concerns regarding the competence of fitness professionals to provide nutrition care have been raised. More than 85% of fitness professionals provide nutrition care beyond the recommended scope of practice. It is currently unclear if the provision of nutrition care beyond scope of practice is intentional, or if it arises as a consequence of discussions around lifestyle modification. The aim of this study was to investigate the intention of fitness professionals to provide nutrition care, by comparing the advertised nutrition content of fitness business websites and social media pages with a national scope of practice document for fitness professionals. Fitness businesses were targeted because advertisement of a service indicates that it would be provided, and advertisements may influence public expectations of fitness professional services. **Methods** Inductive content analysis of websites and social media sites was undertaken for 36 registered fitness businesses in Queensland, Australia. This review included 8 franchise fitness businesses with more than 400 sites each across Australia and was conducted from August to October, 2014. Advertisements were considered *within scope* if they referred to national nutrition guidelines or dietetic services, *at risk* of being beyond scope if they advertised services that were not clearly in line within national nutrition guidelines, or *beyond scope* if they advertised nutrition care beyond the fitness professional scope of practice, such as personalized dietary prescription outside of national dietary guidelines. **Results** Of the businesses reviewed, 15% advertised content classed as *within scope*, 34% were *at risk*, and 51% were *beyond scope*. These included advertisements for diet planning and nutrition counselling, as well as food or nutrition claims, and recipe provision. **Conclusions** Many fitness businesses advertised nutrition care, provided by their staff members, which extended beyond the recommended scope of practice for fitness professionals. Strategies that support fitness professionals to provide nutrition care of value to clients, without extending beyond their scope of practice, are warranted.

3563 Board #10 June 3 8:00 AM - 9:30 AM

Globalizing the ACSM Certified Personal Trainer Job Task Analysis: The Case Study of China

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China relies on foreign vendors such as the American College of Sports Medicine (ACSM) certifications and related workshops to educate its exercise specialists. **PURPOSE:** Examine the relevancy of the current ACSM Job Task Analysis (JTA) for the Certified Personal Trainer (CPT) certification in China. **METHODS:** Seventeen Chinese (including six females) and six Taiwanese (including two females) fitness professionals (age: 34.95±5.10 years) attended an ACSM CPT workshop in Shanghai, China in 2016. At the end of the workshop, U.S. presenters verbally read each JTA in English to the participants, and these were simultaneously translated verbally into Mandarin. The JTAs consist of knowledge and skills (N=191) covering four domains (D): Initial Client Consultation & Assessment (D1; N=58), Exercise Programming & Implementation (D2; N=53), Exercise Leadership & Client Education (D3; N=27), and Legal, Professional, Business & Marketing (D4; N=53). The participants were asked, "How relevant is the JTA in China?" on a scale of 1 to 3 (1: excellent, 2: somewhat relevant; 3: poor). **RESULTS:** Response rate was 87%. 67% of the participants reported that the JTAs' relevancy was excellent and 21% somewhat relevant. When individual JTAs were combined to represent their specific domain collectively, the frequency of a poor rating was 12% for D1, 5% for D2, 10% for D3, and 34% for D4. T-tests revealed that 48 JTAs were significantly ($p<0.05$) higher than the hypothesized score of 1. D4 and D1 contained the majority of these higher scores, 64% and 30% respectively (v. D2 and D3, around 10%). Specifically, the initial client consultation and interview for health appraisals, medical clearance, seeking client feedback for exercise enjoyment, dietary guidelines, liability, safety policies, professional attire, business models and plan, marketing materials and networking, copyrights and client confidentiality were significantly different. **CONCLUSIONS:** This is the first time that the ACSM CPT JTAs are investigated abroad showing an impact on their relevance for a foreign country. The desire to create a set of international JTAs outside of the U.S. should

be recommended by certified and culturally sensitive ACSM professionals. The new international JTAs should also be specific to the culture for the concerned region of the world.

G-27 Free Communication/Poster - Chronic Disease and Nutrition

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3564 Board #11 June 3 8:00 AM - 9:30 AM

Influence of Ischemic Preconditioning on Glucose Tolerance in Obese and Overweight Adults

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(No relationships reported)

The ergogenic and protective cardiovascular benefits of ischemic preconditioning (brief and repeated occlusion of blood flow) have been well described; it is unclear if ischemic preconditioning also provides metabolic benefit. **PURPOSE:** To determine the influence of lower limb ischemic preconditioning on glucose regulation in overweight and obese adult humans. **METHODS:** Following initial screening, 10 men and women (age: 45 ± 4 years; body mass index: 30.4 ± 1.2 kg/m² (mean ± SE)) visited the laboratory on 2 separate and randomly ordered occasions, separated by a minimum of 14 days. Automated pressure cuffs were inflated/deflated on alternate legs to either 20 mmHg (control condition) or 200 mmHg (ischemic preconditioning), in five-minute intervals, for a total of 40 minutes (20 minutes per leg). 15 minutes post-treatment, subjects ingested 75g of glucose dissolved in 300 ml of water; circulating glucose and insulin concentrations were measured over 180 minutes. **RESULTS:** Area under the glucose response curve was lower ($P=0.026$) after ischemic preconditioning compared with control (17,840 ± 521 vs. 17,095 ± 393). This favorable attenuation of the glucose response curve could not be attributed to a modified circulating insulin response (area under the insulin curve: 8356 ± 1807 vs. 7641 ± 1353; $P=0.33$). **CONCLUSIONS:** These preliminary data suggest that ischemic preconditioning may improve oral glucose tolerance in overweight and obese adults, without affecting the circulating insulin response. In addition to possessing ergogenic and protective cardiovascular properties, ischemic preconditioning may also provide metabolic benefit to overweight and obese adults.

3565 Board #12 June 3 8:00 AM - 9:30 AM

Effects of a Sedentary vs. Active Lifestyle on Blood Glucose Uptake

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It is well known that obesity, led by sedentary lifestyle, increases the risk of developing cardiovascular and metabolic disorders. However, whether leading a sedentary lifestyle alone would independently increase the risk of developing these diseases is less clear. **Purpose:** To examine the effects of sedentary (SED) vs. active (ACT) lifestyles on blood glucose (BG) uptake at rest and post exercise to identify possible predisposition for metabolic and cardiovascular diseases in young adults. **Methods:** Seven SED (age 21.0 ± 0.6 years; height 164.8 ± 6.2 cm; weight 57.9 ± 8.5 kg; % body fat 16.7 ± 5.6%) and thirteen ACT (age 20.3 ± 1.0 years; height 173.3 ± 9.5 cm; weight 66.8 ± 9.7 kg; % Body Fat 13.0 ± 6.2%) individuals participated in the study. After obtaining baseline anthropometric measures, BG was monitored at 15 minute intervals under two separate conditions; resting (R) and after exercise (E). During E, subjects cycled for 30 minutes at 60% of their estimated VO_{2max} . Before, during, and after E, subjects' heart rate (HR), blood pressure (BP), and rate of perceived exertion (RPE) were measured. Each condition was separated by a minimum of 24 hours. A 2 x 2 ANOVA was performed to make comparisons between groups (SED vs. ACT) and conditions (R vs. E). **Results:** For the baseline measure, significantly higher resting HR was seen in SED when compared to ACT (SED 95.3 ± 13.9 vs ACT 79.9 ± 14.5 bpm, $p<0.05$). Furthermore, a trend of higher BG was shown in SED throughout the hour post exercise when compared to ACT. However, these differences were not significant ($p<0.05$). Interestingly, this trend of higher BG was shown during the E condition but not during the R condition. **Conclusion:** Sedentary lifestyle in young adults may lead to early alterations in cardiovascular function. Although the difference in glucose uptake between SED and ACT groups was less clear, adapting an active lifestyle should still be considered to promote an individual's health and well-being.

3566 Board #13 June 3 8:00 AM - 9:30 AM

Multiple Short Bouts Of Walking Activity Attenuate Blood Glucose Response In Obese Women

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PURPOSE: We sought to determine the effect of 2 and 5-min multiple walking breaks interspersed during sedentary time on blood glucose responses in sedentary obese women.

METHODS: 10 obese women (age = 36.1±16.3, BMI = 38.0±5.2, Body Fat= 49.57±4.35%) participated in this crossover-design study. All participants completed three conditions in randomized order; 1) 4-h of continuous sedentary behavior (SED), 2) 4-h of sedentary behavior with 2-min of walking at a moderate intensity every 30-min (SED+2m), and 3) 4-h of sedentary behavior with 5-minutes of walking at a moderate intensity every 30 minutes (SED+5m). 48-h of 'washout' occurred between conditions. A Continuous Glucose Monitor System (CGMS) was positioned on each participant's abdomen region for the entire experiment with calibration to "finger-stick" glucose values occurring 4 times/day. Body composition was assessed with iDXA and the actigraph accelerometry was used to assess sedentary behavior and physical activity.

RESULTS: Accelerometry measured sedentary time was 99.8%, 93.7% and 84% for the SED, SED+2m and SED+5m conditions, respectively. SED+5m significantly decreased plasma glucose levels during the protocol compared to the SED condition as evidenced by a reduction in 120-min post-prandial glucose (PPG)-area under the curve (AUC) (15.9±8.8 mg/dL/min vs 22.5±13.1 mg/dL/min for SED+5m and SED respectively, p=0.031), and 180-min PPG AUC (13.2±7.8 mg/dL/min vs 20.8±13.9 mg/dL/min for SED+5m and SED respectively, p=0.006). SED+2m 60-min PPG AUC and 120-min PPG AUC values were 14.2±11.1 mg/dL/min and 13.2±7.8 mg/dL/min, respectively, but were not found to be significantly different from either the SED or SED+5m conditions.

CONCLUSIONS: Our findings show that 5 minutes of moderate intensity walking each 30 minutes to interrupt sedentary behavior can attenuate PPG excursions in sedentary obese women.

3567 Board #14 June 3 8:00 AM - 9:30 AM

The Effects Of Malnutrition On Muscle Strength And Self Care Ability Of Elderly Living Alone In Taiwan

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The aging population has been increasing globally and raising significant concern. Research points out that the prevalence of malnutrition in community-dwelling elderly was 35% - 40%, and the risk of malnutrition of elderly living alone was 11.1 times more than non-solitary elderly. Malnutrition led to poor health, frailty, disability and death as well as other serious problems, which further reducing elderly's quality of life and at the same time increasing healthcare costs.

PURPOSE: This study aimed to investigate muscle strength and self-care ability of elderly living alone with malnutrition status.

METHODS: A total of 229 elderly individuals age 65 and above (aged 78.93 ± 7.65 years) were recruited and divided into nutrition group (MNA ≥ 12, N = 126) and malnutrition group (MNA < 12, N = 103) based on their nutritional status by mini nutritional assessment short form (MNA-SF). Muscle strength and self-care ability were measured, including maximum grip force was measured by electronic grip equipment, activities of daily living (ADL) and instrumental activities of daily living (IADL).

RESULTS: The results showed 45% elderly living alone had malnutrition. Comparing to the nutrition group, the maximum grip strength, activities of daily living and instrumental activities of daily living for elderly living alone with malnutrition were decreased by 11% ($t_{(227)} = 4.401$, $p < 0.000$), 9% ($t_{(227)} = 4.947$, $p < 0.000$) and 23% ($t_{(227)} = 5.822$, $p < 0.000$), respectively.

CONCLUSIONS: Malnutrition may reduce muscle strength and self-care ability of elderly living alone, thus it is imperative to pay attention to their food intake and conduct periodical nutritional assessment in order to early intervene malnutrition. To establish of regular exercise habits, appropriate muscle strength training, increase muscle strength and activity function.

3568 Board #15 June 3 8:00 AM - 9:30 AM

Association Between Nutritional Risk, Physical Function, and Physical Activity in Older Adults

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Under nutrition in older adults leads to increased incidence of illness, disease, disability, slow recovery, and poor outcomes, as well as worsening of existing disease and illness. While community based exercise programs are available to help older adults improve mobility and increase physical activity (PA) levels, screening for adequate nutrition is often overlooked and may impede improvements in mobility and PA. **PURPOSE:** To examine the association between nutritional risk, physical function and PA in older adults. **METHODS:** One hundred four participants (age= 71.0 yrs±7.7); BMI=33.1±7.9) completed questionnaires related to nutritional risk (SCREEN Nutritional Risk Questionnaire) for older adults, physical function (Physical Function Questionnaire, PFQ), and physical activity (PA, CHAMPS physical activity questionnaire). Additional physical function measures included: 1) timed up and go (TUG), which involved rising from a chair, walking three meters, returning to the chair and sitting down, 2) usual gait speed (UGS) over a six-meter distance, and 3) 6-minute walk (6MW). Spearman correlation coefficients were used to examine the association between nutritional risk and the different measures of physical function and PA. **RESULTS:** In this population of community dwelling older adults, 34.4% were considered to be at risk of under nutrition. There was a significant association ($p < 0.05$) between nutritional risk and PFQ ($r = .291$), TUG ($r = -.247$) and UGS ($r = -.263$). There were also significant associations between PFQ and TUG ($r = -.508$), PFQ and UGS ($r = -.630$), and PFQ and 6MW ($r = .524$). There was not a significant association between nutritional risk and 6MW ($r = .12$). **CONCLUSIONS:** These results suggest that risk of under nutrition is prevalent in older adults living in the community. In addition, risk of undernutrition is related to objective and subjective measures of physical function. Given the association between nutritional risk and mobility, community based exercise and PA programs for older adults designed to improve mobility and physical function should include screening for nutritional risk with appropriate follow-up.

3569 Board #16 June 3 8:00 AM - 9:30 AM

Effects of A Kefir Diet on Kidney Antioxidant Enzymes of Rats Treated with Doxorubicin

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(No relationships reported)

Doxorubicin (DOX) is a potent chemotherapy drug whose mechanisms of action includes generation of reactive oxygen species (ROS), and as such, its use as an anticancer drug is limited by toxicities in non-cancer cells. The kidney is susceptible to oxidative stress (OS), and it has been shown previously that DOX disrupts antioxidant enzyme expression. Exogenous antioxidant administration has been shown to minimize OS associated with kidney injury, and as such, interventions to protect against DOX-induced antioxidant disruption in the kidney would be of benefit. The fermented milk product kefir (K) has antioxidant properties and acts to protect against ROS-induced cell damage, but K's effect on the DOX treated kidney has yet to be explored. **PURPOSE:** To examine the expression of catalase (CAT), glutathione peroxidase (GPx) and cytosolic superoxide dismutase (SOD1) in the kidney of rats fed K prior to and during DOX treatment. **METHODS:** Male rats were randomly assigned to one of four groups: kefir+saline (K+S), kefir+DOX (K+D), milk+saline (M+S), or milk+DOX (M+D). Rats were fed either a diet supplemented with K or a milk-based control diet for 8 weeks before and after receiving 15 mg/kg DOX or saline (SAL) as a placebo. Five days after injections, kidneys were excised and Western blotting was performed to assess CAT, GPx, and SOD-1 expression. **RESULTS:** No significant drug effect ($p = 0.11$), diet effect ($p = 0.08$), or interaction ($p = 0.76$) was observed for CAT, and a 26% greater CAT expression was observed in K+D when compared to M+D. With GPx expression, no significant drug effect ($p = 0.09$), diet effect ($p = 0.11$), or interaction ($p = 0.66$) was observed, and K+D had a 32% lower GPx expression than M+D. No significant SOD-1 drug effect ($p = 0.07$), diet effect ($p = 0.61$), or interaction ($p = 0.46$) was observed, and K+D had a 27% lower SOD1 expression than M+D. **CONCLUSIONS:** DOX did not significantly alter kidney CAT, GPx, or SOD1 expression in K or M fed animals suggesting no significant protective effect of chronic K feeding on kidney antioxidant expression versus chronic M feeding. Future work, however, should include standard chow as a control diet to better elucidate the impact DOX has on kidney as it is possible that both K and M were protective against the antioxidant changes typically observed with DOX.

3570 Board #17 June 3 8:00 AM - 9:30 AM
Pre-adolescent Cardio-metabolic Associations And Correlates: Pacmac
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The process of atherosclerosis is increasingly frequently initiating during preadulthood. The early onset of atherosclerosis has been linked to cardiometabolic complications, including obesity, which in turn are associated with deficient lifestyle behaviors.

PURPOSE: Assess the associations between body fitness and lifestyle behaviors with cardiometabolic health in prepubescent children aged 8-10 years.

METHODS: Three hundred ninety two children aged 8-10 years (195 male, 197 female; 9.5 ± 1.1y) were recruited from three regions across New Zealand. Body composition was evaluated using anthropometric measurements (waist: hip ratio) and bio-electrical impedance analysis (body fat %). Cardio-respiratory fitness was calculated using the 20-meter shuttle run. Physical activity and sedentary behavior was estimated using the Youth Physical Activity Questionnaire. Nutritional behavior was evaluated using the New Zealand Adolescent Food Frequency Questionnaire (processed food, fruit/veg consumption, breakfast foods). Quality of sleep was assessed using the Child Sleep Habits Questionnaire (duration, habits, social jet lag). Cardiometabolic health was gauged using pulse wave analysis to assess blood pressures (diastolic, systolic, central systolic) and arterial wave reflections (augmentation pressure), and finger prick procedures to evaluate fasting blood lipids (LDL, HDL, total cholesterol, triglycerides), glucose, and glycosylated hemoglobin.

RESULTS: The cardiometabolic variables were reduced to 4 factors using principle component analysis: (blood pressure, cholesterol, vascular, carbohydrate-metabolic). Following adjustment for co-founders, body fat % associated with blood pressure and vascular factors. Cardio-respiratory fitness and strength associated with CHO-Met, whereas sedentary associated with cholesterol and vascular factors. Processed foods associated with vascular, whereas fruit/veg associated with cholesterol. Social lag associated only with cholesterol.

CONCLUSION: One common factor is unlikely to define cardiometabolic health in pre-adolescent children, and each of the underlying cardiometabolic health factors is associated with different lifestyle behaviors.

3571 Board #18 June 3 8:00 AM - 9:30 AM
Cardio-metabolic Risk Variables In Pre-adolescent Children - A Factor Analysis
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 (No relationships reported)

BACKGROUND: Atherosclerosis begins during pre-adolescence and is occurring at an accelerated rate. This acceleration has been linked to poor lifestyle behaviors and subsequent cardio-metabolic complications. Although the clustering of cardio-metabolic risk factors has been recognized for well over two decades, previous studies in children have predominantly examined the relationships between atherosclerosis and individual cardio-metabolic risk factors, or have grouped together pre-adolescent and adolescent children. Further, no known studies have included glycosylated haemoglobin (HbA1c), or central hemodynamic measures such as central blood pressure (cSBP) and augmentation index (AIx). **PURPOSE:** In pre-adolescent children, explore the: (1) underlying factors that explain cardio-metabolic risk factors using principle components analysis; (2) unique value of HbA1c, cSBP and AIx; (3) associations between cardio-metabolic risk factors and overweight-obese status. **METHODS:** Principle component analysis was performed on 392 children (9.54 y, 50% F) from three representative sample sites across New Zealand. **RESULTS** Four factors explained 60% of the variance in the measured variables. In order of variance explained, the factors were: blood pressure (cSBP, peripheral systolic and diastolic blood pressure), adiposity (waist circumference, body mass index, HbA1c), lipids (total cholesterol, low-density lipoproteins, high-density lipoproteins) and vascular (AIx, heart rate, fasting blood glucose [FBG]). For each factor, except lipids, the overweight-obese had a small-large likelihood of having higher (worse) risk scores.

CONCLUSIONS: In accordance with previous findings in adults and adolescents, one common factor is unlikely to define cardio-metabolic health in pre-adolescent children. Each of the factors, except vascular, which was predominantly explained by AIx, are in agreement with previous findings in adolescents. An additional novel finding was that HbA1c and FBG loaded on to different factors, supporting previous work suggesting that FBG indicates short-term glycemic control whereas HbA1c reflects chronic glycemic control. Lastly, overweight-obese pre-adolescents were found to have worse scores for the adiposity, blood pressure and vascular factors.

3572 Board #19 June 3 8:00 AM - 9:30 AM
Daily Heart Rate in Relation to Cardiorespiratory Fitness and Metabolic Syndrome in HIV+ Hispanic Adults
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 (No relationships reported)

Daily heart rate (HR) is usually higher among HIV+ compared with HIV- adults, a possible aspect of chronotropic incompetence (CI) in this population. Low cardiorespiratory fitness (CRF) and metabolic syndrome (MetSyn) are prevalent among HIV+ adults, possibly influencing CI. However, information regarding 24-hr HR as an index of CI, and its association with CRF and MetSyn in this population is non-existent. **PURPOSE:** To describe the association between CRF, MetSyn, and daily HR in a group of HIV+ and HIV- Hispanic adults in Puerto Rico. **METHODS:** Eighty-Nine adults (59-HIV+ and 30 HIV-) completed measurements of CRF (VO₂ peak), 24-hr blood pressure and HR, and metabolic syndrome (fasting glucose and lipid profile, resting BP, waist circumference). T-tests were used to detect differences between groups, and correlation analyses to evaluate associations between variables. **RESULTS:** The proportion of low CRF based on age and sex, and MetSyn was not different between HIV+ and HIV-participants (56 vs. 40%; and 53 vs. 37%; P=0.2, respectively). However, 24-hr HR, daytime HR, and night-time HR were all significantly higher in HIV+ compared with HIV- participants (78.3±9.4 vs. 67.4±8.4, 81.9±9.9 vs. 69.7±8.6, 70.7±9.4 vs. 62.7±9.0 bpm, respectively, P<0.05 for all). VO₂ peak was inversely correlated with 24-hr HR, daytime HR, and night-time HR in both groups (ρ = -0.40, -0.36, -0.49, P<0.05 for all). Considering CRF classification in each group, all HR measures were significantly lower among those with high CRF vs. low CRF regardless of HIV status (HIV+: 24-hr HR by CRF: low= 81.1±8.2 vs. high= 74.8±9.7 bpm, P=0.009; daytime HR: low=85.0±8.7 vs. high=78.0±10.2 bpm, P=0.006; night-time HR: low=72.8±8.7 vs. high=68.0±9.8 bpm, P=0.02) (HIV-: 24-hr HR by CRF: low= 72.1±4.4 vs. high= 64.2±9.9 bpm, P=0.009; daytime HR: low=74.1±4.9 vs. high=66.8±9.4 bpm, P=0.02; night-time HR: low=67.8±6.1 vs. high=59.2±9.1 bpm, P=0.008). No HR differences were observed by MetSyn in the HIV+ group, but HR measures in the HIV- group were lower in those without MetSyn. **CONCLUSION:** These results suggest that CRF but not MetSyn, influence daily HR in HIV+ participants, with potential impact on CI correction. Intervention studies must be conducted to confirm these results. Supported by: NIH/CTSA KL2-RR024151, NIH/NIMHHD 8U54MD 007587-03.

3573 Board #20 June 3 8:00 AM - 9:30 AM
Response Of The Serum Metabolic Fingerprint To Postprandial Vs. Postabsorptive Exercise In Overweight Sedentary Men
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In individuals with cardiometabolic risk factors, meal timing in relation to exercise may be important for optimal metabolic control. The holistic approach of metabolic fingerprinting can provide new insights into metabolic changes due to stimuli such as exercise and meal consumption. **PURPOSE:** To investigate the effect of prior meal consumption on the serum metabolic fingerprint of exercise. **METHODS:** Eight overweight sedentary men participated in two trials: high-intensity interval exercise (HIIE) after the consumption of a standardized meal (postprandial exercise, PpEx) and HIIE in the fasted state (postabsorptive exercise, PaEx). Blood samples were collected before and immediately after exercise for targeted metabolomic analysis by liquid chromatography-mass spectrometry (HLIC-UPLC-MS/MS). Data for the 45 identified serum metabolites were subjected to univariate and multivariate analysis. **RESULTS:** A two-way repeated measures ANOVA on peak areas revealed six metabolites with significant trial x time interaction: alanine (PpEx, 11 ± 10 % change from baseline vs PaEx, 39 ± 17 %; p = 0.04), betaine (PpEx, 4 ± 1 % vs PaEx, 1 ±

8 %; $p = 0.03$), glutamate (PpEx, -23 ± 13 % vs PaEx, 2 ± 17 %; $p = 0.04$), serine (PpEx, 3 ± 9 % vs PaEx, 3 ± 16 %; $p = 0.01$), threonine (PpEx, 9 ± 13 % vs PaEx, 3 ± 21 %; $p = 0.01$), and uridine (PpEx, 1 ± 20 % vs PaEx, 20 ± 23 %; $p = 0.01$). Partial least-square discriminant analysis separated the metabolic fingerprints of PpEx and PaEx immediately after exercise ($R^2Y = 0.935$, $Q^2Y = 0.629$, $CV\text{-ANOVA} p = 0.03$). Discriminating metabolites with VIP score > 1 were: leucine-isoleucine, lysine, and tryptophan, which were higher after PpEx; and acetylcarnitine, hypoxanthine, taurine, pyruvate, and lactate, which were higher after PaEx. **CONCLUSION:** The response of the serum metabolic fingerprint to exercise in overweight sedentary men depends on the prior consumption of a meal. Our findings support the value of metabolic fingerprinting in the study of exercise metabolism.

**3574 Board #21 June 3 8:00 AM - 9:30 AM
Lipid And Glucose Profiles Of Middle-aged Male Runners After 3-week High Fat-low Carbohydrate Diet**

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(No relationships reported)

PURPOSE: High fat-very low carbohydrate diets (HFLC) have become increasingly popular in the endurance community, but there is little data concerning the effects of HFLC on markers of cardiovascular disease risk. The aim of this study was to examine glucose and lipid marker responses following a prolonged HFLC. **METHODS:** Eight middle-aged (39.5 ± 9.9 y), trained but non-elite ($VO_{2peak} = 48.5 \pm 4.5$ ml/kg/min) runners (1.77 ± 0.08 m; 81.7 ± 7.0 kg; $19.3 \pm 6\%$ body fat) served as participants. Venous blood was drawn from an antecubital vein after an overnight fast with standardized evening fluid intake on 4 occasions. During the first phase, runners simply consumed their habitual high carbohydrate diet (HC). Blood was collected around 0600 following ~48 h of restriction from any intense exercise. A 50-min run in the heat followed by a 5-km time trial was implemented following blood collection to induce significant heat and exercise stress. A fasted blood sample was acquired the subsequent morning to further delineate the influence of exercise stress. This protocol was repeated after 3 weeks during which time runners continued normal training but consumed < 50 g of carbohydrate/day with ~70% of daily calories derived from fat. **RESULTS:** Diet intervention approached ($p = 0.07$) but did not reach significance for glucose. Triacylglycerol did not differ between treatments (pre-exercise HC = 65 ± 17 ; HFLC = 67 ± 35 mg/dL) but decreased ($p < 0.05$) for both treatments 24-h after exercise (HC = 42 ± 16 ; HFLC = 35 ± 21 mg/dL). There was a main effect for diet on HDL-C (pre-exercise: HC = 48 ± 10 and 50 ± 11 ; post-exercise: HFLC = 57 ± 13 and 60 ± 13 mg/dL). There was also a main effect ($p = 0.02$) for diet on LDL-C with HFLC exceeding HC at both collection points by ~20 mg/dL. Total cholesterol was approximately 30 mg/dL higher for HFLC both before and 24-h after exercise ($p < 0.05$). There was no change in VLDL-C and Lp(a). **CONCLUSION:** Implementing a HFLC does not appear to elicit significant negative cardiovascular disease risk in male runners 30-50 years of age with desirable pre-intervention lipid and glucose marker status.

**3575 Board #22 June 3 8:00 AM - 9:30 AM
Effects Of A Low-carbohydrate Diet And Walking Exercise On Inflammation In Type 2 Diabetes.**

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Low-carbohydrate high-fat (LCHF) diets are regaining popularity for improving glucose control in patients with type 2 diabetes (T2D). However, largely based on studies in rodents and findings from cell culture models, concern still remains over the possible pro-inflammatory and cardiovascular risk consequences of consuming a diet high in fat. The well-recognized anti-inflammatory and cardioprotective properties of exercise makes it a potential adjuvant to therapeutic LCHF diets. **PURPOSE:** To determine the impact of a short-term 1) LCHF diet, 2) LCHF diet with daily post-meal walking (LCHF+PW) and 3) low-fat, low glycemic index "guidelines" (G) diet on glucose control, markers of cellular inflammation, and cardiovascular risk factors in patients with T2D. **METHODS:** Nine individuals with T2D (age: 63 ± 9 , HbA1c: 6.7 ± 0.9 , means \pm SD) completed three isocaloric 4-day controlled diet conditions in a randomized crossover design. The LCHF+PW diet included three daily 15-min post meal walks at a light-to-moderate intensity. Glucose profiles were assessed by continuous glucose monitoring. Fasting blood samples were obtained before and after each intervention to measure glucose and lipids. Cellular markers implicated in the pro-inflammatory effects of excess lipids, including monocyte toll-like receptor 2 (TLR2) and 4 (TLR4) and platelet-monocyte aggregates (PMA), were measured by flow cytometry. **RESULTS:** When compared to G (7.3 ± 1.2 mmol/l), both the LCHF (6.6 ± 1.3 mmol/l) and LCHF+PW (6.4 ± 1.1 mmol/l) diets decreased the 4-day

mean glucose concentrations ($p < 0.001$). PMA count per ml increased significantly after G ($+27 \pm 16\%$, $p = 0.02$) but was not significantly altered after LCHF ($+21 \pm 68\%$, $p = 0.06$) or LCHF+PW ($-0.1 \pm 42.5\%$; $p = 0.99$). Median fluorescence intensity of TLR4 on CD16+ monocytes decreased by ~4.3% ($p = 0.05$) after the LCHF diet. No other significant changes were seen in monocyte TLR2 or TLR4 (all $p \geq 0.106$). **CONCLUSIONS:** As compared to a G diet, four days of a LCHF diet reduced hyperglycemia and improved some inflammatory markers in people with T2D. The addition of three daily post meal walks did not appear to further improve glycemic or inflammatory status. Funding from Canadian Institutes of Health Research (MSH-141980) and Medtronic Diabetes.

**3576 Board #23 June 3 8:00 AM - 9:30 AM
Subjective and Objective Measures of Physical Exertion in Adults With and Without Type 2 Diabetes**

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(No relationships reported)

PURPOSE: Regular exercise is a cornerstone of type 2 diabetes (T2D) management because it improves cardiovascular outcomes. However, greater perceived effort at low absolute work rates remains a barrier to exercise for people with T2D. In turn, disparities in perceived effort are linked to poor adherence to regular exercise. It remains unknown if the link between T2D and greater perceived effort is due to lower peak oxygen consumption levels (VO_{2peak}). We hypothesized that exercise effort would be greater in people with T2D at relative work rates below the anaerobic threshold (AT), as compared to healthy counterparts. As T2D impacts VO_{2peak} more profoundly in women than men, we also hypothesized that sex would modify the association between T2D and exercise effort. **METHODS:** During assessment of VO_{2peak} , we measured objective (heart rate (HR)) and subjective exercise effort (Borg Rating of Perceived Exertion (RPE)) every 1 and 2 minutes, respectively. AT was identified by V-slope method. Group differences in RPE and HR were determined at 15%, 25% and 35% of VO_{2peak} . **RESULTS:** We analyzed data from 112 previous adult participants in our laboratory (Table). As compared to nondiabetic participants, we found greater effort (Table) at 25% VO_{2peak} (HR) and at 35% VO_{2peak} (RPE). We found no sex differences in the association between T2D and effort.

	Healthy men and premenopausal women (n = 55)	Men and premenopausal women with T2D (n = 57)	p-value
Age (yrs)	44.7 (6.3)	45.9 (6.1)	
BMI (kg/m ²)	29.4 (3.3)	30.9 (4.1)	
VO_{2peak} (ml/kg/min)	24.5 (6.6)	20.7 (4.5)	
Peak RER	1.22 (0.08)	1.21 (0.11)	
RPE at 15% VO_{2peak}	8.1 (1.5)	8.6 (1.7)	0.24
RPE at 25% VO_{2peak}	9.3 (1.5)	9.3 (2.0)	0.92
RPE at 35% VO_{2peak}	10.2 (1.5)	10.9 (1.6)	0.04*
HR at 15% VO_{2peak}	89.1 (11.5)	91.5 (9.5)	0.13
HR at 25% VO_{2peak}	93.2 (9.3)	96.8 (10.0)	0.02*
HR at 35% VO_{2peak}	101.4 (10.9)	104.2 (10.7)	0.11

Data presented as mean (standard deviation); * $p < 0.05$; Abbreviations: BMI, Body Mass Index; VO_{2peak} , Peak oxygen utilization; RER, Respiratory Exchange Ratio; RPE, Rating of Perceived Exertion; HR, heart rate.

CONCLUSION: T2D status conferred greater objective and subjective exercise effort at some but not all relative work rates below AT in T2D compared to nondiabetic adults. Counter to our hypothesis, there were no sex differences in the association between T2D and effort. Contradictions with our prior studies showing higher exercise effort for participants with T2D may be explained by differences in exercise test protocols and the use of relative work rates. Future research should assess if T2D status influences exercise effort during relative work rates of longer duration. Supported by ADA grants 7-02-CR-25, 1-08-CR-52, 1-12-CT-64

3577 Board #24 June 3 8:00 AM - 9:30 AM
Prediabetes And Diabetes In College-aged Students At A Hispanic-serving Institution In South Texas

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PURPOSE: To quantify the prevalence of prediabetes and diabetes in college-aged students 18-30 years old at a Hispanic-serving institution in south Texas.
METHODS: Fasting glucose levels and hemoglobin A1C levels, along with BMI from two hundred twenty college-aged students 18-30 years old (women: 152, men: 68) were quantitatively analyzed and compared with the American Diabetes Association's (ADA) 2015 prediabetes and diabetes criteria. An independent t-test between females and males identified the statistical significance and variance of the anthropometric measurements and blood biomarkers. These results were organized and analyzed by gender and colleges across campus.

RESULTS: Females fasting glucose (92.56±27.23 mg/dL), A1C levels (5.744±0.922%), as well as BMI (32.72±9.060) and males fasting glucose (96.25±27.52 mg/dL), A1C levels (5.772±1.050%), and BMI (32.41±9.302) were below the blood biomarker levels that define diabetes. However, students showed risk for prediabetes at this young age according to the 2015 ADA prediabetes A1C criteria (5.7-6.4%). The A1C levels across colleges ranged between 5.6% College of Health Affairs (COHA), 5.62% College of Sciences (COS), 5.7% College of Education (COE), 5.71% College of Business and Entrepreneurship (COBE), 5.8% College of Liberal Arts (COLA), 6.0% College of Fine Arts (COFA), and 6.1% College of Engineering and Computer Science (COECS). Females showed a greater prevalence in prediabetic A1C levels at 40.13% with a mean of 5.744, while males exhibited 27.94% at an average of 5.772. The t-test assessment concluded that no statistically significant differences (p<0.05) in fasting glucose levels (p=0.36), A1C levels (p=0.9), and BMI (p=0.81) between genders were found.

CONCLUSIONS: This research targets a young population where early intervention would be most effective. Results indicated that 5 out of the 7 colleges were prediabetic according to the A1C levels. Moreover, the gender comparison in prevalence proved that females were at a greater risk for prediabetes and diabetes than males. These findings suggest that surveillance and education is recommended for the prevention of chronic metabolic conditions in college-aged students at a Hispanic-serving institution.

3578 Board #25 June 3 8:00 AM - 9:30 AM
Omega-3-Fatty Acids Hold Therapeutic Potential for the Prevention and Treatment of Diabetic Neuropathy

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Mice fed a high fat diet exhibit signs of neuropathy including mechanical hindpaw hypersensitivity and neuronal inflammation, suggesting high fat diet-induced inflammation may play a role in the development of neuropathy. Omega-3 (n-3) fatty acids have anti-inflammatory properties and may hold therapeutic potential as a preventative treatment for prediabetic and diabetic patients at risk for neuropathy.
PURPOSE: Investigate the impact of diet composition on signs of neuropathy. We hypothesized that a diet rich in n-3 fatty acids would attenuate hindpaw hypersensitivity during prolonged feeding of a high fat diet. **METHODS:** C57BL/6 mice were randomized into four diet groups (n = 12/group) for 32 weeks: 10% low fat-fish oil (LFFO), 41% high fat-fish oil (HFFO), 10% low fat-lard (LFL), or 41% high fat-lard (HFL). Neuropathy was characterized at baseline and every other week thereafter using the von Frey behavioral test for hindpaw mechanical sensitivity. A glucose tolerance test was performed at end study, and total area under the curve (AUC) was calculated using the trapezoidal method. **RESULTS:** At end study, body weight was greater in HFL compared to all other groups. Body weight was also greater in HFFO compared to LFFO. Fasting glucose and glucose AUC were higher in HFL compared to LFFO and HFFO. Following the same pattern as body weight, fasting glucose was higher in HFFO compared to LFFO. Although percent paw withdrawal was greater in HFL compared to HFFO and LFFO, there were no significant differences for LF vs. HF for fish oil or lard.

End Study Values (32 wks)	Low Fat Fish Oil (LFFO)	High Fat Fish Oil (HFFO)	Low Fat Lard (LFL)	High Fat Lard (HFL)
Body weight (g)	34.3 ± 0.6	39.5 ± 1.6 ^a	37.2 ± 1.1	44.3 ± 1.7 ^{a,b,c}
Fasting glucose (mg/dl)	129.1 ± 5.6	152.0 ± 7.7 ^a	148.1 ± 5.2	158.8 ± 8.8 ^a
Glucose AUC total (mg /120 min / dl)	5368.1 ± 678.9	7282.6 ± 1144.4	7384.3 ± 685.4	9149.6 ± 1013.8 ^a
Percent paw withdrawal (%)	22.5 ± 4.5	29.2 ± 6.4	37.5 ± 7.2	54.2 ± 5.7 ^{a,b}

^aP < 0.05 vs. LFFO; ^bP < 0.05 vs. HFFO; and ^cP < 0.05 vs. LFL

CONCLUSION: A HFL diet induced signs of neuropathy including hindpaw hypersensitivity, whereas a fish oil diet was protective against hindpaw hypersensitivity. Moreover, omega-3-fatty acids may hold therapeutic potential for neuropathy prevention in nondiabetic and diabetic patients.
 Supported by NIH R21NS090282-01

3579 Board #26 June 3 8:00 AM - 9:30 AM
Muscle Specific Overexpression PGC-1α1 Promotes Exercise Adaptations During Western Diet Regardless Of Exercise Volume

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Obesity and its associated comorbidities remain the pivotal public health concern of the 21st century. One interest in the development of insulin resistance is the degeneration and dysfunction of skeletal muscle mitochondria. PGC-1α1, the principle regulator of mitochondrial biogenesis has been proposed as a possible therapeutic target to alleviate lipid overload-induced mitochondrial dysfunction. Yet current data remain controversial on the efficacy of artificially promoting PGC-1α1 as a therapeutic modality. **PURPOSE:** The purpose of this study was to investigate the efficacy of genetic overexpression of PGC-1α1 alone and in combination with physical activity as a therapeutic agent during lipid overload. **METHODS:** wild type (WT, ~20) mice and mice with muscle-specific overexpression of PGC-1α1 (MCK-PGC-1α, ~20) were given Western Diet (WD) at 8 wks of age and allowed to consume food *ad libitum* throughout the course of the study. At 12 wks of age, animals were further divided into sedentary (SED) and physical activity (voluntary wheel running [VWR]) interventions. At ages 7, 11, and 15 wks animals underwent glucose tolerance tests (GTT). At 16 wks of age animals were humanely euthanized and tissues collected for analysis. Results were analyzed by 2X2X3 repeated measures ANOVA with an α=0.05. **RESULTS:** MCK-PGC-1α animals were lighter and had less epididymal fat compared to WT (~6% and ~28% respectively). Food efficiency (weight gained:food consumed) was ~17% lower in MCK-PGC-1α animals. While there was no difference at 7 wks age, at 11 wks age MCK-PGC-1α had ~50% greater GTT integrated area under the curve (IAUC) compared to WT. Yet at 15 wks, VWR had 30% lower IAUC compared to SED, regardless of genotype. MCK-PGC-1α -VWR ran ~3X more per day compared to WT-VWR. Correlations for wheel running distance per day v. IAUC, body weight, and epididymal fat were significant and moderately strong (r=0.67-0.71) for WT-VWR, but in MCK-PGC-1α there was no correlation between these variables and wheel running distance per day (r=0.10-0.20). **CONCLUSION:** These results suggest increasing PGC-1α1 promotes exercise-induced adaptations regardless of exercise volume, but overexpression of PGC-1α1 during lipid overload without physical activity does not mitigate insulin resistance and may in fact exacerbate the condition.

3580 Board #27 June 3 8:00 AM - 9:30 AM
Differential Metabolic Responses to Acute Fatmax and Lactate Threshold Exercise

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Improvements in glucose tolerance and insulin action with aerobic exercise may be the result of increase glucose utilization and/or more complete oxidation of intramuscular triglycerides. **PURPOSE:** To investigate the effect of acute aerobic exercise at an intensity that maximizes the rate of fat oxidation (FM) on glucose tolerance, insulin action, and metabolic flexibility (MF) compared to acute aerobic exercise at lactate threshold (LT) resulting in greater carbohydrate (CHO) oxidation. **METHODS:**

Participants (aged 20.5±1.5y, BMI 29.5±4.7kg/m²) performed a VO_{2max} and baseline 2hr OGTT (n=8). Isocaloric (400 kcal) exercise sessions at FM (41±12%VO_{2max}) and LT (68±10%VO_{2max}) were performed with an OGTT ~24-hrs post-exercise. **RESULTS:** FM exercise elicited significantly (p<0.01) greater fat utilization (18.6±12.1g) than LT (10.1±20.3g) during exercise. Accordingly, LT (82.8±12.1g) exercise elicited significantly (p<0.05) greater CHO utilization than FM (62.4±20.3g) exercise. There was no significant difference in total energy expenditure between FM (416.1±11.4) and LT (422.1±10.4) exercise (p=0.2). However, AUC for glucose was significantly higher for LT exercise than baseline and FM exercise (p<0.05). MF was significantly (p<0.05) reduced post-FM (Δ120-min RER=0.04±0.03) exercise when compared to baseline (0.13±0.04). **CONCLUSION:** LT exercise appears to have deleterious effects on oral glucose tolerance acutely, however, FM exercise does not confer improved MF. These results suggest a disconnect between glucose tolerance and MF and that preferential substrate utilization does not promote comprehensive metabolic improvements acutely in young overweight men.

the final exercise session. **RESULTS:** At baseline, 2AAA and PEDF were positively correlated with HOMA-IR (r = 0.54 and 0.43, respectively) and inversely correlated with insulin sensitivity (r = -0.60 and -0.62, respectively). After the exercise program, body mass and composition were unchanged. The AIT group increased peak cycling power 11% and absolute VO_{2peak} 8% (p<0.05, effect size 0.3 for both) but the CME group did not increase aerobic fitness. HOMA-IR was unchanged in either group but insulin sensitivity during the meal was modestly increased, though only in the CME group (+5%, p<0.03, effect size 0.38). Neither PEDF (-4% overall) nor 2AAA (-12% overall) were significantly altered by the exercise, though the changes in their concentrations were positively correlated with one another (r=0.62). **CONCLUSION:** A short term exercise program has only modest effect on insulin sensitivity in habitually sedentary, overweight adolescents, and does not alter the concentration of either PEDF or 2AAA. Supported by NIH Grant P20 RR024215

3581 Board #28 June 3 8:00 AM - 9:30 AM
The Relationship Between Sedentary Bout Duration And Glucose In Adults With Type 2 Diabetes
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3583 Board #30 June 3 8:00 AM - 9:30 AM
Exercise Prescription in Type 1 Diabetes: Should We Use Percentages of Maximum Heart Rate?
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 (No relationships reported)

Physical activity is important for blood glucose management in people with Type 2 diabetes (T2D). Little research has explored the relationship between sedentary behaviour and mean glucose and glucose variability in people with T2D using objective and continuous measurements. **Aims:** To explore the relationship between sedentary bout duration and mean glucose and glucose variability in people with T2D using objective continuous measurement. **Methods:** 16 participants with T2D managed with diet, Metformin or DPP4 inhibitors were recruited (mean age 64.1±10.9 yr & BMI 29.4±6.9 kg/m²). Participants completed a demographic questionnaire and wore an activPAL accelerometer and FreeStyle Libre continuous glucose monitor for 3-14 days whilst documenting sleep, food and medication. Average proportion of time spent sitting/lying, during the waking day were calculated. Bouts of wake time sedentary behaviour were identified and defined as a period of at least 30 minutes continuous, uninterrupted sitting/lying during the waking day. Correlation analysis was conducted to investigate the relationships between sedentary bout duration and mean glucose, glucose range and glucose coefficient of variation. **Results:** On average, participants spent 65% of their day sitting/lying, 76% of sedentary bouts were ≥30minutes and 29% of bouts were ≥60minutes. Mean glucose was negatively (r = -0.08, p <0.01) associated with sedentary bout duration. Glucose range (r =0.47, p <0.001) and glucose coefficient of variation (r = 0.26, p <0.001) both positively correlated with sedentary bout duration. Participant characteristics such as age, gender and BMI appear to influence the relationship between sedentary bout duration and glucose response. **Conclusions:** Results indicate increased sedentary time leads to improved mean glucose and increased glucose variability.

Physical activity is highly beneficial in patients with type 1 diabetes (T1D). The American Diabetes Association recommends at least 150min/week of moderate intensity aerobic physical activity, defined as 50–70% of maximum heart rate (HR_{max}); however, exercise intensity prescribed as percentages of HR_{max} leads to inhomogeneous cardio-respiratory acute responses when dealing with individuals with T1D where chronic stress may affect β₁-receptor sensitivity. **PURPOSE:** To determine the exercise intensity given as percentages of HR_{max} in T1D patients versus healthy controls (nT1D) related to the degree and direction of the HR performance curve (HRPC). **METHODS:** Eight male T1D patients (25±5 yrs, BMI: 24±2 kg/m², HbA1c: 7.3±0.6%, duration of diabetes: 15±9 yrs) and eight male nT1D (26±5 yrs, BMI: 23±2 kg/m²) performed an incremental exercise test (IET) until exhaustion (start 40 W; increase 20 W/min). nT1D were matched for age and maximum power output (P_{max}), respectively. The first and the second lactate turn points (LTP₁/LTP₂), as well as the direction and degree of the time course of HRPC (k_{HR}), were determined from IET and compared to 50% and 70% of HR_{max}. k_{HR}, power output (P) and HR at LTP₁ were compared between groups in relation to 50% and 70% of HR_{max}. Group differences were calculated by an ANOVA with post-hoc testing, p<0.05. **RESULTS:** No significant differences were found between both groups for HR_{max} and P_{max} (p>0.05). HR at LTP₁ vs. 50%HR_{max} and 70%HR_{max} were significantly different for both groups, except for the nT1D group at 70%HR_{max}. P at 50%HR_{max} was significantly lower than at LTP₁ in both groups; at 70%HR_{max} P was significantly higher only in T1D (p<0.05). Significant differences for P between both groups were only found at 70%HR_{max} (133±17 W vs. 91±38 W, p<0.05) 50%HR_{max} was as low as resting conditions (0 W) in 38% of the T1D group and 50% of the nT1D. k_{HR} was lower in T1D (0.21±0.30 vs. 0.39±0.27) but the difference was not statistically significant (p>0.05). **CONCLUSION:** 50%HR_{max} is clearly too low to induce any training effects even when exercising 150min/week. A lower k_{HR} for the acute HR response in T1D patients indicates a reduced β₁-receptor sensitivity, which needs to be respected for the calculation of target exercise intensities.

3582 Board #29 June 3 8:00 AM - 9:30 AM
Effect of Short-term Exercise Training on Novel Diabetes Risk Biomarkers in Overweight/Obese Adolescents
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 (No relationships reported)

3584 Board #31 June 3 8:00 AM - 9:30 AM
Metabolic Changes After Two Different Exercise Programs In Sedentary Type 2 Diabetic Patients.
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Several novel biomarkers of risk for diabetes in adults have been reported that have not been carefully examined in adolescents with metabolic risk factors. We previously reported that pigment epithelial derived factor (PEDF) is increased in obese adolescents and associated with insulin resistance. 2-aminoadipic acid (2AAA) was shown to predict future diabetes onset in the Framingham study, and to decline in adults following insulin sensitizer treatment. Exercise can also increase insulin sensitivity but it is unknown whether PEDF or 2AAA are altered by exercise in adolescents. **PURPOSE:** To determine whether a short-term exercise program could alter insulin sensitivity, PEDF, and 2AAA in adolescents. **METHODS:** 22 habitually inactive, overweight/obese boys and girls (15±1 y, BMI-z 1.62±0.9, BMI 94±1 %ile, 36±2% body fat) performed 2 supervised and 1 home-based exercise session per week for 5 weeks. Half of the group performed continuous moderate intensity exercise (CME; 45-min walking at 70% HRmax) while the other half performed aerobic interval training of matched total energy expenditure (AIT; 4 x 4-min at 90% HRmax with 3-min recovery intervals at 60% HRmax plus 5-min warm up and cool down). A mixed meal test with blood sampling was performed at baseline and 40 hours after

Purpose: The prevalence of type 2 diabetes mellitus (T2DM) is increasing worldwide and exercise has been shown to be a key component in the prevention of this disease. However, there is limited information comparing metabolic control in T2DM patients after high intensity interval training (HIIT). The purpose of this study was to compare body composition and metabolic changes following 16 weeks of continuous aerobic training (AT) or HIIT in T2DM patients.

Methods: Twenty-four sedentary T2DM patients (age: 46 ± 6 years, body mass index (BMI): 30 ± 5.5 kg/m², glycosylated hemoglobin (HbA1C) 6.3 ± 0.9 %) were included in this study. Maximal heart rate (HR_{max}) and oxygen consumption (VO_{2max}) were measured before and after the interventions. Participants were then randomly allocated to AT (3 times/week, 60 minutes, at 70% HR_{max}) or HIIT (3 times/week, 10 × 1:1 work-to-rest ratio, at ~85% HR_{max}) on a cycle ergometer. Anthropometrics, blood pressure, and metabolic markers (plasma glucose, HbA1c, total cholesterol, triglycerides and HDL) were obtained before and after the interventions. Data are presented as means \pm SD. Statistical analysis included repeated measured ANOVA with LSD *post hoc* analysis.

Results: No significant differences were observed between groups at baseline. Following the interventions, both groups decreased BMI (0.9 ± 0.7 kg/m², $P < 0.04$ vs. 0.03 ± 0.7 kg/m², $P < 0.01$), waist circumference (-0.4 ± 0.7 vs. 2.3 ± 4.8 , $P < 0.001$ for both) and increased VO_{2max} (7.65 ± 3.2 vs. 6.51 ± 3.6 , $P < 0.001$ for both). Although glucose significantly decreased in the HIIT group (-28 ± 46 P < 0.05), it was not significantly different compared to the no change in the AT group.

Conclusions:

Metabolic changes, aerobic fitness and measures of central adiposity were similarly improved in both groups following 16 weeks. Therefore, HIIT is an efficient alternative to continuous aerobic training for diabetic patients who enjoyed high intensity training.

Table 1. Clinical, anthropometric and metabolic characteristics

	HIIT			AEROBIC		
	BASE LINE	FINAL	p	BASE LINE	FINAL	p
AGE (yr)	45.8					
WEIGHT (kg)	71.1 ± 7.5	69.1 ± 7.2	0.7	77.5 ± 19.1	76.9 ± 20.4	0.6
BMI (Kg/m ²)	29.8 ± 4.7	28.9 ± 4.5	0.044	31.9 ± 7.2	31.6 ± 7.7	0.013
SBP (mmHg)	120 ± 10.4	121.0 ± 9.6	0.608	123.6 ± 15.3	120.1 ± 16.2	0.183
DBP (mmHg)	73.9 ± 7.7	73.5 ± 8.0	1.000	73.8 ± 6.9	72.8 ± 7.6	0.711
BF (%)	35.1 ± 6.9	33.4 ± 7.2	0.071	37.0 ± 9.5	36.9 ± 10.4	0.944
MUSCLE MASS (%)	43.4 ± 3.6	43.4 ± 4.0	0.829	44.1 ± 8.15	44.6 ± 7.6	0.638
WAIST C. (cm)	95.8 ± 10.3	90.8 ± 9.6	0.003	101.4 ± 16.7	99.1 ± 16.5	0.001
GLUCOSE (mg/dl)	156.80 ± 60.68	112.38 ± 33.48	0.023	142.20 ± 50.58	145.50 ± 7.98	0.951
HbA1C (%)	6.30 ± 0.93	5.73 ± 0.75	0.144	6.34 ± 0.89	6.55 ± 1.28	0.593
CT (mg/dl)	181.86 ± 36.08	187.07 ± 47.16	0.205	196.93 ± 36.99	192.58 ± 47.20	0.478
HDL-C (mg/dl)	55.60 ± 10.14	55.76 ± 13.24	0.857	51.33 ± 11.51	52.41 ± 12.95	0.542
LDL-C (mg/dl)	90.60 ± 26.70	100.61 ± 38.82	0.079	105.46 ± 33.83	103.83 ± 34.61	0.326
Tg (mg/dl)	178.00 ± 98.54	154.00 ± 54.95	0.589	200.86 ± 78.15	180.58 ± 72.68	0.565
VO2 MAX (ml/kg*min)	29.99 ± 4.62	37.55 ± 4.92	0.001	28.06 ± 5.47	34.57 ± 7.98	0.001

3585 Board #32 June 3 8:00 AM - 9:30 AM

Relationship Between Mitochondrial Respiration and Glucose Tolerance in Individuals at Risk of Type 2 Diabetes

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(No relationships reported)

The relationship between skeletal muscle mitochondrial respiration and development of chronic diseases is a highly contentious topic since assessment of mitochondrial function varies across studies. **PURPOSE:** To determine if ex-vivo mitochondrial respiration of permeabilized muscle fibers is related to postprandial glucose tolerance in individuals at risk of developing Type 2 Diabetes (T2D). **METHODS:** Participants (n=27; ≥ 55 yrs), with impaired fasting glucose (100-125 mg/dL), HbA1c (5.7-6.4%), impaired glucose tolerance (140-200 mg/dL) or family history of T2D twice arrived overnight fasted for an oral glucose tolerance test (OGTT) or a skeletal muscle biopsy. Glucose area under the curve (AUC) was determined after a standard 75g glucose load. Vastus lateralis skeletal muscle samples were permeabilized and evaluated by high-resolution respirometry during 2 substrate-uncoupler-inhibitor-titration (SUIT) protocols. SUIT1 evaluated NADH supported respiration during complex I-linked leak (CI_I) and maximal coupled oxidative phosphorylation (OXPHOS; CI_P) with sequential addition of fatty acid (CI&FAO_P) and complex II-linked carbohydrate substrates to determine OXPHOS (CI+CI&FAO_P) and uncoupled electron transport system (ETS) respiration. SUIT2 used an ADP titration to determine ADP sensitivity followed by evaluation of CI_P, CI+II_P, and ETS capacity. **RESULTS:** All p-values < 0.05. In SUIT1 CI_I (r=-0.45), CI+II&FAO_P (r=-0.48), and ETS (r=-0.50) were negatively correlated with glucose AUC. In SUIT2, CI_P (r=-0.60), CI+II_P (r=-0.46), and uncoupled maximal ETS (r=-0.52) were all associated with glucose AUC, as well as CI_P/CI_I (r=0.63) and CI+II&FAO_P/CI_I (r=0.63). **CONCLUSION:** In both SUIT protocols maximal mitochondrial OXPHOS and ETS were negatively correlated with glucose AUC in participants at risk for T2D. These data suggest that mitochondrial capacity is associated with impaired glucose tolerance and may contribute to the progression of T2D. Further studies will determine if there are defects in proteostatic mechanisms that impair mitochondrial function in these individuals. Funding provided by the National Dairy Council.

ACSM May 30 - June 3, 2017

3586 Board #33 June 3 8:00 AM - 9:30 AM

Neuronal Inflammation: A Potential Contributing Mechanism to High Fat Diet-Induced Neuropathy

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(No relationships reported)

Neuropathy, a debilitating complication of diabetes, has primarily been attributed to poor glycemic control, but has recently been associated with obesity and the metabolic syndrome in nondiabetic individuals. A robust body of evidence indicates that a high-fat diet can induce signs of neuropathy in mice but the pathogenesis of high fat diet-induced neuropathy remains unknown.

PURPOSE: To determine if neuronal inflammation is a potential initiating mechanism for the development of mechanical hypersensitivity and nerve fiber changes (signs of neuropathy) in high fat fed mice. **METHODS:** Male C57Bl/6 mice were randomized to a standard (Std, 15% kcal from fat) or high fat diet (HF, 54% kcal from fat) for 2, 4, or 8 wks (n = 11-12 per group). Lumbar dorsal root ganglia were harvested and inflammatory mediators (IL-1 α , IL-1 β , IL-2, IL-3, IL-4, IL-5, IL-6, IL-10, IL-12p70, IL-17, MCP-1, IFN- γ , TNF- α , MIP-1 α , GM-CSF, RANTES) were quantified using a Multiplex ELISA and normalized to total protein. Neuropathy was characterized by the von Frey test for mechanical sensitivity at wk 0 and every other week thereafter. Hindpaw foot pad skin was harvested at end study and used to quantify intraepidermal nerve fiber density (IENFD) and pain-sensing (TrkA) nerve fibers via immunohistochemistry. **RESULTS:** After 8 wks, HF had greater bodyweight (33.3 ± 1.0 vs. 26.7 ± 0.5 g, p < 0.001), fasting blood glucose (160.3 ± 9.4 vs. 138.5 ± 3.4 mg/dl, p < 0.05) and insulin (3.58 ± 0.46 vs. 0.82 ± 0.14 μ g/L, p < 0.001) compared to Std. IL-1 α and IL-5 were higher in HF compared to Std after 2 wks and 4 wks, respectively (IL-1 α : 4.8 ± 1.3 vs. 2.9 ± 0.6 pg/mg, p < 0.05; IL-5: 5.8 ± 0.7 vs. 3.1 ± 0.5 pg/mg, p < 0.05). IENFD and TrkA fiber density were also higher in HF vs. Std after 4 wks (IENFD: 39.4 ± 1.2 vs. 32.2 ± 1.3 fibers/mm, p < 0.001; TrkA: 30.4 ± 1.8 vs. 22.4 ± 1.3 fibers/mm). There were no significant differences in hindpaw sensitivity for Std vs. HF at any time point. **CONCLUSION:** Increased inflammatory mediators preceded and accompanied an increase in a specific population of pain sensing nerve fibers (TrkA) in the hindpaw footpad of high fat fed mice. Diets high in fat may increase neuronal inflammation and initiate nerve fiber changes responsible for painful neuropathy in nondiabetic and diabetic individuals.

Supported by SIUE Seed Grants for Transitional and Exploratory Projects

3587 Board #34 June 3 8:00 AM - 9:30 AM

Association Between Whole-body Vo2peak And Skeletal Muscle Mitochondrial Respiration In Adults At Risk Of Diabetes

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(No relationships reported)

Whole body oxygen consumption (VO_{2peak}) is a strong predictor of morbidity and mortality. In populations at risk for chronic disease, the relationship between skeletal muscle mitochondrial respiratory capacity and VO_{2peak} is relatively unexplored.

PURPOSE: To identify associations between VO_{2peak} and mitochondrial respiration in adults at risk for Type 2 Diabetes (T2D). **METHODS:** We enrolled 23 older adults (63+/-6yrs) at risk for T2D as defined by impaired fasting glucose (100-126mg/dL), HbA1c (5.7-6.4%), impaired glucose tolerance (140-200mg/dL), or a family history of T2D. VO_{2peak} was measured during a graded exercise test on a cycle ergometer while mitochondrial respiration was assessed in permeabilized skeletal muscle fibers obtained from muscle biopsy samples of the vastus lateralis. Two different substrate-uncoupler-inhibitor-titration (SUIT) protocols were implemented. SUIT1 evaluated carbohydrate supported respiration during complex I-linked leak (CI_I) and maximal coupled oxidative phosphorylation (OXPHOS; CI_P) with sequential addition of fatty acid (CI&FAO_P) and complex-II linked carbohydrate substrates to determine OXPHOS (CI+II&FAO_P) and uncoupled electron transport system (ETS) respiration. SUIT2 utilized an ADP titration to determine mitochondrial ADP sensitivity, as defined by apparent ADP Km, followed by OXPHOS and ETS capacity. **RESULTS:** VO_{2peak} (ml/kg/min) correlated with CI_P (r=0.687, p=0.0003) and ETS (r=0.454, p=0.047). When analyzing relative to VO_{2peak} expressed as fat free mass (FFM), these correlations were further strengthened (CI_P: r=0.694, p=0.0002; ETS: r=0.547, p=0.007). **CONCLUSIONS:** Our findings demonstrate skeletal muscle mitochondrial respiratory capacity is significantly correlated to VO_{2peak} in those at risk for T2D and is strengthened when adjusted for FFM. The data may provide a mechanistic link between mitochondrial dysfunction and the predictive value of VO_{2peak} on morbidity and mortality.

Supported by the National Dairy Council.

3588 Board #35 June 3 8:00 AM - 9:30 AM
The Effect of a Western Diet on Hepatic Autophagy in Age Accelerated SAMP8 Mice
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Non-alcoholic steatohepatitis (NASH) is characterized as a dysregulation of hepatic lipid metabolism and a chronic inflammatory state. It is hypothesized the link between lipid dysregulation and inflammation may be due in part to defective hepatic autophagy and reduced mitochondrial capacity to oxidize fatty acids. It remains to be determined; however, the effects of a Western diet on hepatic autophagy and mitochondrial function during aging. **PURPOSE:** The purpose of this study was to determine the effect of a high-fat high-fructose diet (HFF) on markers of hepatic autophagy and mitochondrial function in an age-accelerated mouse model. **METHODS:** Twenty-week old, male and female, SAMP8 mice (n=49) were randomly assigned, matching for gender, to either a standard chow (SC) or HFF (45% fat, 24% fructose) diet for 32 weeks. Liver tissue was analyzed for mRNA expression of autophagic (BNIP3, Beclin 1, p62, and Atg7) and mitochondrial (PGC-1 α and COX-IV) genes. Differences between gender and dietary groups were identified by a 2 x 2 ANOVA and statistical significance was set at p<0.05. **RESULTS:** Following 32 weeks of feeding, male mice fed the HFF diet were significantly heavier than male mice in the SC group (31.6 g vs 26.5 g; p=0.001); however, no difference was observed between diet groups for female mice. The HFF diet resulted in higher autophagic activity as observed by Beclin 1 (+36%; p=0.001) and BNIP3 (+40%; P=0.003) expression. Despite the higher autophagic activity, p62 was higher (+31%; p<0.001) in the HFF compared to the SC group, suggesting impaired autophagic flux. In addition, mitochondrial COX-IV expression was elevated (+43%; P<0.001) in the HFF group compared to the SC group suggesting increased β -oxidation. Overall, the expression of all autophagic and mitochondrial markers was higher in male compared to female mice; however, both sexes responded similarly to the HFF diet. **CONCLUSION:** Despite the higher expression of autophagic and mitochondrial genes, elevated expression of p62 suggests an impaired autophagic flux in age-accelerated mice following a Western diet.

3589 Board #36 June 3 8:00 AM - 9:30 AM
Fish-oils Increase BAMBI Expression to Protect Against Fibrotic Activity in LPS Stimulated Hepatic Tissue
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 (No relationships reported)

Non-alcoholic steatohepatitis (NASH), defined as excess hepatic lipid and chronic inflammation, provides an environment prone for the development of hepatic fibrosis. Recent evidence suggests that the antifibrotic protein BAMBI (BMP-Activin membrane bound inhibitor) is downregulated in the presence of inflammation, and may be central to the development of fibrosis. Diets rich in omega-3 (ω -3) fatty acids are known to provide anti-inflammatory effects; however, the effects of ω -3 fatty acids on hepatic fibrosis are not well-established. **PURPOSE:** To determine the effects of fish-oils on the hepatic fibrosis signaling cascade, following 32-weeks of high-fat feeding in a LPS-induced model of NASH. **METHODS:** Male C57BL/6 mice were randomly assigned to one of four diets for 32 weeks (n=9/group): low-fat lard based (LFL, 10% kcal fat), low-fat fish-oil based (LFFO, 10% kcal fat), high-fat lard based (HFL, 41% kcal fat), or high-fat fish-oil based (HFFO, 41% kcal fat). Following *in situ* LPS stimulation, liver mRNA expression of CD14, TLR4, MyD88, BAMBI, and TGF- β 1 was quantified using quantitative RT-PCR. Differences between diets were identified using a one-way ANOVA with statistical significance set at p<0.05. **RESULTS:** Following LPS stimulation, CD14 was increased 2.5 fold (p=0.020) in HFFO when compared to HFL. Despite the increase in CD14, TLR4 showed no difference between groups. In contrast, MyD88 was 2.8 fold greater (p<0.001) in HFL compared to HFFO. In comparison to untreated tissue, BAMBI was 1.7 fold (p=0.017) higher in the HFFO LPS-stimulated tissue, which best explained the 1-fold (p=0.004) lower expression of TGF- β 1 in HFFO when compared to HFL post-LPS stimulation. **CONCLUSION:** Despite the increase in extracellular LPS signaling receptor CD14, the consumption of fish-oils produced a protective intracellular response as observed by an increase in BAMBI and decrease in TGF- β 1. These results suggest that a diet high in ω -3 fatty acids may protect against the development of hepatic fibrosis.

3590 Board #37 June 3 8:00 AM - 9:30 AM
Adiposity, Physical Activity and Sedentary Time in Overweight Children With and Without Hepatic Steatosis
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PURPOSE: To examine differences in adiposity, physical activity (PA) and sedentary time (ST) between overweight and obese children with or without non-alcoholic fatty liver disease (NAFLD). **METHODS:** A total of 35 overweight and 54 obese (IOTF) children (46 girls) aged 8- 12y from the EFIGRO trial were included in this study. Hepatic fat content was measured by magnetic resonance imaging and body fat percent (BF%) by Dual X-ray Absorptiometry. Children were categorized into two groups according to the presence (n=41) or absence (n=48) of NAFLD (\geq 4.85% or <4.85% of hepatic fat, respectively). PA and ST were measured using accelerometers over 7 days. PA was categorized into light (LPA), moderate to vigorous (MVPA) and VPA. **RESULTS:** There were not found significant differences in BMI (26.2 \pm 0.5 vs. 25.1 \pm 0.4 kg/m², respectively, age and sex adjusted P=0.10) and obesity percentage (63.4% vs. 58.4%, respectively, adjusted P=0.60) between children having or not having NAFLD. However, BF% was higher in children with NAFLD than in those without NAFLD (41.4 \pm 0.7% vs. 38.7 \pm 0.7%, respectively, adjusted P=0.01). Children with NAFLD spent less time in VPA (6.28 \pm 0.85 vs. 8.51 \pm 0.77 min/day, respectively, P=0.06) and total PA (3517 \pm 99 vs. 3815 \pm 91 cpm, respectively; P=0.03) than those without NAFLD regardless of age, sex and accelerometer wear time, but were diminished after further adjustment for BF%. There were no significant differences in ST, LPA and MVPA between children with or without NAFLD (Ps>0.05). **CONCLUSIONS:** Overweight children with NAFLD had higher adiposity and spend less time in total PA, particularly in VPA, than their peers without NAFLD, regardless of their overweight/obesity status. These results suggest that health intervention programs should promote total PA, especially VPA, to prevent an excess of adiposity and hepatic steatosis in overweight and obese children.
Supported by: PI13/01335, GIU14/21 and FPU14/03329

3591 Board #38 June 3 8:00 AM - 9:30 AM
Effects Of Paradoxal Sleep Deprivation On Liver Functionality Of Sedentary Rats
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 (No relationships reported)

PURPOSE: Evaluate the influence of PSD and sleep recovery (SR) on the integrity and functionality of liver in sedentary rats
METHODS: Thirty male Wistar rats, 3 month old, were distributed into 3 groups: Control (CTRL), submitted to PSD for 96h (PSD96), and PSD for 96h plus sleep recovery period for 96h (SR96). After the protocol, the rats were euthanized and blood sample were collected to analyze corticosterone, insulin, alanine aminotransferase (ALT) and aspartate aminotransferase (AST). A central fragment of liver was process by immunohistochemistry and the 8OHdG, TNF- α , COX-2 inflammation and oxidative stress biomarkers was performed. The data were analyzed by one-way ANOVA with Tukey *post hoc*, p<0.05. The present study was approved by ethics and research committee of Universidade Federal de São Paulo (8357240615). **RESULTS:** The corticosterone and AST concentrations increased in PSD96 and SR96 respectively compared to CTRL (148.87 \pm 71.06 vs 44.58 \pm 24.34; 95.03 \pm 18.47 vs 61.44 \pm 15.5 respectively; P<0.05) and insulin in PSD96 group decreased compared to CTRL (0.96 \pm 0.94 vs 5.72 \pm 2.88 respectively; P<0.05). The qualitative immunohistochemistry analysis showed an increase in 8OHdG and COX2 in SR96 group compared to CTRL (2.4 \pm 0.89 vs 0.66 \pm 0.51; 1.16 \pm 0.40 vs 0.33 \pm 0.51 respectively; P<0.05). No changes were seen for other variables. **CONCLUSIONS:** Hormonal and metabolic changes associated with PSD can modify parameters of inflammation and oxidative stress in the liver of sedentary rats. Physical exercise could be an important strategy to minimize the effects observed with PSD.

3592 Board #39 June 3 8:00 AM - 9:30 AM
Asprosin, A Newly Identified Fasting-Induced Hormone Is Not Elevated In Obesity And Is Insensitive To Acute Exercise

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INTRODUCTION: White adipose tissue is the main source of circulating Asprosin - a newly identified protein hormone encoded by *FBN1*. It triggers hepatic glucose release into the bloodstream in order to maintain hemal energy standards between meals and is suggested to serve as target battling obesity and T2D. In obese male individuals plasma Asprosin levels were found to be increased twofold and in male Ob/Ob-mice, the *Fbn1*-mRNA expression was also elevated in skeletal muscle compared to non-obese animals (Romero et al. Cell 2016). **PURPOSE:** (i) To estimate the basal Asprosin secretion in obese women and (ii) to analyze the changes in Asprosin response after an acute bout of high intensity exercise in obese versus non-obese subjects. **METHODS:** 12 highly obese women (age 47.1±14.2; BMI 47.3±12.7) and 6 men (age 53.7±7.5; BMI 46.3±12.0) were matched to age and sex adjusted controls (age 46.1±13.6; BMI 21.6±2.2, age 52.3±5.0; BMI 23.8±1.5) and their resting serum Asprosin levels were analyzed using the human Asprosin ELISA kit from Wuhan EIAab Science, PR China. To evaluate Asprosin response to an exhaustive bout of exercise 14 obese individuals (10 women and 4 men) underwent an adapted treadmill protocol at individually adjusted speeds between 2 and 4.9 km/h constantly with increasing slopes, finishing >85% of their age-dependent maximal HR. Normal weight recreational athletes, 8 females (age 26.4±5.4; La max 9.0±1.8; HR max 190.6±8.6) and 9 males (age 25.8±6.8; La max 7.3±2.8; HR max 193.0±12.3) serving as controls performed a treadmill running test at a starting speed of 6 km/h with 2 km/h increments every 3 min accompanied by venous blood draws pre- and immediately post exercise. **RESULTS:** Resting Asprosin levels among obese women and men were comparable (19.9±36.7 and 7.1±7.5) and also similar to non-obese subjects (9.2±9.5 and 12.4±10.4) yet with huge individual variations. These results were reflected when individuals experienced acute exhaustive exercise with high interindividual distributions but low intraindividual spreadings applying to obese and lean subjects. **CONCLUSIONS:** Contrary to findings of Romero et al. we could not reproduce differences in Asprosin levels between obese and non-obese subjects. Also an acute bout of treadmill exercise did not affect Asprosin secretion in order to reflect hemal glucose status.

3593 Board #40 June 3 8:00 AM - 9:30 AM
Cross-validation Of The Developed Obesity Cut-off Points For Korean Adults

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 (No relationships reported)

PURPOSE: Establishing valid criteria for the diagnosis of obesity is important for screening and treating obesity-related disorders. Several different cut-off points (CP) have been developed for obesity to predict cardiovascular disease risk factors (CDRF) such as hypertension, dyslipidemia, and diabetes mellitus (DM) in Korean adults; however, there are no cross-validation studies for the developed obesity CP. Therefore, the aim of this study is to examine the diagnostic accuracy of obesity CP. **METHODS:** Data (9,425 adults [≥18 years], male = 4,031) from the 2008 and 2011 Korea National Health and Nutrition Examination Survey was analyzed to examine the accuracy of obesity CP developed using three obesity indices: body mass index (BMI; 23, 24, 25, & 26kg/m²), waist circumference (WC; 84, 85, & 90cm for male; 78, 80, & 85cm for female), and body fat percentage (BF%; 20, 21, & 26 for male; 36 & 37 for female). Participants with CDRF were operationally defined as having one or more of the followings; hypertension, dyslipidemia, and/or DM. CP of BMI, WC, and BF% were evaluated using Youden Index (YI; sensitivity [SE] + specificity [SP] - 1). To evaluate the CP with highest YI, adjusted odds ratios (OR) of having CDRF were calculated while controlling for age, sex, physical activity status, smoking, alcohol consumption, household income, and education level. **RESULTS:** Overall, SE and SP of the CP were low across three obesity indices (SE=29.26-75.86%, SP=46.51-85.98%). CP with highest YI were BMI of 23 (SE=69.25%, SP=53.21%), WC of 84 (SE=62.68%, SP=66.67%), and BF% of 20 (SE=75.86%, SP=46.51%) and BMI of 23 (SE=66.74%, SP=64.86%), WC of 78 (SE=69.52%, SP=67.89%), and BF% of 35 (SE=50.73%, SP=69.64%) for male and female, respectively. Obese adults were more likely to have CDRF compared to

none-obese adults (OR=2.61-2.96, 95% CI=2.19-3.63 for male; OR=2.05-3.00, 95% CI=1.69-3.60 for female, respectively). CP of WC had the highest YI and OR while the CP of BF% had the lowest for both male and female. **CONCLUSIONS:** WC of 84cm for male and 78cm for female were identified as the best obesity CP to predict CDRF for Korean adults. The overall diagnostic accuracy (i.e., SE and SP) of the obesity CP, however, was performed poorly. Therefore, caution is necessary when using the developed obesity CP.

3594 Board #41 June 3 8:00 AM - 9:30 AM
Total Body Adiposity And Accumulated Visceral Adipose Tissue: Influence Of Age, Race/ethnicity And Sex

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PURPOSE: It has been shown that visceral adipose tissue (VAT) does not increase linearly with an increase in total body fat percentage (BF%). Instead, a BF% threshold was identified above which VAT increases more rapidly. The primary purpose of this study was to investigate the effect of age, ethnicity, and sex on the BF% threshold at which the accumulation of VAT increases significantly. **METHODS:** A convenience sample of 3,211 (1,756 females and 1,455 males) participants, 18-75 years of age, who had a dual X-ray absorptiometry scan conducted at The Fitness Institute of Texas between 2008-2016, were included in this study. Self-selected ethnicities were Asian (18.1%), Black (6.7%), Hispanic (19.8%) and White (55.4%). A set of segmented linear regression models for each sex and ethnicity category were specified to estimate thresholds at which the relationship between BF% and VAT mass changed. **RESULTS:** The BF% threshold above which VAT increased more rapidly was identified and it varied between females and males and among ethnicities. The BF% threshold for females were: Asian 29.2%, Black 35.6%, Hispanic 31.7%, and White 34.2%. For males, the BF% thresholds were: Asian 25.3%, Black 23.9%, Hispanic 24.3%, and White 22.8%. There was more variability in VAT mass among participants above the BF% threshold than for those below. In order to attempt to explain this additional variability, age and ethnicity were added as covariates in multiple linear regression models applied to post-threshold participants, for both females and males separately. Post-threshold, the impact of BF% is amplified for older participants controlling for ethnicity for both females ($\beta = 0.28$, SE = .003, $p < .001$) and males ($\beta = 0.81$, SE = .006, $p < .001$), meaning that the VAT increased at a faster rate for older individuals. Controlling for age, BF% has a significantly lower impact on VAT mass for Black females compared to their White counterparts ($\beta = -3.05$, SE = 1.44, $p < .05$) and Asian males compared to their White counterparts ($\beta = -0.11$, SE = 2.3, $p < .001$), meaning that the VAT increased at a faster rate for White females and males than Black females and Asian males. **CONCLUSION:** The BF% threshold above which VAT increased more rapidly was identified and it varied by sex and ethnicity. Post threshold the increase in VAT was affected by age and ethnicity.

3595 Board #42 June 3 8:00 AM - 9:30 AM
Muscle Extracellular Matrix and Metabolic Outcomes Favour Moderate Intensity Training Over HIIT in Obese Mice

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PURPOSE: Skeletal muscle dysfunction is a consequence of obesity, where changes in the extracellular matrix (ECM) and adiponectin dysregulation may play a role. To determine if an exercise regimen can prevent these changes we investigated the effect

of 10 weeks of two isocaloric training programs; moderate-intensity endurance (END) (70% of maximal running capacity (MRC)) or high intensity interval training (HIIT) (50-90% of MRC), in a mouse model of diet-induced obesity.

METHODS: Ten week-old male C57BL/6 mice were fed a high fat diet (HFD) (45% kcal from fat) *ab libitum*, and simultaneously underwent END or HIIT (3x40min sessions/week). Untrained HFD and chow-fed mice acted as controls. After 10 weeks mice were euthanased and *quadriceps* muscle was extracted for analysis.

RESULTS: END and HIIT, each with HFD, showed similar prevention in body weight (BW) gain ($p < .05$) (HFD=45±2g; END=37±2g; HIIT=36±2g), preserved fat-free mass (%FFM) (HFD=58±3; END=72±6; HIIT=72±7), and improved insulin sensitivity (blood glucose_{AUC}) during an insulin tolerance test (0.65 IU/kg*BW) (HFD=41±54; END=350±57; HIIT=320±66 A.U.). HFD induced decreases in grip strength (N) were prevented by END and HIIT similarly (HFD=1.42±0.06; END=1.53±0.10; HIIT=1.51±0.17; $P < .05$). Aerobic performance (treadmill progressive test) was higher in END and HIIT groups compared to untrained HFD, with END being superior to HIIT (2.8±0.5 and 2.2±0.3 fold-change respectively; $p < .05$). Fasting hyperglycaemia and hyperinsulinaemia found in HFD untrained mice (each $p < .05$ vs controls) were each partially prevented by END.

The higher collagen protein deposition found in HFD untrained mice, was not prevented by END nor HIIT. However, decreased collagen-I (~50% of controls; $p < .05$) and increased collagen-III (~2-fold controls; $p < .05$) seen in HFD untrained mice was prevented by both END and HIIT. Only END increased skeletal muscle adiponectin mRNA (14-fold; $p < .05$) compared to HFD untrained. Furthermore, END but not HIIT prevented the HFD downregulation in mRNA level of PGC1 α , and upregulation of UCP2 (1.5-fold; $p < .05$).

CONCLUSIONS: Whilst further research is needed to clarify the differential impact of END and HIIT in muscle function this data favour END training rather than HIIT in having muscle specific and metabolic advantages during high fat feeding.

3596 Board #43 June 3 8:00 AM - 9:30 AM

Kefir Alters Cardiac Function and Left Ventricular Dimensions in a Model of Doxorubicin-Induced Cardiomyopathy

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Doxorubicin (DOX), a powerful anthracycline antibiotic commonly used to treat many different forms of cancer, is associated with the production of reactive oxygen species that cause oxidative damage resulting in cardiac dysfunction. Kefir is a naturally fermented milk product containing antioxidants, probiotic bacteria and yeast.

The antioxidants contained in kefir interact with several types of reactive oxidative species, some of which act to manage oxidative stress. While recent studies suggest that consumption of kefir may have anti-tumor and antimicrobial properties, none have explored its potential for protecting against DOX-induced cardiac dysfunction.

PURPOSE: To explore the effects of dietary kefir on DOX-induced cardiotoxicity in rats. **METHODS:** Singly housed, 10 week old, male Sprague Dawley rats were placed on 1 of 2 isocaloric diets: milk control diet (CON n=24) or kefir diet (KEF, n=23) with equivalent macronutrient profiles. After 8 weeks of dietary intervention, all animals were given either a bolus injection (15 mg/kg) of DOX (CON-DOX, n=12; KEF-DOX, n=11) or saline (CON-SAL, n=12; KEF-SAL, n=12). Cardiac geometry and cardiac function were evaluated using echocardiography 5 days post injection, and data were analyzed using a 2 X 2 ANOVA. **RESULTS:** Significant effects were observed for left ventricular dimension at systole (diet $p=0.01$, drug $p=0.002$), left ventricular dimension at diastole (diet $p=0.01$ and drug $p < 0.0001$), peak mitral flow velocity (diet $p=0.02$ and drug $p < 0.001$), septal wall thickness at diastole (drug $p=0.0013$), ejection time (drug $p = 0.0039$), left ventricular mass (drug $p = 0.0085$), relative wall thickness (drug $p=0.0002$), and filling time (diet $p=0.0006$). **CONCLUSION:** Incorporation of kefir into the diet altered DOX-induced changes in rat cardiac function and morphology. We speculate that kefir may be an alternative strategy in mitigating the deleterious cardiac side effects of anthracycline chemotherapy.

3597 Board #44 June 3 8:00 AM - 9:30 AM

Nexrutine, a Viable Exercise Mimetic for Prostate Cancer Prevention

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(No relationships reported)

Epidemiological data suggests that physical activity (PA) has the potential to decrease the risk of high-grade prostate cancer (PCa). However, for various reasons, cancer patients fail to meet minimum standards for physical activity. For this reason, efforts need to be made to discover biologics that confer the physiological benefits of exercise, serving as an "exercise mimetic." Previous work by our group has discovered that the natural product Nexrutine® (Nx), a bark extract of the *phellodendron amurense*, can inhibit tumor development in prostate, pancreatic and skin cancers. **PURPOSE:** To compare the effectiveness of Nx and exercise in modulating carcinogenesis of the prostate using the transgenic adenocarcinoma of mouse prostate (TRAMP) model. **METHODS:** 10-week old, male TRAMP mice were randomized to exercise, Nx or control groups (n=15 each). Mice randomized to the exercise group were given access to a running wheel and Nx treated mice were fed 600 mg/kg pelleted into their chow. Mice were sacrificed at weeks 4, 8, 12 and 20 weeks. Mice were monitored weekly for tumor development, activity and food consumption. Efficacy of exercise and Nexrutine was determined by histopathological evaluation of the prostate and tissue expression of pAkt and p65, key signaling proteins for carcinogenesis. One-way analysis of variance was performed with significance set at $p < 0.05$. **RESULTS:** No significant pathological changes were observed as a function of time, therefore, data were pooled for analysis. Animals on exercise intervention group ran an average of 4.4 km/day. Both exercise and Nx groups presented with palpable tumors 4 weeks later than the control group. While 100% of animals developed tumors (varying stages), Nx treated and exercising TRAMP mice had fewer poorly differentiated tumors compared to controls ($p < 0.05$). Only Nexrutine expressed lower pAkt in tumors. No differences were seen in p65 expression. **CONCLUSIONS:** Our data provides preliminary evidence that Nx can act as an exercise mimetic in protecting against tumor development in prostate cancer. Though both Nx and exercise decreased advanced stage tumors, only Nx has lower pAkt expression. Therefore, continued efforts need to be made to decipher the mechanisms by which exercise reduces tumors development.

3598 Board #45 June 3 8:00 AM - 9:30 AM

Interfacing Continuous Glucose and Activity Measurement to Compare Glycemia after Exercise or Breaks from Sitting

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Physical activity is effective in the management of hyperglycemia and cardiovascular disease risk in type 2 diabetes (T2D). While light activity breaks in sitting time lower postprandial hyperglycemia in the laboratory, it is unknown whether these benefits are observed in a free living environment. **PURPOSE:** We compared the effect of increasing physical activity by breaks from sitting after meals (BR) or by a continuous morning walk (EX) on daily and postprandial glucose (PPG) concentrations (measured by continuous glucose monitoring). **METHODS:** Thirty individuals with T2D completed EX, BR and a control condition [normal behavior, (CON)] in a free-living environment, but with strict dietary control, over 7 days. Participants wore an activPAL physical activity monitor during the week and this device was used to verify compliance with experimental conditions (increase their total physical activity in EX and BR by 20, 40 or 60 minutes). Using linear mixed models with repeated measures we (1) compared PPG levels across conditions and (2) assessed the dose-response relationship between activity volume (20, 40 or 60 minutes) and glucose responses. Data are presented as mean (95% confidence interval). **RESULTS:** Compared to CON, EX significantly shortened the duration of postprandial hyperglycemia by 11.4% (7.4-15.4%) but BR was not different. In a subset of participants with high postprandial hyperglycemia at CON (n=9): (1) both EX and BR significantly shortened duration of hyperglycemia compared to CON by 23% (7.0-39.8%) and 25% (8.9-42.7%), respectively and (2) the 40 and 60-minute doses of activity significantly lowered mean PPG by a similar amount. **CONCLUSION:** A continuous walk was more effective than breaks from sitting to manage free living glycemia for the group as a whole but both were equally effective in the subset with high postprandial glycemia. The utility of post-meal breaks from sitting to manage glycemia in the latter group may be due to frequent intervals of physical activity throughout the day.
Funding: Clarkson Doctoral Grant and Graduate School Dissertation Grant from UMass Amherst.

3599 Board #46 June 3 8:00 AM - 9:30 AM
Physical Activity and Self-Efficacy in Overweight/obese Adults with Type 2 Diabetes and Concurrent Kidney Disease

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Physical activity (PA) is an important component in the prevention and management of type 2 diabetes and chronic kidney disease (CKD). Determining current patterns and predictors of PA is essential to implement programs that encourage behavior change for patients with these diseases. **PURPOSE:** To describe self-reported PA and self-efficacy among adults with type 2 diabetes and CKD and determine predictors of overall PA patterns. **METHODS:** 76 overweight/obese participants (age: 66±8 y; body mass index [BMI]: 33.0±5.3 kg/m²; sex: 60% male; ethnicity: 91% non-Hispanic white; race: 80% white) with type 2 diabetes and CKD, participating in a technology-delivered lifestyle intervention, completed two well-validated surveys at baseline: International Physical Activity Questionnaire-Short Version and Self-Efficacy for Exercise (SEE) Scale. Biomarkers (hemoglobin A1c, glomerular filtration rate, C-reactive protein) were collected via blood draw. Multiple linear regression was performed to predict total metabolic equivalent (MET)-minutes/week of PA based on biomarkers, BMI, and SEE. Preliminary analyses were conducted to ensure no violation of the assumptions of the regression model. Statistical analyses were conducted using IBM SPSS Statistics (version 22.0). **RESULTS:** Participants self-reported completing (median [interquartile range, IQR]) 594(1435) MET-minutes/week walking intensity, 160(780) MET-minutes/week moderate intensity, 0(960) MET-minutes/week vigorous intensity, and 1431(2938) total MET-minutes/week. 40.8% of participants met the PA guidelines of 150 minutes/week (median [IQR]: 107[346] min/week). Average SEE scores were 55±22 (range 2 to 90). SEE was the only statistically significant predictor of total MET-minutes/week ($\beta=0.364$, $p=0.004$). **CONCLUSION:** Self-efficacy for exercise was a strong predictor of PA in patients with type 2 diabetes and CKD. Social cognitive theory-based programs that build self-efficacy and incorporate PA should be developed to promote risk reduction of these chronic diseases. Given the tendency to self-report higher levels of PA, future studies should include more objective measures of PA to explore these relationships. Supported by NIH Grant R01 DK100492 (PI MA Sevick)

G-28 Free Communication/Poster - Immunology II

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
 Room: Hall F

3600 Board #47 June 3 9:30 AM - 11:00 AM
Physical Activity Patterns and Markers of Muscle Contractile Efficiency in Male Mice

Nicole L. Stott, Luis A. Gonzalez, William T. Gaines, Madison H. Miller, S. Michaela Singletary, Taylor S. Whitsel, E. Paige Williams, Robert S. Bowen. *Truett McConnell University, Cleveland, GA.*
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Removal of endogenous sex steroids appears to alter an organism's molecular and cellular biology resulting in immediate decreases in physical activity levels. In particular, several skeletal muscle genes have been shown to change following removal of gonadal tissues. The observed changes in expression level may be related to skeletal muscle contractile efficiency and may lead to the notable reductions in physical activity. **PURPOSE:** The purpose of this study was to evaluate changes to physical activity patterns and to quantify differences in expression in several muscle-related genes after loss of the sex hormones. **METHODS:** Physical activity patterns were observed in C57BL/6j male mice (n=28) beginning at nine weeks of age. Wheel running distance (km), duration (min), and speed (m·min⁻¹) were quantified following acclimation to wheel running use. Following acclimation, wheel running patterns were assessed under physiological (n=14, sham orchidectomy) and low circulating sex hormone conditions (n=12, bilateral orchidectomy) for ten days. End of study gastrocnemius muscle titin (Ttn; improves muscle elasticity in response to sex hormone treatment), succinate dehydrogenase (Sdhc; maintains myosin function in response to sex hormone treatment), glutathione peroxidase 3 (Gpx3; facilitates contraction by balancing oxidative stress), and mechanistic target of rapamycin (Mtor; marker for changes to protein synthesis) mRNA levels were evaluated via qPCR assays. Activity parameter and gene expression differences were determined via independent samples t-tests. **RESULTS:** Wheel running distance (sham=8.37±1.99

vs. orch=2.82±1.80; $p=0.0000001$), duration (sham=265±51 vs. orch=98±54; $p=0.00000004$), and speed (sham=31.4±2.8 vs. orch=26.1±5.4; $p=0.008$) were higher in sham treated mice than orchidectomized mice. No expression differences were identified for any of the genes of interest. **CONCLUSIONS:** The results of this study further support the notion that wheel running patterns are immediately affected by the loss of the sex hormones in male mice. Observed decrements in wheel running patterns following sex hormone loss are most likely unrelated to changes in expression of several sex hormone responsive genes in gastrocnemius tissue.

3601 Board #48 June 3 9:30 AM - 11:00 AM
The Effect Of Grape Seed Extract On Markers Of Autophagy In Cd4+ T-lymphocytes From Hiv+ Patients

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Autophagy is one of the most ancient and crucial cellular defense mechanisms against invading pathogens. Recently, autophagy has been shown to restrict HIV-1 infection through lysosomal degradation of the HIV-1 transactivator of transcription, a protein necessary for viral replication in CD4+ T-lymphocytes. However, as HIV-1 has evolved strategies to block the autophagic process, it is important to investigate novel approaches of autophagy upregulation. **PURPOSE:** We investigated whether grape seed extract (GSE) would induce autophagy in CD4+ T-lymphocytes from patients infected with HIV-1 when compared to rapamycin (Rapa) treatment (a known inducer of autophagy). **METHODS:** To test the concept of GSE as a novel HIV-1 treatment, CD4+ T-lymphocytes were harvested from three male HIV-1 subjects (45.7±14.2 years) and incubated at 37°C for 24 hours. The cells were then exposed to either dimethylsulfoxide (DMSO; control), bafilomycin (BAF; 100 nM; autophagy inhibitor), BAF + rapamycin, or BAF+GSE (40 µg/mL) and harvested after 2 hours to determine the efficacy of GSE when compared to Rapa (0.5 nM). Cells were then treated with GSE for 6, 24, and 48 hours and harvested for analysis. LC3-II and p62/SQSTM1 proteins and genes were analyzed via Western blot and qRT-PCR, respectively. **RESULTS:** We found no significant difference in LC3-II or SQSTM1/p62 protein responses between 2 hours Rapa (3.09±4.98RQ and 1.43±2.06RQ, respectively) and GSE treatment (2.25±3.37RQ and 1.13±1.82RQ, respectively) in HIV-1 infected CD4+ T-lymphocytes. Following 48 hours GSE exposure, an increase in both LC3-II (10.03±12.29RQ) and SQSTM1/p62 (18.22±30.23RQ) protein expression was observed, indicating increased autophagy. Expression of MAP1LC3B mRNA and SQSTM1/p62 genes increased above baseline for all measured time points, peaking at 6 hours GSE exposure (2.73±3.10RQ and 15.11±17.17RQ, respectively). **CONCLUSIONS:** Our preliminary findings suggest that GSE may be a potent inducer of autophagy in HIV-1 infected CD4+ T-lymphocytes. Further, GSE treatment resulted in elevated autophagy for up to 48 hours following GSE exposure, suggesting GSE supplementation may be beneficial when used with current antiretroviral therapies.

3602 Board #49 June 3 9:30 AM - 11:00 AM
Lactic Acid Suppresses LPS- Induced Mast Cell Activation and Septic Shock

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 (No relationships reported)

Lactic acid levels are associated with mortality in sepsis, making clearance a treatment goal. However it is unknown if lactic acid contributes to immunosuppression in the late phase of sepsis or if it is solely a consequence of bacterial infection. **PURPOSE:** To determine the effects of lactic acid on LPS-mediated mast cell activation in vitro and in a mouse model of septic shock. **METHODS:** Bone marrow derived mast cells (BMMCs) were cultured in vitro ± lactic acid for 24-hours prior to lipopolysaccharide (LPS, 1 µg/mL) activation. For the septic shock model, an intraperitoneal (IP) injection of lactic acid (80 mg/kg) or PBS was given to C57BL/6J mice 20-hours prior to an IP injection of LPS (25 mg/kg) or PBS. Cytokine production was determined via ELISA in the supernatant or plasma, respectively. **RESULTS:** In vitro, lactic acid significantly suppressed cytokine production (pg/mL ± SEM) compared to the media control: IL-6 (3438.6 ± 352.9 vs. 5734.9 ± 953.6, $p < 0.01$) at concentrations ≥ 6mM and TNF (12.2 ± 2.9 vs. 87.4 ± 16.4, $p < 0.01$) and MCP-1 (296.5 ± 47.6 vs. 717.2 ± 75.9, $p < 0.01$) at concentrations ≥ 12.5 mM. These effects are dependent upon pH, as sodium lactate had no effect on IL-6 (15391.0 ± 2541.0 vs. 17909.1 ± 1948.6, $p = .79$) and formic acid suppressed IL-6 (9797.1 ± 935.4 vs. 17909.1 ± 1948.6, $p < .01$). Additionally, lactic acid effects are transient, since activation in fresh media following a 24-hour treatment with lactic acid did not suppress IL-6 (7423.3 ± 1094.9 vs. 6975.8 ± 535.8, $p = .99$). Similar to the results in vitro, lactic acid significantly suppressed IL-6 (54, 917.6 ± 4508.0 vs. 69,451.6 ± 2283.6, $p < 0.01$) and MIP-1a (53.1 ± 9.9 vs. 149.8 ± 47.9, $p < 0.01$) levels in vivo, with a trend towards reduced TNF and MCP-1. There

was no effect of lactic acid on temperature or observational score. **CONCLUSION:** These findings suggest that elevated lactic acid levels in sepsis patients may attenuate immune cell activation. This information may improve our understanding of immunosuppression in the late phase of sepsis and could reveal new molecular targets for treatment, for which there are currently none. Supported by NIH grants: 1R01AI101153 and 2R01AI059638

3603 Board #50 June 3 9:30 AM - 11:00 AM
The Effect of Creatine Supplementation on Upper Body Strength and Immune Function in Men

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(No relationships reported)

PURPOSE: The purpose of this study was to examine the effect of creatine (CR) loading on upper body strength and immune system function in men. **METHODS:** Using a double-blind design, physically active males (X age \pm SD = 22 \pm 3 yr) were randomly assigned to a CR (n=22) or placebo (PL; n=22) group and were instructed to consume their respective treatments (20 g d⁻¹; CR monohydrate or maltodextrin in powder form) dissolved in water over four equal time periods for 5 d. At baseline (BL) and after the 5 d loading phase, body weight (BW) and one-repetition maximum bench press (1 RM BP) were assessed. At BL and 5 d, a 50 ml blood draw was also extracted in five EDTA tubes and one serum separation tube to obtain lymphocytes and serum. Immunomodulatory effects of CR were determined using RT-PCR to analyze the mRNA expression of pro-inflammatory cytokine tumor necrosis factor- α (TNF- α), while a creatinine assay was used to measure the amount of creatinine present in the sera. Data were analyzed using 2 x 2 (group x time) repeated measures ANOVA and statistical significance for all tests was $p < 0.05$. **RESULTS:** There were no significant interactions or treatment effects for BW or 1 RM BP, however, there was a significant main effect for time with both groups demonstrating an increase in BW (PL = 0.13 kg; CR = 0.46 kg) and 1 RM BP (PL = 1.76 kg; CR = 2.06 kg). There was a significant interaction for serum creatinine, and a significant treatment effect for TNF- α mRNA levels. Post-hoc tests revealed that the CR group demonstrated a significant increase in serum creatinine levels, and significantly lower TNF- α mRNA levels after the 5 d loading phase compared to PL. **CONCLUSIONS:** The changes in BW and serum creatinine observed in the CR group following a 5 d loading phase are consistent with previous research. However, this is one of the first studies using human subjects to show that CR significantly reduced TNF- α mRNA expression, which suggests that it may have an anti-inflammatory effect. Future studies are warranted to further define CR as an immunomodulator and should focus on determining the expression of other pro-inflammatory mediators and markers. **Acknowledgements:** Supported by LB692 and MusclePharm® (CR supplement).

3604 Board #51 June 3 9:30 AM - 11:00 AM
Exercise During Chemotherapy May Reduce Pain By Strengthening Co-regulatory Couplings In The Cytokine Network

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PURPOSE: Chemotherapy is hypothesized to cause pain partly via dysregulation of the inflammatory cytokine network - namely, by weakening the normal co-regulatory couplings between concentrations of pro- and anti-inflammatory cytokines. Although research suggests that exercise reduces pain in cancer patients by favorably influencing individual markers of inflammation, no studies have examined whether exercise influences the co-regulatory couplings between concentrations of pro- and anti-inflammatory cytokines. The purposes of this study were to assess how regulation of the inflammatory cytokine network is (1) affected by exercise and (2) related to pain. **METHODS:** We performed simple network analyses (i.e., correlations matrices) on data from 348 cancer patients enrolled in a randomized trial of chemotherapy plus 6 weeks of moderate-intensity walking and resistance exercise (N = 173) vs. chemotherapy alone (N = 175) in mixed-type, early/mid-stage cancer patients (mean age = 56, 93% female). At pre- and post-intervention, patients (1) provided blood to assess concentrations of IL-1 β , IL-6, IL-8, IL-10, IFN γ , and sTNFR1 via ELISA and (2) reported pain in the last 7 days (0=not present, 10=as bad as you can imagine). **RESULTS:** Compared to chemotherapy alone, exercise plus chemotherapy strengthened the normal co-regulatory couplings between changes in concentrations of

several pro- and anti-inflammatory cytokines - specifically, between IL-6 and all other cytokines ($p < 0.05$) and between IL-10 and all other cytokines ($p < 0.05$). Among exercise participants, decreased pain was associated with strengthened co-regulatory coupling between changes in concentrations of IL-6 and IL-10 ($r = -0.18, p = 0.047$). **CONCLUSIONS:** Exercise strengthened the regulation of the inflammatory cytokine network via strengthened co-regulatory couplings between concentrations of pro- and anti-inflammatory cytokines. The strength of co-regulatory coupling between IL-6 and IL-10 may mediate the beneficial effects of exercise on pain, considering that IL-6 and IL-10 are known to contribute to the physical conditioning effects of exercise. Our novel methods to analyze cytokine data may complement traditional analytic approaches in the investigation of immune-mediated phenomena beyond this study.

3605 Board #52 June 3 9:30 AM - 11:00 AM
The Influence of Menstrual Cycle on Salivary Antimicrobial Proteins during Endurance Exercise

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The oral-respiratory mucosal immunity is important to prevent upper respiratory tract infection after exercise for athletes. Lysozyme and lactoferrin, as salivary antimicrobial proteins, play an important role in first-line defense against invading microbials. The responses of saliva flow rate and composition during exercise are influenced by the sympathetic nervous system. Additionally, the sympathetic nervous system is affected by the menstrual cycle. However, the changes in salivary antimicrobial proteins following exercise at different phases of the menstrual cycle remains unclear. **PURPOSE:** To examine the influence of the menstrual cycle on salivary antimicrobial proteins level at rest and in response to an acute bout of endurance exercise. **METHODS:** Eight healthy recreationally active females completed a cycling exercise at 70% V(O₂)_{peak} for 45 minutes at two time points of the menstrual cycle: during the mid-follicular phase (day 8 \pm 2) and the mid-luteal phase (day 21 \pm 2). All participants have a regular menstrual cycle and have never taken oral contraceptives. Timed unstimulated saliva samples were obtained before, immediately after, and 1 hour after exercise and analyzed for salivary antimicrobial proteins. The concentrations of lysozyme and lactoferrin were measured using enzyme immunoassays. **RESULTS:** The menstrual cycle modified the resting levels of lysozyme (follicular: 23435.0 \pm 314.0 vs. luteal: 15951.7 \pm 7743.4 ng/mL, $p < 0.05$). The menstrual cycle did not significantly modify the levels of lactoferrin at rest (follicular: 4896.6 \pm 1885.0 vs. luteal: 5300.0 \pm 2488.2 ng/mL, NS). Lysozyme concentration was increased after exercise ($p < 0.01$) and lactoferrin concentration was increased immediately after exercise ($p < 0.01$) and 60 minutes after exercise ($p < 0.05$) but unaffected by the menstrual phase. Saliva flow rate was slightly reduced after exercise but not significantly altered by the menstrual cycle. **CONCLUSION:** The pattern of salivary antimicrobial protein secretion in response to endurance exercise was not influenced by the menstrual cycle. These findings indicate that the regular menstrual cycle may not need to be considered when assessing oral-respiratory mucosal immune responses to acute endurance exercise.

3606 Board #53 June 3 9:30 AM - 11:00 AM
Post-STEMI Age-related Non-classical Monocyte CCR2 Expression Differences In Response To Stress Hormones

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C-C chemokine receptor 2 (CCR2) plays an important inflammatory role following ST segment elevation myocardial infarction (STEMI) by regulating the chemotaxis of monocytes to damaged tissue. Circulating non-classical monocytes are responsible for debris clearance following STEMI and are positively correlated with age in healthy individuals, as well as increased plaque area in cardiovascular disease (CVD) patients. While post-STEMI non-classical composition within the monocyte population has been defined in CVD patients, age related differences in monocyte phenotypic characteristics and response to stress hormones remains unclear. Specifically, epinephrine (EPI) and cortisol (CORT), which are elevated during exercise, have been shown to both affect immune cell function and positively correlate to infarct size. **PURPOSE:** To determine the *in-vitro* effects of CORT and EPI on non-classical monocyte CCR2 expression in young and old patients post-STEMI. **METHODS:** Blood was collected from 19 volunteers 72 hours post-STEMI. Samples were grouped by age (<50 [YNG, n=7, 38.7 \pm 6.0 yrs] or \geq 50 [OLD, n=12, 61.7 \pm 6.9 yrs]). Blood was diluted to 1 x 10⁶ cells/mL and cultured for 4 hours either unstimulated, stimulated with EPI (10⁻⁸M), or CORT (10⁻⁶M). Cultures were stained against CD14, CD16, and CCR2. Flow cytometry was performed and non-classical monocytes were determined based on CD14 and CD16 expression. **RESULTS:** Unstimulated CCR2 expression

in non-classical monocytes was neither significantly different between groups (50.75 ± 22.91 [YNG] vs. 71.52 ± 28.79 [OLD], $p=0.104$), nor was there a significant correlation between age and CCR2 expression ($r=0.44$, $p=0.059$). However, there was a significant difference in non-classical monocyte CCR2 expression following EPI (47.69 ± 7.22 [YNG] vs. 80.74 ± 45.60 [OLD], $p=0.03$) and CORT (44.29 ± 21.27 [YNG] vs. 83.77 ± 30.53 [OLD], $p=0.008$). **CONCLUSION:** The results suggest an age-related difference in non-classical monocyte CCR2 expression after EPI and CORT stimulation. It is plausible that aged individuals have an increased sensitivity to EPI and CORT, which increases non-classical monocyte CCR2 expression. Post-STEMI exercise prescriptions may need to be modulated in older individuals to account for exercise induced hormonal responses. Supported by NIH Grant R34HL121402

3607 Board #54 June 3 9:30 AM - 11:00 AM
Exercise Normalizes Dysfunctional Adipose Tissue Phenotype in FGF21-Null Mice

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 (No relationships reported)

Adipose tissue (AT) immunometabolic health predicts systemic metabolic health. Exercise improves metabolic function and insulin sensitivity and is thought to improve AT metabolism by reducing AT inflammation. Fibroblast growth factor 21 (FGF21) is a pleiotropic hormone-like protein that has been shown to have beneficial effects by improving glucose and lipid metabolism and may have beneficial effects on AT immunometabolic function. However, it is unknown whether exercise-induced AT adaptations are mediated through FGF21. **PURPOSE:** To determine the role of FGF21 in exercise-induced adaptations in white (W) and brown (B) AT. **METHODS:** Male FGF21 knock-out (KO) and wild type (WT) mice were fed normal chow and either exercise trained via voluntary wheel running (EX) or kept sedentary (SED) for 8 weeks. Visceral (i.e., epididymal), subcutaneous (inguinal region) WAT, and BAT (interscapular region) depots were removed, weighed and flash-frozen in liquid nitrogen. Techniques used: EchoMRI - body composition, real-time PCR - gene expression, Western blotting - protein content, and H&E staining - histology. **RESULTS:** FGF21KO mice weighed more ($p<0.05$) and had greater overall adiposity. In addition to having greater systemic insulin resistance (IR) based on HOMA-IR ($p<0.01$), AT from FGF21KO mice was more insulin resistant ($p<0.01$) based on fasting plasma insulin and free fatty acids. EX decreased AT IR ($p<0.01$) but only tended to decrease HOMA-IR ($p=0.112$). Phospho-Akt and GLUT4 proteins were increased in AT of FGF21KO mice, combined with increased IR, is suggestive of dysregulated glucose uptake. In WAT and BAT, inflammatory and oxidative stress genes (e.g., MCP-1, TNF α , CD11c, P22phox) were significantly upregulated in FGF21KO and normalized by EX. Mitochondria content, indicated by COX III and IV protein, were significantly reduced in BAT of FGF21KO. **CONCLUSION:** Absence of FGF21 increases AT IR as well as WAT and BAT inflammation; EX rescues this phenotype. Normal WAT mitochondrial adaptations to EX may be adversely affected by loss of FGF21. Metabolic dysfunction in FGF21KO appears largely due to excess AT, and is almost completely normalized by EX. Supported by grant number R25GM056901 from the NIGMS of the NIH, VA-CDA2 IK2BX001299 (RSR), and MU Research Board, Corporate Advisory Board, and Research Council.

3608 Board #55 June 3 9:30 AM - 11:00 AM
Resistance Exercise and Polyphenol Supplementation elicits Unique Recruitment of Monocyte Subsets in Untrained Men

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 (No relationships reported)

PURPOSE: To examine the monocyte subset response to resistance exercise and supplementation with an aqueous proprietary polyphenol blend (PPB) sourced from *Camellia sinensis*. **METHODS:** Untrained men ($n=38$, 22.1 ± 3.1 yrs; 174.0 ± 7.9 cm; 77.8 ± 14.5 kg) were randomized to: PPB ($n=13$), placebo (PL; $n=15$) or control (CON; $n=10$). PPB and PL supplemented for 28 days prior to an acute bout of resistance exercise, consisting of 10 repetitions at 70% of 1-RM for the squat (6 sets), leg press (4 sets) and leg extension (4 sets). Blood was drawn pre (PR),

immediately (IP), 1 (1H), 5 (5H), 24 (24H) and 48 (48H) hours post exercise (PPB/PL), or rest (CON). Biopsies were obtained from the vastus lateralis at PR, 1H, 5H and 48H. Plasma and intramuscular monocyte chemoattractant protein-1 (MCP-1) was assessed by multiplex assay. Relative percent of classical (CLAS; CD14⁺⁺/CD16⁻), intermediate (INT; CD14⁺⁺/CD16⁺) and nonclassical (NC; CD14⁺/CD16⁺) monocytes were assessed via flow cytometry. Repeated measures ANOVA were applied, and non-normally distributed data were LN transformed. **RESULTS:** A group x time interaction was observed for circulating MCP-1 ($p=0.005$), which was greater at 5H in PPB (502.0 ± 154.2 pg·ml⁻¹; $p=0.001$) and PL (416.8 ± 109.9 pg·ml⁻¹; $p=0.012$) than CON (307.3 ± 142.6 pg·ml⁻¹). A time effect was observed for intramuscular MCP-1 content ($p<0.001$), with elevations observed (PR: 9.6 ± 5.0 pg·mg⁻¹; $p<0.001$) at 1H (374.2 ± 388.8 pg·ml⁻¹), 5H (595.7 ± 528.6 pg·ml⁻¹) and 48H (217.0 ± 189.1 pg·ml⁻¹). Interactions were observed for CLAS, INT and NC ($p<0.001$) populations. At IP, CLAS was reduced in PPB ($86.2 \pm 7.6\%$; $p=0.008$) and PL ($85.9 \pm 5.1\%$; $p=0.003$) versus CON ($93.8 \pm 4.3\%$). At 1H, PPB ($96.3 \pm 2.0\%$; $p=0.002$) and PL ($95.3 \pm 4.0\%$; $p=0.006$) was greater than CON ($90.8 \pm 4.3\%$). INT were greater at IP in PPB ($4.9 \pm 2.3\%$; $p=0.034$) and PL ($6.0 \pm 2.0\%$; $p=0.001$) than CON ($2.9 \pm 1.8\%$) and reduced at 1H in PPB ($1.6 \pm 1.0\%$; $p=0.003$) and PL ($2.0 \pm 1.2\%$; $p=0.008$) versus CON ($3.4 \pm 1.6\%$). PPB was greater than CON at 24H ($6.7 \pm 2.9\%$; $4.0 \pm 0.9\%$; $p=0.016$) and 48H ($7.9 \pm 3.4\%$; $4.1 \pm 1.6\%$; $p=0.007$). NC was greater at IP in PPB ($8.9 \pm 6.9\%$; $p=0.020$) and PL ($8.1 \pm 4.0\%$; $p=0.028$) than CON ($3.4 \pm 3.2\%$). **CONCLUSIONS:** Exercise resulted in increased MCP-1 and the mobilization of specific monocyte subsets. Supplementation with PPB may augment the monocyte response. Funded by Kemin Foods, L.C.

3609 Board #56 June 3 9:30 AM - 11:00 AM
Acute Resistance Training Induced Increases in Plasma Interleukin-6 are Volume-dependent

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Exercise induces an inflammatory immune response, which is evidenced by the release of numerous cytokines. Specifically, interleukin-6 (IL-6) is of unique relevance, as exercise-induced release is mediated primarily by contracting skeletal muscle. Accordingly, elevations in IL-6 have been observed following various exercise modes, including resistance training. However, there is limited data comparing the IL-6 response between high-repetition (HR) and low-repetition (LR) resistance training programs. **PURPOSE:** To examine the effect of an acute bout of resistance training on changes in circulating IL-6 levels and to compare the response between volume-equated HR and LR training sessions. **METHODS:** Sixteen males (Age: 23 ± 3 yrs, Body Mass: 84.4 ± 12.3 kg, Body Fat Percentage: $11.7 \pm 4.7\%$) with at least two yrs. of resistance training experience were counterbalanced by relative strength and assigned to one of two groups (high repetition-HR or low repetition-LR), which performed one resistance training session of back squat and bench press: HR ($n=8$): 4 sets of 12 repetitions at 60% of one-repetition maximum (1RM) or LR ($n=8$): 8 sets of 6 repetitions at 75% of 1RM. 10ml blood was obtained from the antecubital vein 30min. prior to and immediately following the resistance training session. Samples were centrifuged and plasma was stored at -80°C until further analysis. IL-6 concentrations were analyzed in duplicate, via a commercially available enzyme linked immunosorbent assay. A 2x2 repeated measures ANOVA with a Tukey post-hoc was used to determine changes in IL-6 response. Significance was set at $p \leq 0.05$. **RESULTS:** A significant time effect was detected for IL-6 response in both groups: HR (0.71 ± 0.19 to 1.39 ± 0.18 pg/mL; $p<0.001$; $+95.77\%$) and LR (0.53 ± 0.10 to 1.27 ± 0.10 pg/mL; $p<0.001$; $+139.62\%$); however, no group differences ($p=0.46$) were observed. **CONCLUSION:** An acute resistance training bout incorporating multi-joint exercises effectively elicits a circulating IL-6 response. Further, in a trained population, this phenomenon appears to occur in a volume-dependent manner as the magnitude of IL-6 increase did not vary with repetition range.

G-29 Free Communication/Poster - Motor Control Across the Lifespan

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3610 Board #57 June 3 9:30 AM - 11:00 AM

Motor Unit Action Potential Sizes of the First Dorsal Interosseous in Young and Older Individuals

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Slopes from the motor unit action potential size (MUAP_{size}) vs. recruitment threshold (RT) relationships provides a non-invasive measurement of MU sizes. As such, the slopes (AP_{slopes}) may be able to quantify age-related MU atrophy. **PURPOSE:** To determine if AP_{slopes} differed between young and old individuals. **METHODS:** Twenty two young (YG, age = 22.5±2.7 yrs) and ten aged (OG, 61.0±2.0 yrs) subjects completed the investigation. Surface electromyography signals were recorded from the first dorsal interosseous (FDI) during an isometric trapezoidal muscle action with the steady force plateau set at 50% maximal voluntary contraction (MVC). The signals were decomposed to yield MUAP_{sizes} and RTs for each MU. The AP_{slopes} was calculated via the MUAP_{sizes} vs. RT relationships for MUs recruited between 10 and 50% MVC for each subject. Few MUs with RTs < 10% MVC were observed in young or old and, thus, these MUs were excluded from the slope calculation. FDI cross-sectional area (CSA) and echo intensity (EI) were quantified using ultrasonography. Possible differences in AP_{slopes}, CSA and EI between groups were examined with independent samples t-tests. **RESULTS:** OG demonstrated significantly reduced AP_{slopes} (OG: 0.033 ± 0.010; YG: 0.048 ± 0.020; p = 0.048) and greater EI (OG: 41.3 ± 7.0 AU; YG: 50.6 ± 7.5 AU; p = 0.002), however, CSA was similar between YG and OG (OG: 2.22 ± 0.47 cm²; YG: 2.09 ± 0.31 cm²; p = 0.438). **CONCLUSION:** The AP_{slopes} suggested non-uniform differences in MUAP_{sizes} in relation to RT, likely due to reduced sizes of higher threshold MUs. Higher threshold MUs have been suggested to contain a greater proportion of type II muscle fibers, which demonstrate greater age induced atrophy than type I fibers commonly associated with lower threshold MUs. As such, the difference in AP_{slopes} suggested atrophy of higher threshold MUs in OG. In addition, OG's elevated EI indicates greater infiltration of adipose and connective tissue into the muscle. Greater EI in combination with similar CSA may indicate a reduced contractile tissue volume in the OG, supporting the speculation that the AP_{slopes} differences were due to MU atrophy.

3611 Board #58 June 3 9:30 AM - 11:00 AM

Ankle Proprioception And Soccer Skills in Youth Recreational Players

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Evidence suggests that ankle proprioceptive ability is significantly correlated with soccer performance level. It has not been determined if ankle proprioception is associated with specific soccer skills in youth recreational soccer players. **PURPOSE:** to investigate the relationship between ankle proprioception and soccer skills in youth recreational players. **METHODS:** twenty-seven youth recreational soccer player (mean 14.8 years old, range 13-17), without ankle injury during the past 3 months, participated in this study. Their passing, shooting and dribbling skills were assessed by using the reliable and valid Soccer Skill Tests (Russell et al. 2010). Ankle proprioception was measured by using the active movement extend discrimination apparatus (AMEDA) in standing. **RESULTS:** Ankle proprioceptive discrimination accuracy scores were significantly positively correlated with passing, shooting and dribbling accuracy scores (r=0.52, r=0.71, and r=0.53, respectively; all p<0.01). Further, participants who had history of ankle injury beyond 3 months performed significantly worse in both ankle proprioception and shooting accuracy tests than those who did not (F_{1,25}=5.01, p=0.03, and F_{1,25}=5.77, p=0.02, respectively). **CONCLUSION:** Findings here highlight the importance of ankle proprioception for soccer skills in youth recreational soccer players. Future research is needed to determine if there is a causal relationship between poor ankle proprioception and injury history, because this is crucial for talent identification, ankle injury prevention and rehabilitation in youth soccer players.

3612 Board #59 June 3 9:30 AM - 11:00 AM
Force-Time Characteristics During A Reactionary Gripping Task: Effects Of A 10-Week Introductory Judo Course

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(No relationships reported)

Judo is an intermittent sport associated with explosive movements reliant on static and dynamic grip strength. Analysis of force-time curves has been implemented in many judo related analyses; however, the effects of judo training in novice practitioners as an intervention is absent.

PURPOSE: To examine the effects of a 10-week introductory judo class on a reactionary gripping task.

METHODS: Sixteen healthy men (age: 22.6±3.4yr; height: 172.5±6.4cm; body mass: 78.8±13.2kg), 8 in an introductory judo class and 8 age-matched controls, were recruited. All participants performed 3, 5s maximal voluntary isometric contractions with their right hand on a handgrip dynamometer before and after the 10-week intervention. The handgrip dynamometer was connected to a data acquisition system and the force-time curve was constructed from the raw voltage data and analyzed with computer software. The variables measured were: peak force (PF), average force (AVGF), rate of force development (RFD), time to PF (TPF), force at peak RFD (F@RFD), 1s impulse (AUC1) and 2s impulse (AUC2). A 2x2 [group (judo vs. control) x time (pre vs. post)] repeated measures ANOVA was used to assess all force-time curve parameters.

RESULTS: No differences were observed between groups within any variable (Table 1). However, there was a statistically significant main effect for time (post > pre) in AUC2 (F = 5.75, p = 0.031, η² = 0.291).

CONCLUSIONS: A 10-week introductory judo class did not have an effect on handgrip performance during a reactionary gripping task. Future studies should examine longer training interventions or the force-time characteristics during gripping between novice and experienced judokas.

Table 1. Force-time curve characteristics during a reactionary gripping task before (Pre) and after (Post) the 10-week intervention

	Judo (n=8)		Controls (n=8)	
	Pre	Post	Pre	Post
PF (mV)	1.707 ± 0.240	1.773 ± 0.201	1.697 ± 0.220	1.696 ± 0.183
TPF (s)	2.539 ± 0.985	2.025 ± 0.682	2.346 ± 0.772	2.622 ± 0.510
AvgF (mV)	1.498 ± 0.215	1.551 ± 0.157	1.483 ± 0.218	1.533 ± 0.176
AUC1 (mV·s)	1.412 ± 0.206	1.454 ± 0.166	1.378 ± 0.188	1.436 ± 0.155
AUC2 (mV·s)	2.987 ± 0.472	3.162 ± 0.386*	2.965 ± 0.415	3.048 ± 0.323*
RFD (mV/s)	6.600 ± 1.260	6.182 ± 1.297	6.971 ± 1.615	6.880 ± 1.812
F@RFD (mV)	1.196 ± 0.167	1.241 ± 0.150	1.205 ± 0.129	1.243 ± 0.139

*Statistically significant from Pre (p<0.05). PF = Peak force; TPF = Time to peak force; AvgTP = Average force; AUC1 = 1s impulse; AUC2 = 2s impulse; RFD = Maximal rate of force development; F@RFD = Force at maximal rate of force development. Data presented as Mean±SD.

3613 Board #60 June 3 9:30 AM - 11:00 AM

Differences in Mobility Among Older Adults are Associated with Motor Unit Activity and Muscle Strength

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Advancing age is often accompanied by declines in muscle function and walking performance, which likely involve changes in the discharge characteristics of motor units in key leg muscles. **PURPOSE:** To determine the associations between the discharge characteristics of motor units in leg muscles during steady contractions and performance on functional tests of walking endurance, chair rise time, and maximal walking speed of older adults. **METHODS:** 20 healthy older adults (8 men, 72 ± 4 yrs) were recruited to participate in up to 4 experimental visits spanning ~10 wks. Motor unit characteristics were assessed by decomposing surface EMGs detected with a grid of 4x8 electrodes placed over the medial gastrocnemius (MG), lateral soleus (LS), and tibialis anterior (TA) muscles during 30 s isometric contractions with the plantarflexors (PF) or dorsiflexors (DF). The target torque was 10% or 20% of maximum. Time to walk 400 m (205 ± 43 s), time to rise and sit as quickly as possible from a chair five times (8 ± 2 s), and maximal walking speed over 10 m (2.3

± 0.5 m/s) were measured in the same visit. A best-subsets regression was performed to identify predictor variables from which the models with the lowest Bayesian Information Criterion score for each functional task was selected as the regression model. **RESULTS:** Data acquired from 70 trials were decomposed into the discharge times of single motor units, yielding data for 5,146 motor units: 1,086 from MG, 1,582 from LS, and 2,477 from TA. The mean coefficient of variation for interspike interval (ISI) during the 20% LS task ($0.47 \pm 0.2\%$) and mean ISI during the 10% LS task (150 ± 27 ms) explained 54% of the variance for 400 m walk time ($p < 0.0001$). The mean ISI during the 10% LS task, PF maximal torque (23 ± 12 N•m), and mean ISI during 10% TA task (105 ± 18 ms) explained 38% of the variance in chair rise time ($p < 0.001$). Mean ISI during the 20% MG task (145 ± 25 ms) explained 18% of the variance for 10 m walking time ($p < 0.0001$). **CONCLUSION:** Significant amounts of the variance in tests of physical function for older adults were explained by the discharge characteristics of motor units in leg muscles during steady isometric contractions and the strength of the plantarflexors. However, the predictor variables differed across the three tests of physical function.

3614 Board #61 June 3 9:30 AM - 11:00 AM
Reliability of the V-Wave during Maximal Voluntary Plantar Flexion Exercise

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An emerging technique to quantify supra-spinal contributions to neuromuscular function is the V-wave. However, little data exist regarding its day-to-day reliability in comparison to traditional measures such as MVC and motor unit recruitment assessed via twitch interpolation. **PURPOSE:** To determine the reliability of the V-wave in comparison to MVC, evoked twitches, and motor unit recruitment across 4 testing visits. **METHODS:** Eleven men and women were tested on 4 separate occasions over the course of 7-10 days. During each visit, transcutaneous electrical stimulation was applied over the tibial nerve while surface EMG recordings were obtained from the soleus muscle. Initially, single 1 ms pulses were delivered every 5 to 10 seconds in ascending increments of 5 mA until evoked M-wave amplitude peaked. Participants then performed 3, 3-second maximal voluntary isometric contractions. During each contraction, a supramaximal stimulus (150% M-max) was applied 2.5 seconds into the contraction with control twitches occurring 2 and 4 seconds following relaxation. V-wave amplitudes were determined from the peak-to-peak amplitudes of the EMG signal following the stimulation during MVC. Intra-class correlation coefficients ($ICC_{3,1}$) were calculated to determine test-retest reliability and repeated-measures ANOVAs were used evaluate the means between the 4 testing visits. **RESULTS:** No differences were observed between visits for motor unit recruitment 83 ± 19 , 89 ± 14 , 95 ± 9 , and $95 \pm 9\%$ ($p = 0.06$); twitch force 117 ± 33 , 109 ± 29 , 112 ± 28 , and 108 ± 25 N ($p = 0.61$), or the V-to-M ratio 0.42 ± 0.23 , 0.50 ± 0.28 , 0.49 ± 0.21 , and 0.48 ± 0.22 ($p = 0.65$). MVC increased across the test days ($p = 0.008$), but did not differ ($p = 0.68$) between days 3 (707 ± 220 N) and 4 (695 ± 188). Motor unit recruitment ($0.77-0.91$), twitch force ($0.86-0.91$), MVC ($0.95-0.97$), and the V-to-M ratio ($0.79-0.84$) exhibited adequate test-retest reliability that tended to improve over time. **CONCLUSIONS:** Our findings indicate the magnitude of V-wave remains stable over multiple testing days despite measured changes in motor unit recruitment and force. Indicating changes in spinal excitability and/or antagonist co-activation rather than altered supra-spinal input may underlie the changes in force and motor unit recruitment.

3615 Board #62 June 3 9:30 AM - 11:00 AM
Unilateral Fatiguing Exercise And Its Effect On Relative, Percent Change Differences Between Vastus Lateralis Muscles

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ABSTRACT. Relative, percent change differences between homologous vastus lateralis muscles across different resting muscular lengths have not previously been reported following the cessation of unilateral fatiguing aerobic exercise. **PURPOSE:** The purpose of the present study was to compare contralateral cross-over adaptations following unilateral fatiguing exercise, between different aerobically trained populations, across resting postural positions (RPPs) that incorporated different hip and knee joint angles. **METHODS:** Twenty healthy, college-aged men (mean \pm SD; age = 22.9 ± 3.5 years and 22.8 ± 2.6 years; height = 181 ± 7.5 cm and 180 ± 5.9 cm; weight = 87.2 ± 10.7 kg and 85.2 ± 10.5 kg; BMI = 26.6 ± 3 kg/m² and 26.2 ± 2.2 kg/m²; dominant thigh skinfold thickness = 15.1 ± 4.6 mm and 14.55 ± 5.3 mm; non-dominant thigh skinfold thickness = 15.55 ± 3.5 mm and 15.2 ± 3.8 mm; and VO₂ peak 25.1 ± 4.3 ml/kg/min and 44.7 ± 3.7 ml/kg/min, for the 10 novice and 10

advanced trained participants, respectively) exercised on an upright cycle ergometer, using only their dominant limb, for 30 minutes at 60% of their VO₂ peak. Resting surface electromyographic (sEMG) and mechanomyographic (MMG) signals were measured prior to and following exercise. **RESULTS:** The results indicated that the relative, percent change difference of the normalized MMG amplitude values were 7.6% and 4%; 9.1% and 7.5%; 5.7% and 3.9%; and 3.7% and 2%; while the results for the relative, percent change difference of the normalized MMG mean frequency values were 4.7% and 5.7%; 8.4% and 7.4%; 4.2% and 3.2%; and 2.7% and 3.7% (for the upright sitting position with legs extended 180° [1]; upright sitting position with legs bent 90° [2]; lying supine position with legs extended 180° [3]; and lying supine with legs bent 90° [4], respectively), for the novice and advanced groups, respectively. **CONCLUSION:** Our results provide further evidence to the concept that muscles are capable of possessing MMG activity post-exercise, despite a lack of sEMG signals. Additionally, our results suggest that there may be multiple neural and mechanical mechanisms concurrently contributing to the contralateral cross-over adaptations observed across the post-exercise recovery time course.

3616 Board #63 June 3 9:30 AM - 11:00 AM
Is There A Cessation Of Motor Unit Remodeling As A Compensatory Strategy To Age-related Motor Unit Loss?

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Despite the compensatory process of collateral reinnervation to counteract human age-related muscle fiber denervation, a substantial loss of functioning motor units (MUs) occurs which seems to be accelerated after the 7-8th decades of life. However, it is not known whether there is a limitation or cessation of this process in very old age because to date MU remodelling has not been explored in those above ~85 years of age. **PURPOSE:** To explore in an accessory elbow extensor muscle electrophysiological factors including, motor unit number estimations (MUNE) and measures of compensatory MU remodeling in men in their 9th and 10th decades of life. **METHODS:** A maximal compound muscle action potential (CMAP) was recorded from the anconeus in 8 healthy men aged to 82-91 years. Decomposition-enhanced spike-triggered averaging was used to collect surface and intramuscular electromyography (EMG) from the anconeus during a series of submaximal (30% and 50% of the maximal root mean squared (RMS) EMG of the anconeus) voluntary isometric elbow extensor contractions. In addition, motor unit potential (MUP) analysis was performed to provide a detailed assessment of neuromuscular status. **RESULTS:** Results were compared with a young cohort (~25y of age) published previously using the same procedures. Participants in the current study had CMAPs of ~3 mV, surface motor unit potentials (S-MUPS) of ~168 and ~232 μ V at 30 and 50% RMS, resulting in a MUNE of ~23 and ~16 at the two respective intensities. In contrast young adults had CMAPs of ~5.5 mV, but similar S-MUPS of ~155 and ~240 μ V at 30% and 50% RMS compared with the old. These values indicate a significant loss of muscle mass, but due to no difference in S-MUPS the old do not show signs of collateral reinnervation. **CONCLUSION:** Thus, compensatory remodeling may no longer be a viable process to counteract age-related loss of MUs in the very old; although this could be muscle or activity dependent.
 Supported by NSERC

3617 Board #64 June 3 9:30 AM - 11:00 AM
The Difficulty Of EMG Burst Identification: Visual And Bayesian Changeoint Analysis

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Surface electromyography (EMG) is commonly used to add physiologic context to observed patterns of movement. The onset of the EMG is often used to determine when a person responds to stimuli or to identify maladaptive muscle coordination strategies. Our research group has previously shown that Bayesian Changeoint Analysis (BCP) is superior to the standard linear envelope methodologies when determining a single EMG onset in a data series. **PURPOSE:** Examine the effectiveness of visual inspection and the novel BCP algorithm to detect EMG bursts in multiple muscles during complex movements. **METHODS:** Muscle activity from 10 healthy subjects was collected from the gastrocnemius, biceps femoris, and vastus lateralis muscles using surface EMG electrodes (4kHz sampling rate). Subjects completed 4 minutes of exercise on three modalities: treadmill running, ergometer cycling and stair climbing. All exercises were performed at self-selected low-to-moderate intensities. Six to ten seconds of EMG was collected at 90 and 210 seconds into the exercise. Three researchers visually identified the number of bursts in a trial twice

(randomized, double-blind methodology). The instances where all six identifications (three reviewers, twice) agreed on the number of bursts, were compared with the identification results from the BCP algorithm. **RESULTS:** While the within rater reliability (ICC: 0.85) and between rater reliability (ICC: 0.83) were good, the visual review only resulted in 111 trials (out of 180) where all raters agreed on the number of bursts (61.7% total agreement). The correlation between the number of bursts raters identified and the BCP algorithm was moderate (Pearson's R: 0.52). Furthermore, across all trials, there was a difference of 711 EMG bursts between the two methods. **CONCLUSIONS:** While visual assessment of the EMG is the "gold standard" for burst detection, its reproducibility is generally poor in dynamic tasks. Despite initial success with the BCP algorithm in determining EMG onset, the current iteration of the algorithm is insufficient for EMG burst identification in complex waveforms. This work highlights the need for a standardized algorithm of EMG burst detection, but also indicates that further work is necessary to make algorithms of sufficient accuracy and reliability.

3618 Board #65 June 3 9:30 AM - 11:00 AM
Comparisons Between Voluntary Muscle Activation And Evoked V-wave Responses As A Function Of Torque

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The interpolated twitch technique is used to assess motor unit recruitment during voluntary actions. The V-wave is a complementary measure indicating supra-spinal contributions to force. No study has examined the relationship of these measures as a function of increasing force production. **PURPOSE:** To compare the magnitude of ITT assessed motor unit recruitment to V-wave amplitude during contractions of increasing force. **METHODS:** Thirteen men and women volunteered to participate in this study. Transcutaneous electrical stimulation was applied over the tibial nerve while surface EMG was recorded from the soleus muscle. Single 1 ms pulses were delivered every 5 to 10 seconds in ascending increments of 5 mA until the M-wave amplitude plateaued. Participants then performed 3, 3-second maximal voluntary contractions. During each contraction, a supramaximal stimulus (150% M-max) was applied 2.5 seconds into the contraction with control twitches occurring 2 and 4 seconds following relaxation. Lastly, 3 randomized series of submaximal contractions (20%, 40%, 60%, and 80% of MVC) were performed under the same stimulation conditions. Values for % recruitment and the V-to-M ratio were averaged across the 3 efforts at each force level. Repeated measures ANOVAs were conducted to examine changes in recruitment and the V-to-M ratio as a function of force. **RESULTS:** Recruitment increased as force increased ($p < 0.01$) from $6 \pm 14\%$ to $51 \pm 18\%$ to $82 \pm 13\%$ to $94 \pm 11\%$ to $95 \pm 8\%$ at 20%, 40%, 60%, 80%, and 100% of MVC, respectively. All values differed from each other ($p < 0.05$) except for values from 80% and 100% of MVC ($p = .75$). Similarly, the V-to-M ratio also increased ($p < .01$) as force was increased—with values increasing from $5 \pm 3\%$ to $13 \pm 8\%$ to $23 \pm 7\%$ to $38 \pm 18\%$ to $48 \pm 20\%$ at 20%, 40%, 60%, 80%, and 100% of MVC, respectively. Unlike recruitment all values for the V-to-M ratio differed from each other ($p < 0.05$). The increase in recruitment as a function of force was modeled with a polynomial equation ($R^2 = 0.99$) while a linear model better fit the relative V-to-M ratio ($R^2 = 0.97$). **CONCLUSION:** As the demand for force production increases, supra-spinal output increases in a linear manner while recruitment plateaus around 80% of MVC. As recruitment plateaus, the increased supra-spinal input likely increases rate coding to augment force production.

3619 Board #66 June 3 9:30 AM - 11:00 AM
Exploring Bilateral Handgrip Forces Control During Inter-limb Coordination Task After Hemiparetic Stroke: A Preliminary Study

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Interhemisphere cooperation plays an important role in daily living because the most functional performances of daily activities require the participation of bilateral hands simultaneously. However, the influence of stroke-related impairments on bilateral handgrip forces control between hands was still unclear. Therefore, it is necessary to develop a quantitative method to directly evaluate the coordination performances of two hands in stroke patients. **PURPOSE:** The purpose of this preliminary study was to investigate interhemisphere cooperation by analyzing inter-limb force control and coordination during inter-limb coordination tasks. **METHODS:** Seven stroke participants (Brunnstrom motor recovery stage III recovery or beyond, mean age = 57.0 ± 7.8 y/o) were recruited and asked to execute maximal voluntary contraction

(MVC) tests and inter-limb coordination tasks with reciprocal grasping, holding, and releasing of a dynamometer of two hands at two target force levels (20% and 40% MCV of paretic hand). The force outputs of the participant's hands were recorded and the alternating time of cross point (from non-paretic to paretic hand and paretic to non-paretic) in force generation was calculated and identified for the evaluation of bimanual coordination in both hands. Differences in non-paretic and paretic grip force and changes in hand-grip performance at two targeted force levels were determined using paired samples t-test and two-way ANOVA. **RESULTS:** The results demonstrated that the alternating time in non-paretic to paretic hand was longer than in paretic to non-paretic hand condition at 20% ($41.3 \pm 15.6\%$ vs. $23.7 \pm 12.0\%$, $p = .006$) and 40% ($52.8 \pm 19.4\%$ vs. $26.0 \pm 14.6\%$, $p = .004$) inter-limb coordination tasks. No significant changes in the force modulation timing between the non-paretic and paretic hand at different force levels were found ($F = .608$, $p = .443$). **CONCLUSION:** This is the first study to directly evaluate the capacity and quality of coordination control via the grip force between two hands and demonstrate the non-hemiparetic brain controlling non-paretic hand has greater coordination control ability than hemiparetic brain during bilateral force modulation for stroke patients, which may provide useful information on developing effective exercise interventions in stroke rehabilitation.

3620 Board #67 June 3 9:30 AM - 11:00 AM
Inter-individual Variability In The Mechanomyographic Frequency Response During A Sustained Isometric Force Task

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Inter-individual variability in the mechanomyographic frequency response during a sustained isometric force task.

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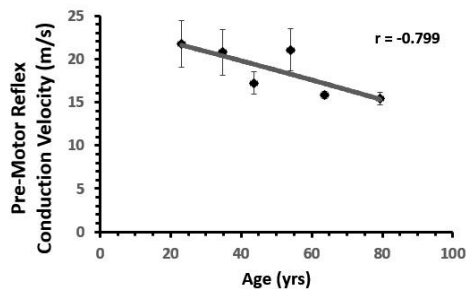
There is recent evidence that suggests a relationship exists between the frequency content of the mechanomyographic signal (MMG MNF) and motor unit activity. The fatigue-based changes that occur in the MMG MNF during a sustained force task may provide insight regarding the alterations in motor control that lead to task failure. **PURPOSE:** To examine the individual patterns of response for MMG MNF during a sustained submaximal isometric force task to failure. **METHODS:** Twenty males (mean \pm SD: age = 24 ± 3 years) volunteered for this investigation and were familiarized with the procedures prior to testing. Before the fatigue test, the subjects maximal voluntary contraction force (MVC_0) of their dominant elbow flexors was established. The subjects then performed a sustained submaximal isometric force task (60% MVC_0) for as long as possible. A piezoelectric accelerometer was used to detect the MMG signal from the biceps brachii. Polynomial regression was used to determine the relationships for MMG MNF versus time for each subject. **RESULTS:** The results indicated significant ($p < 0.05$) relationships for MMG MNF versus time for all subjects, and that the majority of subjects demonstrated curvilinear reductions in MMG MNF during the fatigue task. Specifically, the relationships were fit with linear (4 of 20, $R^2 = 0.72$), quadratic (12 of 20, $R^2 = 0.49$), and cubic (4 of 20, $R^2 = 0.86$) models. **CONCLUSIONS:** These results demonstrated that the MMG MNF response was capable of monitoring the fatigue-based changes in muscle function that progressed to task failure. The consistent declines exhibited for MMG MNF during the sustained isometric force task likely reflects alterations in the twitch properties of the contributing motor units. The inter-individual variability in the patterns of response may be due to differences in training status, muscle fiber type composition, or subject-specific motor control strategies related to the demands of the fatigue task.

3621 Board #68 June 3 9:30 AM - 11:00 AM
An Examination of Patellar Tendon Reflex Pre-Motor Conduction Velocity across the Adult Lifespan

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It is known that aging is accompanied by a loss in muscle mass and motor units. However, the direct cause for the loss of motor units has not been identified. One possible mechanism could be related to changes in the sensory input motor neurons receive. Therefore, it is important to find objective measures to quantify sensory function that are sensitive to changes with aging. **PURPOSE:** To determine if the conduction velocity of a patellar tendon reflex is sensitive to aging. **METHODS:** One hundred and one volunteers participated in this study. Tendon taps were delivered to the patellar tendon of each subject while surface electromyographic (EMG) signals were recorded from the rectus femoris. The pre-motor reflex latency was calculated as the time from the onset of the hammer-strike to the onset of EMG activity. This latency (s) was adjusted for femur length (m) to instead provide a pre-motor conduction velocity (CV; m/s). The subjects were then grouped and averaged into intervals based on age as follows: 18 - 29 yrs. ($n = 50$), 30 - 39 ($n = 10$), 40 - 49 ($n = 6$), 50 - 59 ($n =$

16), 60 - 69 (n = 13) and > 70 (n = 6). Linear regression was applied across the mean age and pre-motor CV from each interval. **RESULTS:** Pre-motor CV was negatively related to age ($r = -0.799$; $p = 0.028$). The resulting regression equation was $y = -0.1113x + 24.216$. The group averaged data as well as the line of best fit are shown in the figure below. **CONCLUSION:** Our findings show that the conduction velocity of a patellar tendon reflex is significantly related to age. Therefore, this variable may be useful in future studies that wish to track changes in sensory function across age.



3622 Board #69 June 3 9:30 AM - 11:00 AM

Motor Execution And Imagery With Greater Task Difficulty Increases Corticospinal Excitability

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PURPOSE: To elucidate the influence of task difficulty during actual and imaginary force control by the unilateral first dorsal interosseous muscle (FDI) on the corticospinal excitability of 1) the contracting and contralateral resting hands and 2) the resting hand, respectively. **METHODS:** Seventeen young adults were asked to perform isometric abduction with their left index fingers (contracting hand) at 5 and 15% of maximal voluntary contraction (MVC) with visual guidance in actual force control task and to imagine isometric abduction at 15% MVC in imaginary force control task with the same procedure to actual force control task. Task difficulty was adjusted by the size of range about target force displayed on the computer monitor, which was defined by upper and lower lines, i.e., $\pm 7\%$ of target force between lines as 'easy' task and 0% of target force between lines as 'difficult' task. Subjects actually or imaginarily attempted to match their abduction force within the target range as steady as possible. In each task, transcranial magnetic stimulation was applied twenty times to the optimal scalp position for eliciting the motor evoked potential (MEP) in FDI overlying right or left motor cortex. The averaged MEP was normalized by the maximal motor response (% Mmax) that was obtained during supramaximal electrical stimulation to the ulnar nerve. **RESULTS:** In actual force control task, the MEP of the contracting hand was significantly larger ($P < 0.05$) during difficult task (24.8% Mmax) compared with easy task (22.3% Mmax) when collapsed across force levels. The MEP of the resting hand was also significantly larger ($P < 0.05$) in difficult task (12.3% Mmax) than in easy task (9.5% Mmax) when collapsed across force levels. In imaginary force control task, the MEP for difficult task (11.0% Mmax) was significantly larger ($P < 0.05$) compared with that for easy task (8.1% Mmax) in the resting hand. **CONCLUSION:** These results indicate that 1) actual force control task with greater task difficulty increases corticospinal excitability of the contracting hand, and 2) corticospinal excitability of the resting hand is enhanced when subjects actually and imaginarily perform force control task with greater task difficulty by the unilateral hand.

3623 Board #70 June 3 9:30 AM - 11:00 AM

Bilateral Arthrogenic Muscle Inhibition in the Soleus Muscle Following Acute Ankle Sprain

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Arthrogenic muscle inhibition (AMI) is characterized by decreased spinal excitability, and has been suggested to be one of the neurophysiological mechanisms responsible for muscle dysfunction following joint injury. AMI has been found in individuals with chronic ankle instability, yet it is unclear whether AMI is present in patients with acute ankle sprain (AAS). **PURPOSE:** To determine the effects of AAS on spinal excitability in lower leg muscles. **METHODS:** Nineteen subjects with AAS within 72 hours of the injury onset (10 females; age=21 \pm 2.7 years; height=173.2 \pm 9.2cm; weight=71.7 \pm 11.7kg) and 19 healthy controls without any history of ankle sprain (10 females; age=22 \pm 2.2 years; height=170.8 \pm 9.2cm; mass=68.9 \pm 14.2kg) participated.

Hoffman reflex (H-reflex) was used to quantify AMI. H-reflex tests of the soleus, fibularis longus, and tibialis anterior were performed bilaterally in the prone position. Maximum peak-to-peak amplitudes of H-reflexes (H-max) and motor waves (M-max) were recorded. Since H-max significantly varies between individuals, it was normalized to M-max to obtain a $H_{max}:M_{max}$ ratio for each muscle. Separate two-way ANOVAs with repeated measures were performed to compare groups (AAS, control) and limbs (injured, uninjured) for each of the muscles. The alpha level was set at <0.05 . **RESULTS:** There were no significant group-by-limb interactions for all muscles: the soleus ($F_{(1,34)}=1.763$, $P=0.19$), fibularis longus ($F_{(1,32)}=1.194$, $P=0.28$) and tibialis anterior ($F_{(1,32)}=0.887$, $P=0.35$). However, there was a significant group main effect for the soleus ($F_{(1,34)}=5.219$, $P=0.029$). The $H_{max}:M_{max}$ ratio in the AAS group (0.56 \pm 0.04) was significantly lower than in the healthy control group (0.68 \pm 0.04). No significant main effects were found in the fibularis longus ($F_{(1,31)}=0.084$, $P=0.77$) and tibialis anterior ($F_{(1,32)}=1.255$, $P=0.27$). **CONCLUSION:** AMI in the soleus muscle was present bilaterally in patients with AAS, which provides insight into neurophysiological mechanisms responsible for bilateral muscle dysfunction following the unilateral acute injury.

Supported by Texas State University College of Education

3624 Board #71 June 3 9:30 AM - 11:00 AM

Changes In Motor Unit Recruitment And De-recruitment Strategies Are Not Associated With The Repeated-bout Effect

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The "repeated bout effect" (RBE) is an adaption that attenuates muscle damage following eccentric exercise. Several neural adaptations have been proposed to underlie the RBE. **PURPOSE:** This study used decomposition of surface EMG signals (dEMG) to examine the relationship between recruitment (RT) and de-recruitment thresholds (DRT) and changes in firing rates or motor units during recruitment and de-recruitment prior to and following eccentric exercise resulting in the RBE. **METHODS:** Nine participants performed 5 sub-maximal isometric trapezoid contractions at force levels corresponding to 50% and 80% of maximal isometric strength (MVC). Eccentric exercise was then performed until biceps brachii MVC had decreased by ~40%. MVC, range-of-motion (ROM), and delayed onset muscle soreness (DOMS) were measured 24-hours, 72-hours, and 1-week following eccentric exercise. Three weeks later all procedures were repeated. EMG signals of the biceps brachii were decomposed into individual motor-unit action potential trains. The relationship between RT and DT was examined using linear regression. The slope of the change in mean firing rate (MFR) during the ramp-up and ramp-down phase of the trapezoid contraction was also examined. **RESULTS:** No changes were found in the slope of the RT vs DT relationship for 50% MVC (1.13 \pm 0.17 vs 1.29 \pm 0.43; $p=0.42$) and 80% MVC (1.09 \pm 0.18 vs 1.25 \pm 0.41; $p=0.25$). There were also no changes in the y-intercept of the RT vs DT relationship at 50% (-13.79 \pm 6.77 vs -15.37 \pm 17.07; $p=0.80$) and at 80% (-9.29 \pm 10.71 vs -23.07 \pm 20.28; $p=0.06$) of MVC. The mean slope of the increase in firing rate during recruitment did not change between bouts 10.2 \pm 1.8 vs 10.5 \pm 2.2 pps/s ($p=0.77$) and 8.4 \pm 0.7 vs 9.0 \pm 1.6 pps/s ($p=0.28$) for 50% and 80% of MVC, respectively. The slope of the decrease in firing rate during de-recruitment did not differ at 50% of MVC -9.7 \pm 1.5 vs -10.2 \pm 1.8 pps/s ($p=0.48$), but became steeper during contractions at 80% of MVC -7.3 \pm 0.9 vs -8.7 \pm 1.7 pps/s ($p=0.04$). However, no relationship was observed between the change in DT slope and the magnitude of the RBE. **CONCLUSION:** A bout of eccentric exercise conferred protection from a subsequent identical bout. Few changes in motor-unit recruitment and de-recruitment behavior were observed suggesting changes in these parameters are not responsible for the RBE.

3625 Board #72 June 3 9:30 AM - 11:00 AM

Myosin Heavy Chain Influences Firing Rate Behavior from Moderate to High Intensity Targeted Forces

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PURPOSE: It is suggested the ratio of myosin heavy chain (MHC) isoforms and their influence on twitch forces and fatigability effect motor unit (MU) behavior. However, no study has correlated changes in MU firing rates among moderate- to high-intensity contractions with MHC area *in vivo*.

METHODS: Twelve individuals (age=20.89 \pm 2.52 yrs, weight=72.03 \pm 14.02 kg) performed 3 isometric maximal voluntary contractions (MVC) of the leg extensors on an isokinetic dynamometer followed by randomly ordered isometric muscle actions at 50, 70, and 90% MVC. An electromyographic (EMG) sensor was placed over the

VL. EMG signals were decomposed to extract action potentials and firing events of single MUs. Only MUs with > 90% accuracy were used for analysis. Recruitment thresholds (REC Thresh) and mean firing rates (MFR) were calculated for each MU. MFR was calculated as the average value of the MFR trajectory during steady force. Subjects gave a muscle biopsy of the VL. Type I %MHC area was determined by SDS-PAGE. Linear regressions were performed for the 50% MVC, whereas inverse exponential regressions were performed on the 70% and 90% MVC to determine the slopes and y-intercepts for the MFR vs REC Thresh relationships. Predicted firing rates at target force were calculated from the regression equations for each subject for MUs with a REC threshold of 5-45% MVC in 5% increments. To examine changes in MU firing rates in relation to REC Thresh, predicted firing rates from the 70% and 90% MVC were normalized to the predicted firing rate value for the 50% MVC. For each REC Thresh, linear regressions were performed on the normalized firing rate values vs contraction intensity. Pearson's product moment correlations were calculated comparing the slopes and type I %MHC area. Alpha was set at 0.05.

RESULTS: Pearson's product moment correlations were significant among type I %MHC area and the slopes of the change in predicted firing rates vs contraction intensity for MUs with a REC thresh of 35, 40, and 45% MVC ($P < 0.05$; $R = -0.754$ to -0.669).

CONCLUSIONS: Individuals with lower percentages of type I MHC area had greater increases in MU firing rates with increments in targeted forces for MUs with REC Thresh of 35 - 45% MVC. This may indicate that MU firing rate and recruitment patterns differ as a function of MHC area.

3626 Board #73 June 3 9:30 AM - 11:00 AM

Fatiguing Knee Extensors Has Differential Effects on Contralateral Homologous and Non-Related Heterogenous Muscles

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Non-local muscle fatigue (NLMF), defined as a temporary motor performance deficit in a non-exercised muscle group following a fatiguing protocol on a different muscle group, has been gaining attention in the recent decade.

PURPOSE: To examine the possible NLMF-induced changes in isometric strength and surface electromyographic (EMG) of both the contralateral homologous and non-related heterogenous muscles after fatiguing the unilateral knee extensor (KE) muscle group.

METHODS: Ten men (27 ± 3 years) and five women (27 ± 2 years) participated in a 3-visit investigation which consisted of a familiarization visit and 2 separate randomly sequenced experimental visits. During the experimental visits, the same fatiguing intervention (six sets of 30-second maximal isometric KE contractions, with 30-second rest interval between sets) were applied. Before and after the fatiguing intervention, the maximal isometric strength and the corresponding surface EMG amplitude were measured on the non-exercised left elbow flexors (EF) or KE. Separate paired sample t-tests were used to examine the potential changes in the dependent variables described above.

RESULTS: After the fatiguing intervention, there was a significant decrement in isometric strength for the non-exercised EF (Pre- vs. Post-fatigue = 382.06 ± 34.28 vs. 354.20 ± 120.76 N, $t = 3.676$, $p = 0.001$), but not for the non-exercised KE. For the non-exercised EF, there was also a decreased normalized EMG amplitude in the biceps brachii (Pre- vs. Post-fatigue = $100.0 \pm 0.0\%$ vs. $86.5 \pm 6.6\%$, $t = 2.049$, $p = 0.03$). However, the normalized EMG amplitude did not change in the non-exercised vastus lateralis (VL).

CONCLUSIONS: Fatiguing the unilateral KE did induce the NLMF in the non-related heterogenous upper body muscle group (the EF), which was possibly due to the fatigue-induced decreased voluntary drive. However, for its contralateral homologous muscle group (non-exercised KE), the NLMF effect on isometric strength was absent, which could be explained by the unaltered maximal muscle activation level in the non-exercised VL. Therefore, fatiguing unilateral KE has differential effects on contralateral homologous and non-related heterogenous muscles.

3627 Board #74 June 3 9:30 AM - 11:00 AM

Recruitment Properties In Vastus Medialis And Vastus Medialis Oblique In Individuals With Patellofemoral Pain Syndrome

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Patellofemoral pain syndrome (PFPS) is a commonly diagnosed knee pathology that is twice as prevalent in women. Sports medicine clinicians commonly use exercises to attempt to preferentially activate the vastus medialis oblique (VMO) to enhance medially vectored forces on the patella. Recently, our group confirmed clinical theory that the VMO is neurologically distinct from the vastus medialis (VM). However, the ability to voluntarily activate these muscle sub-sections is still disputed. **Purpose:** To determine how PFPS affects neuromuscular control of VM/VMO and examine if hip rotation during a straight leg raise (SLR) modifies motor patterns. **Methods:** Thirteen healthy women and four women with PFPS performed isometric SLR in neutral hip rotation (SLR-NR) and during 30 degrees hip lateral rotation (SLR-LR). Participants performed ramp contractions by tracing a line on a screen with a rate of rise of 7.5% maximal voluntary contraction (MVC) per second up to 75% MVC. Bipolar intramuscular fine-wire electrodes were inserted into the VM and VMO. Initial motor unit firing rates (IFR) and recruitment threshold (RT) forces were measured. Generalized linear mixed models and Tukey post hoc tests were used to assess significant differences. The recruitment thresholds were log-transformed to meet the assumptions of normality of residuals and constant variance within each level. **Results:** A total of 420 motor units were analyzed. There was a significant interaction effect for Muscle \times Group for RT ($p=0.02$), demonstrating that women with PFPS activated their VMO later ($20.4 \pm 2.5\%$ MVC) than healthy women ($11.2 \pm 1.5\%$ MVC; $p=0.01$). The Group \times Hip Position interaction effect was also significant for RT ($p=0.02$). Healthy women activated their VMO earlier during SLR-NR ($9.9 \pm 1.5\%$ MVC) than during SLR-LR ($14.9 \pm 1.5\%$ MVC; $p=0.02$). Women with PFPS had a delayed VMO onset time ($19.1 \pm 2.5\%$ MVC) compared to healthy women ($9.9 \pm 1.5\%$ MVC) in SLR-NR ($p=0.02$). There was no significant difference in IFR between muscles or hip positions between groups. **Conclusions:** Targeted strengthening of the VMO in SLR with a neutral hip rotation is a more effective training position for women with PFPS than using lateral hip rotation.

3628 Board #75 June 3 9:30 AM - 11:00 AM

Sensorimotor Cortex Neuroplasticity Following Neuromuscular Training Augmented With Real Time Biofeedback

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Non-contact anterior cruciate ligament (ACL) injury is associated with motor coordination errors leading to comprised knee positioning and resultant knee loads that exceed ligament structural integrity. The nature of the ACL injury event (non-contact) and typical occurrence during high neurocognitive demand situations indicate a nervous system mechanism underlying the inciting event associated with injury. A better understanding of the neural contribution to ACL injury prevention training may enhance the ability to target the underlying mechanisms associated with injury risk. However, it is unknown what neuroplastic mechanisms contribute to the improved motor control documented after neuromuscular training.

Purpose: To compare the knee sensorimotor cortex activation level before and after neuromuscular control training.

Methods: Ten high school female soccer participants from the local community (age: 15.7 ± 0.95 years; height: 168.4 ± 4.60 cm; mass: 59.91 ± 5.62 kg.) were included in the analysis. fMRI data were collected during performance of a unilateral knee motor task of the left knee consisting of repeated cycles of extension-flexion before and after neuromuscular training. The activation level (blood oxygen level dependent signal) was calculated within the sensorimotor cortex as the primary region of interest. The neuromuscular training program consisted of 6 weeks of standardized ACL injury prevention training augmented with real time feedback designed to reduce movement related knee injury risk factors.

Results: Sensorimotor cortex activation increased after training (cluster data: voxels: 1120; $p < 0.0001$; z -max: 8.55; MNI coordinate peak voxel: 12, -26, 80; %signal difference: 0.37 ± 0.81) relative to pre-training.

Conclusions: The sensorimotor increased activation associated with neuromuscular training is similar to motor recovery after injury and after long-duration (weeks) motor skill training. The increased sensorimotor cortex activation indicates the cortical representation may be functionally increased for knee motor control after the focused intervention. Future work with expanded sample sizes will map whole brain connectivity and other brain region activation changes associated with neuromuscular training.

3629 Board #76 June 3 9:30 AM - 11:00 AM

Exploring Relations Between Gross Motor Skills, Attention, and Inhibition in Adolescents

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(No relationships reported)

PURPOSE: Scientific literature addressing the association between Gross Motor Skills (GMS), attention, and inhibition is scarce. Studying these relations helps better understand the interactions and their behavioral repercussions. The aim of this study is to search for relations between gross motor skills, attention, and inhibition. **METHODS:** GMS of adolescents ($n=220$, range=13-17; mean 15.0 ± 1.4 yrs) were assessed using protocols from UQAC-UQAM research team. Measures included: Arm and Leg Limb Speed, Agility, Coordination, Balance and Simple Reaction Time. Attention and inhibition measurements were collected using a Continuous Performance Test (CPT) protocol. Reaction times, number of errors, types of errors and derived measures from the CPT were used. Statistical analysis includes Spearman correlation test and Kruskal Wallis ANOVA. Both parents and adolescents gave their written consents. **RESULTS:** Reaction Time was in relation with all agility measurements (Circle Run: $r = .19$, $p < .01$; Shuttle Run: $r = .17$, $p = .01$; Slalom Run: $r = .17$, $p = .01$), but also with Limb Speed measures ($r = -.21$, $p < .01$). Variability of Reaction Time was correlated with Agility (Circle Run test: $r = .16$, $p < .05$), (Slalom Run test: $r = .15$, $p < .05$), Limb Speed ($r = .24$, $p < .01$) and Balance ($r = .15$, $p < .05$). Girls showed more correlations between GMS and neuropsychological measures. **CONCLUSIONS:** Some neuropsychological measures obtained with CPT protocol were related to Limb Speed, Agility, Balance and Reaction Time in adolescents. This conclusion suggests that motor and psychomotor development may play a role in helping adolescents to better perform in attention and inhibition ability. The relations between functions were affected by gender. Future research is needed to better understand the role of motor and psychomotor development program on psychological measurements.

3630 Board #77 June 3 9:30 AM - 11:00 AM

Gaze Stability of Visually Trained and Non-Visually Trained Athletes During a Sport-Like Postural Task

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(No relationships reported)

During object tracking, reflexive eye movements away from the target object or directional errors occur in order to capture visual field information. These 'off-target' visual data aid the brain in determining the velocity, location, and orientation of the objects in motion. However, an excessive amount of movement is classified as pro-saccade errors and can disrupt gaze stability. Little is known about how these errors differentiate between athletes who participate in object tracking sports versus those that do not in object tracking sports. **PURPOSE:** The aim of this study was to compare gaze stability of athletes who train and perform in visually (VT) and non-visually (NVT) rich environments during a sport-like postural anti-saccade task, the Wii Fit Soccer Heading Game (WFS). **METHODS:** 12 NCAA Division I VT (17.91 ± 0.51 years of age) and 12 matched (NVT) athletes (18.08 ± 0.51 years of age) wore a monocular eye tracker (240 Hz) while participating in two WFS trials of approximately 60 s. Athletes were instructed to maintain their gaze on the center of the screen during play. Motion capture was synced during the postural task to determine instantaneous gaze coordinates. Multivariate ANOVAs assessed gaze by direction (horizontal and vertical) for excursion and peak velocity, while an independent t-test assessed pro-saccade errors. **RESULTS:** A significant group difference was observed in vertical gaze ($p < .05$). Follow up assessments indicated greater gaze excursions (VT = 871.74 ± 446.23 pixels; NVT = 554.79 ± 220.54 pixels; $p = 0.038$) and vertical peak velocities (VT = 1660.25 ± 860.78 pixels/s; NVT = 711.01 ± 551.45 pixels/s; $p = 0.004$). No significant differences were observed in the horizontal direction. There were no significant differences in pro-saccade errors between the groups ($p = 0.96$; VT SE = 2.64; NVT SE = 1.63). **CONCLUSION:** These results suggest that VT athletes' gaze moved more and had greater velocity in the vertical direction when compared to NVT. This could indicate that VT use a vertical scanning visual strategy to locate and determine

velocity of the object during a sport-like anti-saccade postural task. This could suggest that VT use different motor control strategies to maintain gaze stability during anti-saccade task than NVT.

3631 Board #78 June 3 9:30 AM - 11:00 AM

The Effect of Different Cognitive Tasks on Motor Output in Young Adults

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Performance of a cognitive task can alter performance on a simultaneous motor task. The underlying mechanisms leading to these changes are unknown. **PURPOSE:** To determine the effects of a simple and complex cognitive task on motor cortex excitability and inhibition. **METHODS:** Transcranial magnetic stimulation of the motor cortex was performed on 11 participants (21.2 ± 0.9 years; 6 females) to measure motor evoked potentials (MEP), an assessment of cortical excitability, and cortical silent periods (CSP), an assessment of cortical inhibition, from the first dorsal interosseous muscle. MEP and CSP were obtained during: (1) baseline with no cognitive task, (2) a simple cognitive task, and (3) a complex cognitive task. The simple cognitive task consisted of counting from 1 to 10 and the complex task consisted of counting down from a large number by smaller numbers (e.g. count backward from 97 by 6). **RESULTS:** MEP amplitude was similarly increased during the simple ($1.38 + 1.23$ mV) and complex tasks ($1.34 + 1.1$ mV), compared to baseline ($0.68 + 0.38$ mV) ($p = 0.01$). CSP duration was $114.65 + 58.64$ ms at baseline and did not change significantly with either the simple ($117.07 + 53.27$ ms) or complex ($113.93 + 50.71$ ms) task ($p = 0.93$). There was no significant difference in accuracy ($p = 0.89$) or time to complete ($p = 0.95$) the complex task at any time point. **CONCLUSION:** These results indicate that there was no effect of cognitive task on cortical inhibition. Further, the act of talking, rather than the act of thinking, is likely responsible for the increase in cortical excitability.

3632 Board #79 June 3 9:30 AM - 11:00 AM

Quadriceps Torque During High- And Low-frequency Neuromuscular Electrical Stimulation

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Neuromuscular electrical stimulation (NMES) is often used to artificially generate muscle contraction; however, the stimulation parameters that optimally modulate torque output during prolonged stimulation protocols are not well-established. **PURPOSE:** To compare torque output between low-frequency and high-frequency NMES protocols with increasing stimulation intensity throughout the protocol to achieve a constant submaximal torque output. **METHODS:** Ten healthy individuals (age, 24.8 ± 1.2 yrs) participated in the study. This study employed a quasi-experimental crossover design in which each subject received a low-frequency (20 Hz) and a high-frequency (60 Hz) NMES intervention on different days. Repetitive, intermittent stimulation of 10 seconds on and 15 seconds off was applied for 60 min over the quadriceps muscles. Stimulation intensity was increased every 5 min throughout the course of the intervention to achieve a target torque of 15% maximal voluntary contraction (MVC). Mean torque and peak torque were measured for each contraction, were normalized to MVC, and the overall mean for all contractions was used for comparison. Force-time integral (FTI) was also measured for each contraction and the sum of all contractions was compared between protocols. Frequency was compared using paired *t*-tests. **RESULTS:** The 20 Hz protocol compared to the 60 Hz protocol produced a higher overall mean torque ($11.2 \pm 0.5\%$ MVC vs. $8.0 \pm 0.6\%$ MVC, $p < 0.01$) and FTI sum ($38,030.0 \pm 1724.9$ Nm·s vs. $32,128.0 \pm 1668.0$ Nm·s, $p < 0.01$). There was no difference between frequencies for peak torque ($14.0 \pm 0.6\%$ MVC vs. $12.3 \pm 0.7\%$ MVC) or stimulation intensity required to achieve 15% MVC during the first 5 mins (80.2 ± 3.8 mA vs. $120.7 \pm 8.0\%$ mA) or during the last 5 mins of the NMES protocol (74.7 ± 5.0 mA vs. 120.8 ± 10.6 mA, $p > 0.05$) for 20 Hz and 60 Hz, respectively. **CONCLUSION:** Torque maintenance was greater during a low-frequency compared to a high-frequency NMES protocol when stimulation intensity was increased to achieve a constant submaximal torque output. When the goal is to optimize torque output during functional electrical stimulation, low frequency stimulation may be preferred.

3633 Board #80 June 3 9:30 AM - 11:00 AM
Identification of Latent Variables Underlying Manual Dexterity in Middle-aged and Old Adults
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As a biomarker of neurologic health and function, manual dexterity quantifies the ability to coordinate and manipulate objects in a timely manner. The NIH Toolbox measure of manual dexterity is the Rolyan 9-hole pegboard test with the Lafayette 25-hole grooved pegboard test provided as a supplement.

PURPOSE: To identify latent variables associated with pegboard times in middle-aged and old adults. We hypothesized that pegboard times would be slower for old adults and that latent variables would differ for the two groups.

METHODS: Middle-aged (MA, 40-60 yrs; n=25) and old adults (OA, 65-89 yrs; n=28) performed the 9-hole pegboard test (9HPT) and the grooved pegboard test (GPT), as well as tests of maximal grip strength, tactile discrimination, force steadiness, and the NIH Toolbox cognition battery. Latent variables were identified using Independent Component Analysis from significant Spearman's rank correlation coefficients between pegboard times and secondary measures.

RESULTS: MA adults (51±7 yrs) performed significantly faster than OA (72±5 yrs) on both the 9HPT (18±3 s and 20±3 s, $p<0.01$) and GPT (60±9 s and 78±16 s, $p<0.01$). MA adults also had superior tactile discrimination (95±11 au and 72±20 au, $p<0.01$). The latent variables influencing manual dexterity differed for the two tests and age groups: (1) 9HPT - MA times were negatively correlated ($r = -0.84$) with the first Independent Component (IC), which explained 37.8% of the covariance and included the 10% double-action pinch force error as the second largest contributor ($r = 0.45$; scaled $r = 0.54$); OA times were positively correlated ($r = 0.60$) with the first IC, which explained 24.4% of the covariance and included wrist extension strength the second largest contributor ($r = 0.52$; scaled $r = 0.88$); (2) GPT - MA times were positively correlated ($r = 0.71$) with the first IC, which explained 44.7% of the covariance and included index finger abduction strength as the second largest contributor ($r = -0.42$; scaled $r = -0.59$); OA times were negatively correlated ($r = -0.90$) with the first IC, which explained 73.6% of the covariance and included age as the second largest contributor ($r = -0.44$; scaled $r = -0.49$). **CONCLUSIONS:** 9HPT times were explained by accuracy to reach a force target and strength for MA and OA respectively, whereas GPT times were explained by strength and age.

3634 Board #81 June 3 9:30 AM - 11:00 AM
Effect Of Knee Joint Angle On Force Accuracy And Neuromuscular Activation During Force Tracking Task.
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Force steadiness and neuromuscular activities during isometric knee extension have been investigated in a condition of only one joint angle, e.g. 90°. Muscle length may modify force steadiness by change in neuromuscular activation patterns of working muscles; however, it have not been well understood. In terms of the quadriceps femoris muscle (QF), muscle activation differs dependent upon knee joint angle (i.e. muscle length), and its magnitude of difference is muscle dependent during knee extension force exertion. Therefore, there is a possibility that knee joint angle affects to the force accuracy (FA) and neuromuscular activation during force tracking task. **PURPOSE:** The purpose of this study was to examine FA and neuromuscular activity of QF during isometric knee extension force tracking task for 3 knee joint angles.

METHODS: Thirteen healthy men and women (23 ± 4 years) performed force tracking task during isometric knee extension to match a given a constant force signal on a computer monitor. This task was lasted 30 seconds. The force level of the task was 6% of maximal voluntary contraction (MVC). The tasks were performed in 70°, 110° and 150° of knee joint angle (180° = full knee extension). During the tasks, surface electromyogram (EMG) was recorded from 4 QF muscles. We calculated FA as follows: (produced force - target force) / target force*100. The root mean square (RMS) of EMG signals of each muscle was calculated in the middle of 10 seconds during 30 seconds task. The RMS of the individual muscles was normalized by that of the MVC.

RESULTS: There was significant difference in FA between knee joint angles. FA at a knee joint angle of 70° was significantly greater than that at knee joint angle of 110° and 150° ($p = 0.026$ and 0.028). RMS of vastus intermedius (VI) was smaller at 70° than 110° ($p = 0.005$). On the other hands, RMS of vastus lateralis, vastus medialis, and rectus femoris did not differ between knee joint angles ($p > 0.05$).

CONCLUSIONS: The FA of the QF was worse at a flexed knee joint position than other extended knee joint positions. Furthermore, neuromuscular activation pattern of VI was different depend on knee joint angles, whilst that of other muscles was similar. That result suggests that force control strategy may be modified by neuromuscular activation of VI with respect to knee joint angle (i.e. muscle length).

G-30 Free Communication/Poster - Neuromuscular Physiology

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
 Room: Hall F

3635 Board #82 June 3 8:00 AM - 9:30 AM
Locomotor Training with Adjuvant Testosterone Promotes Activity-Mediated Neuromuscular Plasticity in Spinal Cord Injured Rats

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Testosterone (T) treatment preserves motor neuron survival and dendritic morphology after spinal cord injury (SCI), but produces only minimal neuromuscular recovery in the absence of locomotor activity. **PURPOSE:** To determine whether a multimodal strategy involving T treatment with partial body weight supported quadrupedal treadmill (TM) training produces neuromuscular benefit in a rodent severe contusion SCI model. **METHODS:** 16-week old male Sprague-Dawley rats (n = 8-11/group) received: 1) SHAM surgery (T9 laminectomy), 2) severe (250 kdne) contusion SCI, 3) SCI+T (7.0 mg/week, i.m.), or 4) SCI+T+TM. Manually assisted TM training was initiated one-week post-SCI and consisted of two 20 min bouts/day, performed 5 days/week. **RESULTS:** After surgery, all SCI animals exhibited a near-complete absence of hindlimb locomotor function [BBB score < 1 (scale 0-21); $p < 0.01$ vs SHAM]. SCI and SCI+T regained minimal voluntary locomotor function, with BBB scores progressing to 4 ± 1 and 6 ± 1, respectively, over the 8 week intervention. At sacrifice, SCI animals exhibited 42% lower soleus mass ($p \leq 0.001$) and altered *in vitro* force mechanics, characterized by 35% lower maximal tetanic force ($p \leq 0.001$), 8% faster time to peak tension (TPT, $p \leq 0.001$), and 50% faster half-relaxation time (half RT, $p \leq 0.01$) vs SHAM; effects that were not prevented by T treatment-alone. BBB hindlimb locomotor scores were higher in SCI+T+TM vs SCI and SCI+T groups from weeks 2-8 ($p < 0.01$ at all time points), reaching a value of 10 ± 1 by week 8. At sacrifice, 7 of 8 SCI+T+TM animals exhibited unassisted/voluntary weight supported stepping (BBB score ≥ 9), in comparison with 0 of 11 SCI animals and 2 of 10 SCI+T animals ($p \leq 0.001$). In addition, T+TM ameliorated muscle loss and produced a near-complete preservation of muscle mechanical properties, exemplified by 33-40% higher soleus mass ($p \leq 0.001$), 35% higher maximal tetanic force ($p \leq 0.001$ vs SCI-only), 9-11% slower TPT ($p \leq 0.001$), and 130% slower half RT ($p \leq 0.001$) vs SCI and SCI+T groups. **CONCLUSION:** TM training with adjuvant T accelerated hindlimb locomotor recovery after severe contusion SCI and mitigated the loss of soleus muscle mass and muscle function, suggesting that this combinatory strategy promotes activity-mediated neuromuscular plasticity.

Supported by PVA Research Fellowship #2939 to Fan Ye.

3636 Board #83 June 3 8:00 AM - 9:30 AM
Relationship Between Body Composition And The Autonomic Nervous System Behavior At Rest

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In recent years, the assessment of body composition (BC) has been reframed by the hormonal effect that skeletal muscle and adipose tissue have in the body, including the autonomic nervous system (ANS). **PURPOSE:** To determine the relationship between the BC and ANS response in a population of individuals with different levels of physical activity. **METHODS:** 63 individuals (31 men 19.9 ± 2.4 years and 19.6 ± 32 women 2.0 years) were evaluated on their body composition (bioimpedance and anthropometry) and the ANS activity at rest through the Heart Rate Variability. **RESULTS:** In men a directly proportional relationship between the percentage of muscle mass (evaluated for both methods) and indicators of parasympathetic activity was found: The Root Mean Square Successive Differences RMSSD ($r=0.40$; $p<0.05$), the deviation of the scattergram plot in the "short" direction SD1 ($r=0.40$; $p<0.05$), and Vagal Cardiac index VCI ($r=0.46$, $p<0.05$), while body fat was associated with sympathetic indicators as the ratio Low Frequency / High Frequency ($r=0.36$; $p<0.05$) and sympathetic cardiac index SCI ($r=0.36$, $p<0.05$), the SCI was inversely proportional to muscle mass too ($r=-0.41$ $p<0.05$). In women only heart rate was directly related to adipose tissue ($r=0.35$; $p<0.05$) and inversely with muscle mass ($r=-0.42$; $p<0.05$). **CONCLUSIONS:** The muscle mass has an influence on the ANS by increasing parasympathetic activity and reducing the sympathetic activity, the evidence suggests that there are some hormones produced by the muscles (myokines) like the Fibroblast Growth Factor 21 or the Brain Derivate neurotrophic Factor that produce

this effect. For the other hand, some adipokines like the Tumoral Necrosis Factor alpha and the leptin contribute to have greater sympathetic and lower parasympathetic activity.

	HR	RMSSD	pNN50	LF/HF	HFnu	SD1	SCI	IVC
Fat Percentage	0.27	-0.25	-0.25	0.36*	-0.33	-0.25	0.36*	0.19
Muscle Percentage	-0.43*	0.40*	0.45*	0.18	0.25	0.40*	-0.41*	0.46*

3637 Board #84 June 3 8:00 AM - 9:30 AM
The Effects of Short-Term Resistance Training with & without Blood Flow Restriction on Neuromuscular Adaptations

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PURPOSE: To investigate the neuromuscular adaptations in quadriceps muscles after short-term resistance training with and without blood flow restriction (BFR). **METHODS:** Twelve males (age = 27.4 ± 6.3 years; height = 171 ± 7 cm; weight = 79.8 ± 13.2 kg) volunteered to participate in this study. Subjects had their legs randomly assigned to two training conditions that differed in contraction intensity. One leg was trained with blood flow restriction (BFR) at an intensity of 20% of their one repetition maximum (1RM) for a total of four sets (30, 15, 15, 15 repetitions) and the contralateral leg was trained without BFR (non-BFR) at an intensity of 70% 1RM for two sets of 11 repetitions. Subjects performed unilateral knee extensions and trained each leg with their assigned training protocol for 2 weeks, 3 times/wk. Pre, and post 1RM tests were performed for each leg on a dynamic constant external resistance machine and an isokinetic exercise machine was used to determine maximal voluntary contraction (MVC) and isokinetic exercises at two speeds of 60°/s and 180°/s. Additionally, heart rate (HR) and rating of perceived exertion (RPE) were recorded after the completion of each set. **RESULTS:** No condition*time interaction or condition main effect for 1RM strength test was detected, but there was a significant time main effect for 1RM strength from pre to post values (p=0.01). There were significant condition*time, condition*day, and day*time interactions and condition (HR was higher for non-BFR and RPE for BFR), day, and time main effects for HR and RPE values (set 3 and 4 for BFR vs. set 1 and 2 for non-BFR) (p<0.05). There were no significant condition*time interaction, condition main effect, or time main effect for MVC and isokinetic strength at 180°/s and 60°/s (p>0.05). **CONCLUSION:** The findings indicate that both training conditions resulted in similar dynamic strength gains suggesting that low-intensity BFR training is as effective as high-intensity training in neuromuscular adaptation following short-term resistance training. The results also suggest that non-BFR condition placed an increased demand on the cardiovascular system, but subjects experienced higher perceived exertion during BFR.

3638 Board #85 June 3 8:00 AM - 9:30 AM
Validation of the Neuromuscular Fatigue Threshold Treadmill Test

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 (No relationships reported)

PURPOSE: To examine the validity of the physical working capacity at the fatigue threshold (PWC_{FT}) model as a neuromuscular fatigue-threshold during incremental treadmill running. **METHODS:** Twelve aerobically-trained individuals [(mean ± SD) 24.0 ± 14.8 yr, 73.1 ± 13.1 kg, 178.8 ± 9.1 cm] volunteered to perform a treadmill test to exhaustion on four separate visits with electromyographic (EMG) signals recorded from the vastus lateralis. The first visit required each subject to complete an incremental treadmill test to exhaustion that started at 9.0 km·hr⁻¹ and increased 1 km·hr⁻¹ (1% constant grade) every two minutes for determination of their PWC_{FT}. During the second, third, and fourth visits, the subjects completed constant-velocity treadmill runs to exhaustion at 90, 100, or 110% PWC_{FT} in random order. Each laboratory visit was separated by at least 48 hours. **RESULTS:** Mean ± SD values were calculated for the running velocities associated with 90% (11.6 ± 1.5 km·hr⁻¹), 100% (13.0 ± 1.6 km·hr⁻¹), and 110% (14.3 ± 1.8 km·hr⁻¹) PWC_{FT}. The one-way ANOVA with repeated measures and post-hoc analyses indicated that the time to exhaustion (TTE) at the constant velocity of 110% PWC_{FT} (19.44 ± 10.26

min) was significantly less than at 90% PWC_{FT} (60.00 ± 0.00 min) and 100% PWC_{FT} (48.86 ± 14.59 min). Individually, ten of the subjects (83.3%) were able to maintain the running velocity associated with 100% of their PWC_{FT} for at least 40 minutes, whereas only one of the subjects (8.33%) was able to maintain 110% PWC_{FT} for more than 30 minutes. All subjects maintained 90% PWC_{FT} for 60 minutes. Furthermore, the normalized EMG amplitude values increased across time (R² = 0.98, p < 0.001) during the 110% PWC_{FT} run to exhaustion, but resulted in no change during the 90% PWC_{FT} (R² = 0.23, p = 0.16) and 100% PWC_{FT} (R² = 0.03, p = 0.64) runs to exhaustion. **CONCLUSIONS:** The findings of the present study indicated that the PWC_{FT} treadmill test was able to accurately estimate the fastest running velocity that could be maintained for an extended period of time (i.e. ≥ 40 min) without evidence of neuromuscular fatigue (i.e. slope coefficient of zero for the EMG amplitude versus time relationship).

3639 Board #86 June 3 8:00 AM - 9:30 AM
Correlation Between Muscle Strength And Vagal Cardiac Autonomic Modulation In Healthy Men

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Unsatisfactory muscle strength (MS) and low degree of cardiac autonomic modulation (CAM) at rest are related to higher morbidity and mortality in apparently healthy men. However, the association between MS and CAM at rest in this population is still unclear. **Purpose:** We aim to correlate the muscle strength with resting and responsiveness vagal CAM in healthy men. **Methods:** We evaluated 14 clinically normal men, aged 24.1 ± 5.6 years showing BMI = 24.9 ± 1.9 kg/m². MS was assessed by isokinetic dynamometer Biodex during knee extension with 60°/s in 2 sets of 4 maximum repetitions and 60s between them. The highest peak torque (PT), absolute and relative, was adopted as the maximum MS value. CAM was assessed by 5-min heart rate variability (HRV) at rest, supine and orthostatic postures by the time-domain rMSSD and Poincaré plot SD1 vagal indexes, using the Polar RS800® to RR-interval acquisition and the Kubios software for analyses. CAM responsiveness was estimated by the absolute variation (Δabs) of rMSSD and SD1 from supine to orthostatic postures. Due to non-normal distribution of variables (*Shapiro-Wilk test*) we used the Spearman correlation at the 5% level of significance. **Results:** We observed a positive correlation between rMSSD and SD1 in supine position with relative PT and a positive correlation between the Δabs of rMSSD and SD1 with PT absolute and relative, as shown in Table 1.

variables	r-MSSD sup	r-MSSD ort	Δabs r-MSSD	SD1sup	SD1ort	ΔabsSD1
PT(N-M)	r _s = 0.27 (p = 0.17)	r _s = 0.09 (p = 0.36)	r _s = 0.45 (p = 0.05)*	r _s = 0.27 (p = 0.17)	r _s = 0.09 (p = 0.36)	r _s = 0.45 (p = 0.05)*
PT (%)	r _s = 0.51 (p = 0.03)*	r _s = 0.32 (p = 0.12)	r _s = 0.51 (p = 0.03)*	r _s = 0.51 (p = 0.03)*	r _s = 0.32 (p = 0.12)	r _s = 0.51 (p = 0.03)*

PT: peak torque; (N-M): newton-meters; %: relative; sup: supine; ort: orthostatic; Δabs: absolute variation; * *Spearman correlation test* (p ≤ 0.05).

Conclusion: We found significant positive correlation between relative MS with resting vagal CAM on supine position and significant positive correlation between absolute and relative MS with vagal responsiveness (withdrawn) after active orthostatic stress. Our results demonstrate that the higher is the MS the higher is the tonic (resting supine) and phasic (withdrawn on standing up) vagal modulation.

G-31 Free Communication/Poster - Perception

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
 Room: Hall F

3640 Board #87 June 3 8:00 AM - 9:30 AM
Sport Events, Task Motivation Climate and Motivation in Physical Education Learning

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The impact of differences in sport events on the motivation of Physical Education Learning (PEL) has rarely been investigated although it has been reported that task

motivation climate is beneficial to the improvement of PEL. PURPOSE: To investigate the impact of differences in sport events (individual event and group event) and three types of needs (competence, autonomy and relatedness) on motivation and further to explore the causes for the lack of motivation. METHODS: The present study combines experiment and questionnaire. With 65 male students randomly selected from a high school in Dalian as subjects (age: M=16.1, SD=3.4; height: M=176.4cm, SD=9.2; weight: M=69.7kg, SD=7.5), an 8-week experiment was conducted. All the subjects were divided into two groups, 31 of which were allocated to a roller-skating class, the others to a basketball class. In order to control the variable of task motivation climate, the same teacher completed the tasks of teaching in both classes. Before the experiment, a pretest was conducted based on the Sport Situational Motivation Scale and a post-test was carried out based on the Post-Experimental Intrinsic Motivation Inventory when the experiment was completed. RESULT: The task motivation climate helped students to improve the intrinsic motivation in PEL (P>0.05). The satisfaction of competence needs is more important in the environment of autonomous learning (Motivation: $F_{intrinsic}=5.147, P<0.05$; $F_{autonomy}=5.013, P<0.05$; Interests: $F=7.808, P<0.01$; Efforts: $F=12.090, P<0.01$). The needs of autonomy, relatedness and competence are the intermediary variables which influenced the motivation level, interests and efforts in PEL. Relatedness is an important factor to account for the effects on motivation and efforts in PEL ($T_{Relatedness}=-3.995, P<0.01$). CONCLUSION: In physical education teaching, creating task motivation climate is conducive to improve the students' intrinsic motivation in PEL. The factor of sport events has no significant effect on motivation in PEL. The satisfaction of competence needs is more important in the autonomic learning environment and the group event is helpful to improve the students' relatedness.

3641 Board #88 June 3 8:00 AM - 9:30 AM

Perceived Impact Of Restorative Flow Movement Patterns On NCAA Division II Football Athletes

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The Restorative Flow Movement Patterns are a combination of yoga principles, functional movements, and various other training principles. The traditional yoga movements are essentially modified to improve function, recovery, mobility, and stability. The goal of the Restorative Flow Movement Pattern sessions was to improve recovery, prevent injury, and improve symmetry, which is acquired through improved mobility, stability, and functionality. Previous research has indicated a significant decrease in games missed due to injury after implementation of the Restorative Flow Movement Patterns injury prevention program.

PURPOSE: The purpose of this investigation was to determine the perceived effectiveness of the injury prevention program implemented for an NCAA Division II football program, as measured by a qualitative, online survey of the student-athletes.

METHODS: A newly developed injury prevention program (Restorative Flow Movement Patterns) was implemented prior to the 2014 football season. Athletes participated in a modified yoga flow, which combined functional movement patterns with yoga movements, twice a week for the duration of the pre-season, regular season, and spring season. Online survey data was collected after the 2015 football season. Likert scales were used for all questions on the survey. Means and standard deviations were calculated for all question responses.

RESULTS: Thirty-six student-athletes responded to the survey. Participants self-reported decreased muscular soreness after games and workout sessions (1-10 scale, 5.47±2.48), improvements in flexibility (1-10 scale, 6.53±2.24) and overall well-being (1-10 scale, 5.94±1.91) as a result of the injury prevention program. Of the 36 respondents, 14 (39%) claimed the program was a useful addition to their training regimen, and 12 (33%) reported that the program improved their physical health and recovery, and another 12 (33%) reported that the program actually improved their physical health and recovery.

CONCLUSIONS: NCAA Division II football student-athletes perceive that the combination of functional movements and yoga movements can be useful in improving flexibility, decreasing muscular soreness, and improving overall well-being.

3642 Board #89 June 3 8:00 AM - 9:30 AM

Is Vo2max Related To Rating Of Perceived Capacity (RPC) And What Is Vo2max At Onset Of Training?

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ABSTRACT

Objective: To examine how maximal oxygen uptake (VO_{2max}) is related to rating of perceived capacity (RPC) and evaluate VO_{2max} at onset of training in healthy untrained adults.

Methods: In this methodological comparison study, 125 newly registered members, equally males and females, at 25 fitness centers answered an electronic questionnaire including the RPC scale and performed measurements of VO_{2max} . Eligible criteria was <4 weeks of fitness center membership, ≥18 years, and not pregnant. The RPC is a one-page scale based on metabolic equivalents task (MET), where the individual choose the most strenuous activity that can be sustained for at least 30 minutes, rated from 1 to 20. RPC was answered before measurement of VO_{2max} (using a stepwise modified Balke-protocol until exhaustion) at the laboratory. The strength of agreement between the two methods was analyzed by Bland-Altman plot, as well as Pearson correlation coefficient to enable comparison of these results with other studies. VO_{2max} at onset of training is presented as means with standard deviations (SD).

Results: Agreement as seen in Bland-Altman plot demonstrated a tendency of overestimation, meaning that the participants ranked their own aerobic capacity estimated from the RPC scale higher than objectively measured values of VO_{2max} . The mean differences between the two methods were + 0.98 (± 1.96) and + 1.31 (± 1.96) METs, with 95 % confidence limits of agreement varying from + 4.57 to - 2.60 and + 5.35 to - 2.72 METs, in men (n = 62) and women (n = 63), respectively. The Pearson correlation coefficient were moderate, with $r = 0.426$ ($p < 0.01$). VO_{2max} was mean (± SD); 37.7 (± 7.2) ml·min⁻¹·kg⁻¹, with 40.5 (± 7.2) for men and 35.0 (± 6.0) ml·min⁻¹·kg⁻¹ for women.

Conclusions: The RPC scale may be useful in large scale studies of healthy untrained individuals, but may overestimate VO_{2max} individually.

Key words: Rating of perceived capacity, RPC scale, VO_{2max} , METs

3643 Board #90 June 3 8:00 AM - 9:30 AM

Can Rate Of Perceived Exertion Be Used To Estimate Muscle Activation?

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(No relationships reported)

Rate of perceived exertion (RPE) has been shown to be highly correlated with heart rate based training load calculations. However, there is limited information whether RPE can also be used to estimate muscle activation during exercise.

PURPOSE: Therefore, we aimed to assess the relationship between integrated electromyography (iEMG) and RPE in breaststroke swimming.

METHODS: Nine elite breaststroke swimmers (4 male and 5 female, 24 ± 7 years, BMI 23 ± 2 kg/m²) swam 25 m breaststroke at 60% (Borg RPE scale 11), 80% (Borg RPE scale 15) and 100% of maximal effort simulating the 200, 100 and 50 m breaststroke events paces. IEMG was measured from upper body muscles (UBM) including m. triceps brachii, m. biceps brachii, m. trapezius and m. pectoralis major and lower body muscles (LBM) including m. gastrocnemius, m. tibialis anterior, m. biceps femoris and m. rectus femoris. EMG was sampled at 1000 Hz and iEMG was amplitude normalized to the relative maximal voluntary contraction. Relative iEMG was expressed as % of iEMG measured at 100%. The average relative iEMG of UBM, LBM and total measured muscles (TBM). Wilcoxon signed ranks test were used to compare relative iEMG with RPE. Sex differences were assessed with Mann-Whitney U tests.

RESULTS: Relative iEMG for breaststroke was [mean ± standard deviation (SD)] 74 ± 14 for UBM, 64 ± 13 for LBM and 69 ± 13 for TBM for breaststroke at RPE 60% and 89 ± 9 (UBM), 80 ± 8 (LBM) and 85 ± 8 (TBM) for breaststroke at RPE 80%. iEMG from UBM was significantly different from RPE for RPE 60% and RPE 80% ($p=0.015$ and $p=0.038$, respectively) while TBM and LBM were similar ($p>0.05$). M. biceps femoris showed the most similar values compared to RPE (64 ± 15 for RPE 60% and 82 ± 14 for RPE 80%). There were no sex differences in relative iEMG at RPE 60% or RPE 80% ($p>0.05$).

CONCLUSION: The similar results for relative iEMG and RPE for LBM and TBM suggests that RPE can be used to estimate muscle activation of muscles generating the highest propulsive forces in breaststroke swimming. RPE may therefore also be used to optimize training load calculations from breaststroke sessions with high speeds of short duration (e.g. 50-200 m event paces) where quantifying training load from heart rate has its limitations.

3644 Board #91 June 3 8:00 AM - 9:30 AM

Efficacy Of The Repetitions In Reserve-based Rating Of Perceived Exertion For The Bench Press In Experienced And Novice Benchers

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Autoregulation (AR) is the practice of adjusting training variables in response to athlete feedback. One strategy to implement AR is to utilize the resistance training-

specific rating of perceived exertion (RPE) scale measuring repetitions in reserve (RIR). **PURPOSE:** The purpose of this study was to examine the efficacy of this method using the bench press exercise. **METHODS:** Twenty-seven college aged men were assigned to one of two groups based upon training age: experience benchers (EB) (n=14, 4.7±2.0 yrs of training) and novice benchers (NB) (n=13, 1.1±0.6 yrs of training). Subjects performed a one-repetition maximum (1RM) followed by single-repetition sets at 60, 75, and 90% of 1RM and finally an 8-repetition set at 70% 1RM. Subjects reported RIR-based RPEs following every set. Average concentric velocity (ACV) was recorded via the TENDO Weightlifting Analyzer during the 1RM and all single repetitions sets, along with the first and last repetitions of the 8-repetition set. Pearson product moment correlations were used to assess relationships between RPE and velocity, while two-tail independent-sample t-tests examined differences in RPE and velocity between EB and NB. **RESULTS:** ACV at 100% of 1RM in EB was slower (0.14±0.04 m·s⁻¹) compared to NB (0.20±0.05 m·s⁻¹) (p<0.001). EB recorded greater RPE than NB at 100% of 1RM (EB: 9.86±0.14 vs. NB: 9.35±0.36) (p=0.011). No between-group differences existed for average velocity or RPE at any other intensity. Both EB (r=0.85, p<0.001) and NB (r=0.85, p<0.001) had strong inverse significant correlations between average velocity and RPE at all intensities. **CONCLUSION:** Our findings suggest that the RIR-based RPE scale may be an efficacious approach for AR of bench press training load and volume in EB and NB; however, EB may record more accurate RPEs at near maximal loads.

3645 Board #92 June 3 8:00 AM - 9:30 AM
Perceived Versus Actual Health Related Fitness Among College Students

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Half of all young adults between the ages of 18 and 24 yrs have at least one coronary heart disease risk (CHD) factor significantly increasing their risk for heart disease¹. Health-related fitness components are used to measure physical fitness and may facilitate in determining one's risk for CHD and other hypokinetic diseases. **PURPOSE:** The purpose of this study was to compare college students' perceived health-related fitness and their measured health-related fitness. **METHODS:** Health related fitness assessments for flexibility, body composition, cardiovascular fitness, muscular strength, and muscular endurance were selected from ACSM's Guidelines for Exercise Testing and Prescription (8th ed). Participants (n=100; 54 males and 46 females) were asked to complete an electronic questionnaire in which they selected a perceived category for each of the health-related fitness components. Participants then performed the health-related fitness assessments and categorical values were assigned to their fitness test scores. Crosstabs were used to compare actual versus perceived categories of fitness for each assessment and approximate significance was tested using Kendall's tau-b. **RESULTS:** There were significant differences (p= .05) between self-perceived and measured categories of fitness for all health-related fitness components. The area with the least amount of agreement between perceived and actual fitness was cardiovascular fitness where only 6% of participants accurately identified their fitness category. Percent body fat and muscular endurance (curl-up test) also had low levels of agreement with only 19% of participants accurately identifying their body fat category and muscular endurance category. Flexibility was the category with the highest level of agreement (33%) between actual and perceived category. **CONCLUSION:** The results of this study suggest that college students do not accurately perceive their actual health-related fitness compared to their measured fitness. Thinking one is more fit than one is could impact behaviors such as food choice and exercise that increases one's risk of hypokinetic diseases. 1. Arts, J., Fernandez, M. L., & Lofgren, I. E. (2014). Coronary heart disease risk factors in college students. *Advances in Nutrition: An International Review Journal*, 5(2), 177-187.

3646 Board #93 June 3 8:00 AM - 9:30 AM
Physiological, Gait, and Perceptual Responses At 5-km Race Pace On Motorized Vs. Non-motorized Treadmills

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PURPOSE: This study examined physiological, gait, and perceptual differences of running at 5-km race pace on a non-motorized (NMT) versus a traditional motorized treadmill (MT). **METHODS:** Trained (VO₂max = 53.0 ± 6.8 ml/kg/min) male runners (n = 11) of varying skill level and age (30 ± 10 y) completed 3, 5-km time trials on a NMT. During a later session, the average finishing time of the trials was used as the goal pace to maintain during a 5 min run on the NMT. Participants also ran at their personal best 5-km race pace within the last 6 months on a MT for 5 min with a

10 min rest period between bouts (counter-balanced crossover design). **RESULTS:** NMT resulted in a slower pace (10.6 ± 1.5 vs 13.9 ± 2.6 km/h; p < 0.001), shorter stride length (1.02 ± 0.10 vs 1.27 ± 0.18 m; p < 0.001), and decreased cadence (175 ± 12 vs 181 ± 13 steps/min; p = 0.01). However, VO₂ (NMT = 3.4 ± 0.4; MT = 3.4 ± 0.5 L/min), RER (NMT = 0.96 ± 0.04; MT = 0.96 ± 0.04), lactate at 3 min into recovery (NMT = 6.9 ± 3.7; MT = 5.7 ± 3.4 mmol), and heart rate at the end of each trial (NMT = 172 ± 10; MT = 170 ± 10 bpm) did not differ significantly. Likewise, RPE for legs, breathing, and overall did not differ significantly between treatments. **CONCLUSION:** Although gait and pace were altered significantly, physiological and perceptual responses between the MT and NMT were similar. NMT time trial testing can be expected to elicit similar endurance exercise stresses when a more "free" running task is desired, but interpretation of results need to be made with the consideration that performance is expected to decline by ~25% or more likely due to excess resistance from the NMT belt.

3647 Board #94 June 3 8:00 AM - 9:30 AM
Training and Chronological Age Effect Repetitions in Reserve-based Rating of Perceived Exertion Accuracy

Michael H. Haischer¹, Jacob A. Goldsmith¹, Daniel M. Cooke¹, Ryan K. Byrnes¹, Jared H. Perlmutter¹, Jose C. Velazquez¹, Adam Sayih¹, Eric R. Helms¹, Chad Dolan², Michael C. Zourdos¹. ¹Florida Atlantic University, Boca Raton, FL. ²University of Houston, Houston, TX. (Sponsor: Michael Whitehurst, FACSM)
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PURPOSE: The purpose of this study was to examine the relationship between training age (TA) and chronological age (CA) on the accuracy of intra-set recorded rating of perceived exertion (RPE) values on the repetitions in reserve (RIR)-based RPE scale. **METHODS:** Twenty-five college-aged and resistance trained men (Body Mass: 88.95±14.72kg, squat one-repetition maximum-1RM: 175.76±34.68kg) performed a 1RM back squat followed by one set of maximum repetitions at 70% of 1RM. Subjects were blinded to the load during the 70% set via an opaque trash bag covering the weight discs. During the 70% set subjects verbally called a 5RPE (i.e. 5RIR), 7RPE (i.e. 3RIR), and 9RPE (i.e. 1RIR) when the subject believed he was at the respective threshold. Pearson correlations were used to assess relationships between total repetitions performed and the absolute RIR difference from the actual RIR when each RPE was verbally called. For example, if a subject completed 15 total repetitions and called a 5RPE after 7 repetitions then the RIR difference would equal 3. **RESULTS:** Average TA was 4.7±3yrs and CA was 25±3yrs. There were moderate inverse correlations approaching significance between TA and the RIR difference at the called 5RPE (r=-0.35, p=0.094) and 7RPE (r=-0.34, p=0.096), however no relationship for TA at the called 9RPE (r=-0.23, p=0.32). Regarding CA, no difference existed with the RIR difference at 5RPE (r=-0.27, p=0.20), however, CA had a moderate inverse relationship with RIR difference at a 7RPE (r=-0.36, p=0.07), and a moderate significant correlation with a 9RPE (r=-0.50, p=0.021). **CONCLUSION:** Our findings suggest that a lower TA is related to increased difficulty of RIR assessment when 3 or more RIR exist. However, TA was not related to RIR accuracy close to failure (i.e. 9RPE). Interestingly, greater CA is associated with more accurately assessing RIR closer to failure.

3648 Board #95 June 3 8:00 AM - 9:30 AM
Total Repetitions Per Set Effects Repetitions in Reserve-based Rating of Perceived Exertion Accuracy

Jared H. Perlmutter¹, Jacob A. Goldsmith¹, Daniel M. Cooke¹, Ryan K. Byrnes¹, Michael H. Haischer¹, Jose C. Velazquez¹, Adam Sayih¹, Eric R. Helms¹, Chad Dolan², Michael C. Zourdos¹. ¹Florida Atlantic University, Boca Raton, FL. ²University of Houston, Houston, TX. (Sponsor: Michael Whitehurst, FACSM)
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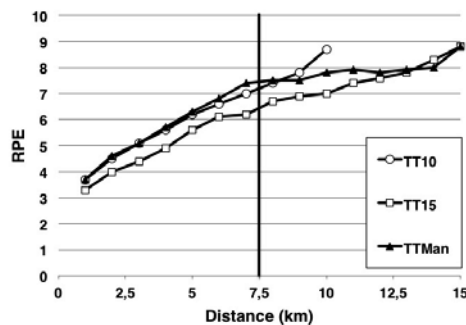
The resistance training-specific rating of perceived exertion (RPE) scale measuring repetitions in reserve (RIR) has been validated to gauge effort per set in resistance exercise. However, it is unknown what descriptive factors of the lifter influence RPE/RIR accuracy. **PURPOSE:** The purpose of this study was to examine the relationship between total repetitions per set and the accuracy of intra-set RPEs of 5, 7, and 9 on the 1-10 RIR-based RPE scale. **METHODS:** Twenty-five college-aged and resistance trained men (Age: 25±3yrs, Body Mass: 88.95±14.72kg) performed a one-repetition maximum (1RM) back squat followed by one set of maximum repetitions at 70% of 1RM. Subjects were blinded to the load during the 70% set via an opaque trash bag covering the weight discs. During the 70% set subjects verbally called a 5RPE (i.e. 5RIR), 7RPE (i.e. 3RIR), and 9RPE (i.e. 1RIR) when the subject believed he was at the respective threshold. Pearson product moment correlations were used to assess relationships between total repetitions performed and the absolute RIR difference

from the actual RIR when each RPE was verbally called. For example, if a subject completed 15 total repetitions and called a 5RPE after 7 repetitions then the RIR difference would equal 3. **RESULTS:** Average squat 1RM was 175.76±34.68kg and the mean number of repetitions performed at 70% of 1RM was 16±4. There were moderate and significant correlations between total repetitions performed and the RIR difference at the called 5RPE ($r=0.64, p=0.01$) and 7RPE ($r=0.56, p=0.004$), however no relationship between total repetitions and the RIR difference existed at the called 9RPE ($r=0.01, p=0.97$). **CONCLUSION:** Our findings suggest that the greater amount of repetitions performed per set is related to increased difficulty to accurately gauge RIR further from failure. However, total repetitions per set do not seem to effect RIR accuracy when close to failure (i.e. 9RPE).

3649 Board #96 June 3 8:00 AM - 9:30 AM
The Role of the Rating of Perceived Exertion Template in Pacing

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The Rating of Perceived Exertion (RPE) template is thought to regulate pacing and has been shown to be very robust in different circumstances. **Purpose:** The primary purpose was to investigate whether the RPE template can be manipulated by changing the anticipated race distance during the course of a time trial. The secondary purpose was to study how athletes cope with this manipulation, especially in terms of the RPE template. **Method:** Trained male cyclists (N=10) performed three cycling time trials: a 10 km (TT10), a 15 km (TT15) and a manipulated 15 km (TTman). During the TTman, subjects started the time trial believing that they were going to perform a 10-km time trial. However, at 7.5 km they were told that it was a 15-km time trial. **Results:** A significant main effect of time-trial condition on RPE scores until kilometer 7.5 was found ($P=0.016$). Post-hoc comparisons showed that the RPE values of the TT15 were lower than the RPE values of the TT10 (Diff:0.60; CI:0.11, 1.0) and TTman (Diff:0.73; CI:0.004, 1.5). After the 7.5 km, a transition phase occurs, in which an interaction effect is present ($P=0.011$). After this transition phase, the RPE values of TTman and TT15 did not statistically differ ($P=1.00$). **Conclusions:** This novel distance-endpoint manipulation demonstrates that it is possible to switch between RPE templates. A clear shift in RPE during the TTman is present between the RPE template of the TT10 and TT15. The shift strongly supports suggestions that pacing is regulated using a RPE template.



3650 Board #97 June 3 8:00 AM - 9:30 AM
Perceived Exertion Compared to Physiological Exertion over the course of Two Different Exercise Interventions

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 (Sponsor: Catrine Tudor-Locke, FACSM)
 (No relationships reported)

PURPOSE: To evaluate the differences in perceived exertion (RPE) and cardiovascular intensity (%HRmax), and to determine the differences in metabolic stress (RER) during two exercise interventions following guidelines for (1) general health and (2) weight loss. **METHODS:** Sedentary, overweight or obese men and women (N=133; age 47.68, range 21-65 y) were randomly assigned to one of two

intervention groups for 24wks. Exercise for general health and weight loss was prescribed at 8 and 20 kcal/kg body weight per week. Exercise was performed at a target HR associated with 65% and 85% of peak oxygen consumption (average HR% = 76.6±6.3%). HR and RPE were recorded every 5min during exercise. Respiratory values (VO₂, VCO₂, and RER) were measured at the start of exercise at BL and periodically during training (weeks 2, 4, 6, 8, 12, 16, 20, and 24) to determine energy expenditure and RER. Data were analyzed using a group by time analysis. **RESULTS:** RPE (mean±SD, 12.10±0.13 vs. 12.18±0.13, resp, treatment $p=0.67$, interaction $p=0.14$) and HR (133.96±1.69 vs. 135.48±1.68, resp, treatment $p=0.53$, interaction $p=0.62$) were not different between healthy exercise and weight loss groups. HR plateaued by week 8 for both the healthy exercise and weight loss groups (treatment $p=0.53$; 134.7±1.9 vs. 136.2±1.9, resp). %HRmax was not different between the healthy exercise and weight loss groups at any time point (treatment $p=0.59$, interaction $p=0.58$). RER was significantly different between groups at Week 8 (0.93, 95% CI [0.91, 0.94]; 0.89, 95%CI [0.87, 0.91], resp, $p=.001$) and Week 12 (0.93, 95% CI [0.91, 0.95]; 0.89, 95% CI [0.87, 0.91], resp, $p=0.0003$). **CONCLUSIONS:** Despite no difference in perceived exertion or cardiovascular intensity, exercise for general health seemed have a higher RER compared to exercise for weight loss. Physiological adaptations seemed to plateau at a similar time point between groups; however the increased caloric expenditure of weight loss may have induced metabolic adaptations at a faster rate compared to general health. Exercise for weight loss could induce metabolic adaptations without greater perceived or cardiovascular stress.

G-32 Free Communication/Poster - Pulmonary Diseases

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
 Room: Hall F

3651 Board #98 June 3 8:00 AM - 9:30 AM
Exercise Capacity In Cystic Fibrosis: Changes In C-Reactive Protein Matter

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INTRODUCTION: Exercise capacity, assessed by peak oxygen uptake (VO₂ peak), has been shown to predict mortality in patients with cystic fibrosis (CF), independent of lung function. Systemic chronic inflammation is a common phenotype in patients with CF characterized by an excessive production of circulating inflammatory mediators. Inflammation contributes to dysfunctional mitochondria, which in turn contributes to exercise intolerance. The link between inflammation and exercise capacity, however, has yet to be investigated in patients with CF. **PURPOSE:** This study sought to test the hypothesis that 1) C-reactive protein (CRP) is related to exercise capacity and 2) changes in CRP are related to changes in exercise capacity. **METHODS:** A prospective longitudinal cohort study was completed in 33 patients with CF (18 males and 15 females; age 20±10 yrs) involving a total of 127 visits over a 4 year period (average 4±2 visits per subject). At every visit, anthropometrics, pulmonary function test, exercise capacity, and circulating levels of CRP were evaluated. **RESULTS:** Overall, a significant inverse relationship was identified between VO₂ peak and circulating concentrations of CRP ($r=-0.389, p<0.001$). Longitudinal changes in VO₂ peak were negatively associated with changes in CRP ($r=-0.336, p=0.004$) and remained significant when either FEV₁ (% predicted) ($r=-0.345, p=0.004$), or BMI ($r=-0.281, p=0.018$) were considered. In addition, changes in VO₂ peak were also significantly associated with changes in CRP ($r=-0.248, p=0.041$) after controlling for FEV₁ (% predicted), BMI, and sex. Longitudinal changes in VO₂ (% predicted) were also correlated with changes in CRP ($r=-0.248, p=0.043$) even after controlling for FEV₁ (% predicted) ($r=-0.263, p=0.039$) or BMI ($r=-0.237, p=0.046$). **CONCLUSION:** Circulating CRP is inversely related to exercise capacity in patients with CF. Additionally, for the first time in CF, we have documented that the changes in CRP over time may predict meaningful changes in exercise capacity. These findings support the use of CRP to provide prognostic information into exercise capacity in patients with CF. Supported in part by NIH/NIDDK R21DK100783 and Vertex Pharmaceuticals IIS (RAH).

3652 Board #99 June 3 8:00 AM - 9:30 AM

Prevalence of Asthma and Exercise-induced Bronchoconstriction In College Wrestlers

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Exercise-Induced Bronchoconstriction (EIB), a transient narrowing of the airways, is activated by vigorous exercise in approximately 10% of the general population. Published articles indicate in college athletic populations, EIB is identified in between 3% and 42% of the tested population. **PURPOSE:** The purpose of this study was to identify the prevalence of asthma and EIB in college wrestlers. **METHODS:** Participants were 33 student-athletes (wrestlers). Athletes underwent baseline spirometry following American Thoracic Society (ATS) guidelines, to determine each athlete's individual baseline FEV₁. Each individual's FEV₁ was used to calculate 50-60% of exercise target ventilation (VE) (35*FEV₁*0.5 and 35*FEV₁*0.6). After the baseline spirometry was obtained the athlete performed exercise on a treadmill at 80-90% of their age predicted maximum heart rate or 40-60% of their maximal ventilation for at least 4 minutes. After exercise the athlete repeated maximum spirometry efforts at 2, 5, 10, 15, and 20-min. A fall in FEV₁ > 10% from baseline was considered positive for EIB. **RESULTS:** Thirty-three wrestlers volunteered for the testing. Three (9.09%) having been previously diagnosed with asthma were excluded. Two of the subjects (6.06%) failed to obtain a minimum of 70% of predicted FEV₁ at pre-test were also excluded. Of the 28 subjects completing the protocol, 4 (12.1%) failed to obtain 90% of their pre-exercise FEV₁ (mean FEV₁ drop post-exercise 12.8±2.2%) indicating EIB. In total, undiagnosed asthma (n=2) and EIB (n=4) were present in 18.8% of the college wrestlers who were unaware of their condition. **CONCLUSION:** Results of this study are important for raising awareness and potentially improving performance due to unknown pulmonary conditions in college wrestlers.

3653 Board #100 June 3 8:00 AM - 9:30 AM

Asthma, Undiagnosed Asthma, And Exercise-Induced Bronchoconstriction In Collegiate Men's Basketball

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Asthma and Exercise-Induced Bronchoconstriction (EIB) are pulmonary conditions associated with narrowing of the airways, one chronically and the other activated by exercise. Screening in college athletes is valuable, as there is a dearth of evidence and great variability (range 3-42%) among the prevalence rates published. **PURPOSE:** The purpose of this ongoing analysis is to systematically investigate these pulmonary conditions in athletes across the University-affiliated athletics program. **METHODS:** The current focus was on men's basketball players. The EIB protocol commenced with spirometry. Participants were encouraged to expire as forcefully as possible (and achieve a six second plateau). Values were collected in duplicate, with readings ideally within 150ml. Subjects with asthma and those failing to achieve a forced expiratory volume (FEV₁) of at least 70% of the predicted value were removed from ongoing testing. After the baseline spirometry was evaluated, the athletes performed a single-bout of exercise, intensifying to 80-90% of age predicted maximal heart rate (HR). Once at target HR, the stage was held for 4 minutes. Confirmation of an appropriate exercise intensity was established by confirming that 40-60% of the maximal ventilation was achieved (35*FEV₁*0.5 and 35*FEV₁*0.6). Post exercise, participants repeated the spirometry efforts at 2, 5, 10, 15, and 20-min time points. A fall in FEV₁ > 10% from baseline was considered positive for EIB. Values were reviewed by a registered respiratory therapist. **RESULTS:** Fifteen student-athletes volunteered for testing, as 1 (6.67%) had been previously diagnosed with asthma, he was excluded from ongoing testing. In the cohort tested, all athlete's obtained a minimum of 70% of predicted FEV₁ at pre-test. Of the 14 subjects completing the protocol, 2 (13.3%) failed to obtain 90% of their pre-exercise FEV₁ (mean drop 11.6±1.2%) at one of the post-test time points; an indication of EIB. In one subject (6.67%), results were not conclusive. **CONCLUSIONS:** There is value in raising awareness of these pulmonary conditions in athletes. Also, future research should simultaneously consider the divergent physiological, environmental, and bioenergetic demands placed on the athlete to investigate the prevalence rates from a more comprehensive view.

3654 Board #101 June 3 8:00 AM - 9:30 AM

Muscle Oxidative Capacity Is Low In The Upper And Lower Limbs Of COPD Patients

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Muscle atrophy, weakness and fatigability are characteristic of patients with chronic obstructive pulmonary disease (COPD), which contribute to dyspnea, exercise intolerance and morbidity. Comparisons between upper and lower limb performance suggests intrinsic differences in muscular adaptations between leg and arm muscles, with preserved *biceps brachii* endurance in COPD (Franssen et al. *MSSE* 37:2-9, 2005). We were therefore interested whether loss of muscle oxidative capacity was different between upper and lower limbs in COPD.

PURPOSE: To compare muscle oxidative capacity in the upper and lower limbs between smokers with or without COPD.

METHODS: 19 COPD patients (GOLD 2/3/4, n=7/6/6; FEV₁%pred 44.1±18.7; M/F=14/5) and 18 smokers with normal spirometry (CON; M/F=14/4) volunteered. Non-dominant medial forearm and medial *gastrocnemius* oxidative capacity was assessed from the O₂ consumption recovery rate constant (*k*) following brief muscle contractions using near-infrared spectroscopy with intermittent vascular occlusion. *k* was estimated from the mean of two repetitions. Differences were determined by 2-way ANOVA (group x limb).

RESULTS: There was a significant main effect of group on muscle oxidative capacity (F=11.7, $\eta_p^2=0.14$, p<0.001): COPD patients had significantly lower *k* in both upper and lower limb muscles (upper 1.01±0.17, lower 1.05±0.24 min⁻¹) compared with CON (1.27±0.49, 1.49±0.67 min⁻¹). However, there was no effect of limb (F=1.8, $\eta_p^2=0.03$, p=0.18) and no group x limb interaction.

CONCLUSION: We found that muscle oxidative capacity is lower in COPD than controls in both upper and lower limbs. Although, when compared to age- and sex-matched smokers with normal spirometry, *k* tended to be more reduced in the *gastrocnemius* (-30%) than the forearm (-20%) of COPD patients, this difference was not significant. Unlike previous findings, these data suggest that muscle mitochondrial function is systemically impaired in COPD patients, and not simply the result of inactivity-induced deconditioning; which is expected to manifest as greater impairments in lower limb than upper limb. The variables contributing to systemic deficiency in muscle oxidative capacity in COPD warrant further study. Supported by SNSF P300PB_167767; PERF; ATS Foundation/Breathe California of Los Angeles

3655 Board #102 June 3 8:00 AM - 9:30 AM

Prevalence of Exercise Induced Bronchoconstriction in Puerto Rican Athletes with Respiratory Symptoms during Exercise

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Athletes in endurance sports such as running, swimming and cycling, are at increased risk for exercise-induced bronchoconstriction (EIB). Exercise hyperventilation and frequent exposure to allergens and bronchial irritants, such as chlorine by-products in swimming pools, have been implicated in bronchial hyperresponsiveness, especially in those with a history of asthma. There is a high prevalence (~11%) of asthma in the general population of Puerto Rico and asthmatic athletes may be at risk of severe asthma exacerbations precipitated by exercise. **PURPOSE:** We examined the prevalence of EIB in athletes with respiratory symptoms during exercise, which underwent an exercise challenge test in our Center. **METHODS:** 54 athletes (14 adults, 40 adolescents; 25 females, 29 males) in 16 sport events classified as either low (skill, sprint/power, multiple events; N=18), medium (team, combat; N=12), or high (endurance; N=24) risk for EIB were examined. They completed an exercise challenge test, either running, cycling, or swimming at an intensity of 70-95% of estimated maximal heart rate for at least 7 to 15 min. Spirometry was measured pre-exercise and at 2, 5, 8, 11, and 15 min post-exercise. A fall in forced expiratory volume in 1 second (FEV₁) >10% was considered positive for EIB. **RESULTS:** Of the 54 athletes, 17 (31.5%) were positive for EIB. The prevalence among female and male athletes was 20% and 41%, respectively. 15/17 EIB positive athletes were adolescents, including 8 swimmers. Half of the EIB positive athletes were from events classified as high risk for EIB such as: long distance running (n=2) and swimming (n=4), road cycling (n=1), and triathlon (n=1). Eleven of the EIB positive athletes (65%) had a previous diagnosis of asthma, and 7 of those also had allergic rhinitis. Two of EIB positive athletes had allergic rhinitis only. Swimmers had an EIB prevalence of 53% (8/15). **CONCLUSION:** Results indicate that EIB may affect 1 in 3 athletes who

report respiratory symptoms during exercise. The prevalence is highest in swimmers suggesting airway hyperresponsiveness that may be associated to a previous history of asthma, allergic rhinitis, and/or exposure to chlorinated irritants. Athletes with previous diagnosis of asthma and/or respiratory symptoms should be screened with a challenge test so EIB can be detected and prevented.

3656 Board #103 June 3 8:00 AM - 9:30 AM

Relationship between Vascular Health and Maximal Exercise Capacity Following Sildenafil Treatment in Cystic Fibrosis

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Patients with cystic fibrosis (CF) have compromised exercise capacity (VO_2 peak) and impaired vascular health. Sildenafil, a phosphodiesterase type 5 inhibitor, has not only been shown to improve vascular health, but also improve maximal exercise capacity in various patient populations. However, it is unknown if improvements in vascular health contribute to improvements in exercise capacity in CF. **PURPOSE:** To investigate the relationship between the change in vascular health and the change in VO_2 peak following sub-acute treatment with sildenafil in patients with CF. **METHODS:** 14 patients with CF (age 9-43 y, BMI = 20.7 ± 4.1 kg/m²) participated in this study. At baseline and 4 weeks following sildenafil treatment (20 mg thrice daily), vascular health was assessed via flow-mediated dilation (FMD) and pulse wave velocity (PWV) to determine endothelial function and arterial stiffness, respectively. In addition, forced expiratory flow in 1 second (FEV_1) was assessed via spirometry as an index of disease severity, and VO_2 peak was determined on a cycle ergometer using the Godfrey protocol. Pearson correlations were used to investigate associations between changes (Δ) in VO_2 peak, FMD, and PWV while controlling for potentially confounding variables. **RESULTS:** VO_2 peak increased from 44.4 ± 8.7 to 46.6 ± 10.0 ml/kgFFM/min ($p = 0.010$) after controlling for baseline disease severity (FEV_1). FMD increased from 8.3 ± 5.2 to 9.3 ± 3.6 % ($p = 0.07$). There was a significant relationship between ΔVO_2 peak and ΔFMD ($r = 0.636$, $p = 0.035$) when controlling for age, BMI, and baseline FMD. PWV tended to decrease following treatment (5.4 ± 0.9 to 5.3 ± 0.9 m/s, $p = 0.077$); however, the change was not associated with ΔVO_2 peak ($r = 0.400$, $p = 0.373$) or ΔFMD ($r = 0.063$, $p = 0.894$) when controlling for age and baseline values. **CONCLUSIONS:** These data suggest that improvements in maximal exercise capacity can, in part, be explained by concomitant increases in FMD following 4 weeks of sildenafil treatment in patients with CF.

3657 Board #104 June 3 8:00 AM - 9:30 AM

<Using Active Video Game For Home Rehabilitation With COPD Patients: A Feasibility Study>

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The Chronic Obstructive Pulmonary Disease (COPD) is a lung disease with a significant deterioration of the quality of life, functional capacity, and important morbidity. However, exercise can improve fitness and functional capacity, linked with a better quality of life for these patients. **PURPOSE:** Motion capture devices with a high intensity interval training active video game never been tried with COPD patients. Thus, the objective was to observe the feasibility of using this device safely and easily with COPD patients. **METHODS:** A total of 14 patients (8 men 69±6 years, 6 women, 74±6 years), with a moderate to severe COPD diagnostic (FEV_1 % predicted: 44.0 ± 14.8 %, FEV_1/VC (%): 43.8 ± 15.2 % and FEV_1 : 1.12 ± 0.38 L, without a significant difference between the genders $F(1)=3.307$, $p=0.096$) performed 4 mini-games (Shape-Up, Ubisoft) adapted for their condition. During the games, the oxygen uptake, ventilation, heart rate and saturation was taken with a portable metabolic analyser (Metamax, Cortex Medical, Germany). Gaming sessions of 10 to 15 min duration were composed of 4 games of about 1.5 min separated with rest. **RESULTS:** The average and peak minute ventilation, and the METs peak were respectively: Stunt Run game (lifting knees on the spot) 25.3 ± 6.8 , 33.5 ± 8.2 L/min, and 4.2 ± 1.5 METs; Arctic Punch (punching targets): 23.1 ± 5.6 , 31.8 ± 9.8 L/min, and 3.7 ± 1.2 METs; To the Core (Core twist), 22.2 ± 7.3 , 29.2 ± 9.9 L/min, and 3.3 ± 1.1 METs, and Squat me to the Moon (sitting to standing from a chair), 27.8 ± 6.7 , 36.8 ± 11.1 L/min, and 4.4 ± 1.1 METs. No important desaturation was observed during the training. **CONCLUSION:** The safety, the pleasure/motivation reported by the participants and, the ability to use it with assistance seems that the game can be a good tool for maintaining physical activity at home for COPD patients. However, further investigation needs to be completed in order to observe the benefits in comparison to a traditional training program and to observe the utilisation at home.

3658 Board #105 June 3 8:00 AM - 9:30 AM

The Acute Response to Sprint Interval Exercise in Adults With and Without Confirmed Airway Hyper-responsiveness

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Among those with airway hyper-responsiveness (AHR), acute bronchoconstriction typically follows an acute bout of moderate intensity continuous exercise (MICE) due to an increase in ventilation. Similar to high intensity interval exercise, sprint interval exercise (SIE) may reduce the risk of bronchoconstriction due to the recovery periods between sprints. **Purpose:** To compare changes in lung function following a SIE and a MICE session in those with and without confirmed AHR. **Methods:** Participants completed four sessions. Session 1 was to confirm AHR using a $\geq 15\%$ decline in forced expiratory volume in 1 second (FEV_1) following a eucapnic voluntary hyperpnea challenge. In session 2, participants completed a maximal exercise test to determine maximal O_2 uptake and peak power output (PPO). Participants then completed SIE (4 x 30 second sprints at 0.075kg/kg bodyweight, separated by 4.5 minutes of unloaded cycling) and MICE (65% PPO for 20 minutes) sessions in random order separated by at least 72 hours. All exercise sessions were completed on a cycle ergometer. Lung function was assessed pre and post exercise (1, 5, 10, 15, and 20 mins post) as well as at 3.5, 8.5, 13.5 and 18.5 minutes during exercise to coincide with time points post-sprint. Expired O_2 and CO_2 were collected breath-by-breath, and deoxygenated hemoglobin (HHb) was continuously monitored throughout exercise using near-infrared spectroscopy. **Results:** No statistically significant difference was observed for FEV_1 when comparing SIE and MICE ($8.56 \pm 7.07\%$ vs. $8.48 \pm 3.09\%$, respectively, $p=0.98$) among those with AHR. One participant with AHR experienced a $\geq 10\%$ decline in FEV_1 following SIE and another participant experience a clinically relevant decline following MICE. In participants with AHR, no statistically significant differences were observed in average ventilation during MICE compared to SIE (66.97 ± 10.69 vs. 64.20 ± 9.89 , $p=0.35$). Peak ventilation was greater during SIE (108.27 ± 17.00) compared to MICE (87.66 ± 13.88 , $p<0.05$). In participants with AHR, maximum ΔHHb was not significantly different when comparing SIE and MICE (5.03 ± 3.73 vs. 5.79 ± 2.67 , respectively, $p=0.43$). **Conclusion:** SIE and MICE lead to similar post-exercise declines in lung function. This may be due to the similar average ventilation observed in both sessions.

3659 Board #106 June 3 8:00 AM - 9:30 AM

Abnormal Gas Exchange in Dyspneic Veterans with Normal Spirometry

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Over the last two decades, more than 3 million veterans have experienced at least one combat deployment to the Middle East. Some Veterans present with respiratory complaints that began after deployment and frequently attribute these symptoms to deployment-related airborne hazards exposure (e.g., sand and dust, burn pits), but spirometry is often within normal limits. **PURPOSE:** To compare cardiopulmonary exercise responses in veterans reporting frequent (High Sx) and infrequent respiratory symptoms (Low Sx) who have normal spirometry. **METHODS:** 28 veterans were referred to our post-deployment tertiary care clinic for a dyspnea evaluation. 15 veterans (45.3±11.6 years) reported ≥ 2 lower respiratory symptoms on a bi-weekly basis over the preceding 6 months (High Sx), and 13 (46.5±8.5 years) reported ≤ 1 lower respiratory symptom at least bi-weekly. All veterans underwent complete pulmonary function testing and cardiopulmonary exercise testing (CPX). **RESULTS:** Forced vital capacity (High Sx, Low Sx: 99.9 ± 10.8 , 98.0 ± 12.8 %predicted) and forced expiratory volume in 1 second (99.5 ± 12.5 , 97.0 ± 14.7 %predicted) were similar between groups. On CPX, veterans in the High Sx group had lower peak oxygen consumption (VO_2) relative to body mass (22.6 ± 7.2 , 27.8 ± 6.0 ml/kg/min, $p=0.05$); though both groups achieved ventilatory threshold at an acceptable level of exercise (52.5 ± 15.9 , 51.7 ± 11.1 % peak VO_2). High Sx veterans had a significantly higher ventilatory equivalent for carbon dioxide (VE/VCO_2) slope (34.7 ± 11.4 , 27.0 ± 3.2 , $p<0.05$), and revealed significantly lower end-tidal carbon dioxide ($PetCO_2$) levels at ventilatory threshold (36.6 ± 7.3 , 41.4 ± 3.2 mmHg, $p<0.05$). **CONCLUSIONS:** Despite similar resting lung function, veterans who reported more frequent lower respiratory symptoms had reduced exercise capacity and poorer gas-exchange in comparison to their less symptomatic counterparts. These findings may suggest an underlying gas exchange pathology that is not yet detectable at rest. Therefore, CPX should be considered when evaluating deployed veterans with respiratory complaints; especially when resting measures of pulmonary function are normal.

3660 Board #107 June 3 8:00 AM - 9:30 AM
Postoperative Complications After Surgical Treatment For Exercised Induced Laryngeal Obstruction

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PURPOSE: Exercised induced laryngeal obstruction (EILO) is a situation in which an apparently normal larynx instead of opening fully during exercise adducts, and thus represents an obstruction to free airflow. In principle, EILO can be primarily glottic or supraglottic. Surgery has been suggested as treatment for highly motivated patients suffering from severe forms of the latter. We would like to report on complications after surgical treatment for supraglottic EILO.

METHODS: During 2010-2015, 66 patients underwent laser supraglottoplasty due to a primary severe supraglottic EILO verified using continuous laryngoscopy during exercise. The surgical procedure was performed in general anaesthesia by one of three surgeons. Care was taken to avoid patients with glottic EILO or other upper airway malformations.

RESULTS: Of 66 patients operated at mean age 15.8 (range 5-26) years, 43 (65%) were females, three (4.5 %) required two surgical procedures, and 63 (95 %) met for a postoperative follow-up exercise laryngoscopy (mean interval 5.8 months). Complications were reported for two patients: (A) Male, 15 years at surgery, diagnosed with postoperative left recurrent laryngeal nerve palsy. Injury caused by intubation or a direct complication from surgery were possible explanations. A mediastinal mass discovered on chest x-ray and a concomitant Epstein-Barr infection, prompted comprehensive work-up; however, with no conclusive findings. At a second follow-up 1.5 year later, the patient had nearly fully recovered and had no problems performing daily activities. (B) Male, 13 years at surgery, diagnosed with postoperative extensive scarring needing a re-operation. Fifteen months after the last surgery, he still had breathing problems during heavy exercise, but reported no problems performing daily activities. Exercise laryngoscopy performed at that time indicated better laryngeal opening when compared to the findings before the first surgery, despite the postoperative scarring.

CONCLUSIONS: Complications were experienced by 2/66 (3%) highly motivated patients operated with supraglottoplasty for severe supraglottic EILO. At follow-up approximately 1.5 years after last surgery, none had symptoms influencing their daily activities.

3661 Board #108 June 3 8:00 AM - 9:30 AM
Influence of Respiratory Limitation on Exercise Capacity with Potential Implication of Ventilatory Muscle Fatigue

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 (No relationships reported)

Introduction: It is known that respiratory muscles are prone to fatigue in women with systemic lupus erythematosus (SLE) but the extent to which this limits their cardiorespiratory capacity is yet unclear. **Purpose:** This study characterized the ventilatory response during maximal exercise testing in women with SLE, examining the potential contribution of respiratory muscle fatigue to diminished cardiorespiratory fitness. **Methods:** Fifteen women participated in the study (control: n=7, age= 36±8 yr, SLE: n=8, age=37±9 yr). Each subject performed a modified Bruce treadmill exercise test to volitional exhaustion. The ventilatory response was characterized by measures of expired minute volume (Ve), tidal volume (Vt), respiratory rate, expiratory time (T_e), ventilatory quotients for O₂ and CO₂ and ventilation-perfusion matching using expired gas analysis and exponential rise CO₂ rebreathing methods. **Results:** Women with SLE had lower Vt (1449±83 vs 1795±124 ml; p=0.04) and Ve (61±6.7 vs 71.4±4.1, Cohen's ES=0.70) and prolonged T_e (42±2.5 vs 32±2.3 ms, p=0.03) compared to the control group. Significant differences of the other cardiorespiratory measures were not observed. The time to exhaustion during the exercise test (13±0.70 vs 17±0.46 min; p=0.02) and peak VO₂ (21±1 vs 29±2 ml/kg/min p= 0.01) were significantly diminished in those with SLE. **Conclusion:** Poor cardiorespiratory endurance has been reported in women with SLE. In the current study, group similarity in ventilatory efficiency and ventilation-perfusion matching eliminate the observation of any impairment of ventilatory drive. Conversely, the decline in Ve and Vt, and an increase in T_e coupled with a decreased time to exhaustion suggest that respiratory muscle fatigue may have contributed to low cardiorespiratory fitness and endurance in these subjects.

NIH/NICHD 1R03HD39775

3662 Board #109 June 3 8:00 AM - 9:30 AM
Health Related Quality of Life in COPD Patients Completing Aerobic and Resistance Training

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Both aerobic and strength training have been found to improve health related quality of life in chronic obstructive pulmonary disease (COPD) patients. However, these findings are not unequivocal, and there has been no direct comparison between the two training methods. **PURPOSE:** To compare improvements in health related quality of life in a group of COPD patients completing both an aerobic and strength training program. **METHODS:** Eleven mildly diseased patients completed a 3 month aerobic training program and, approximately 5 years later, a 3 month strength training program. Differences between 3 month and baseline scores were examined for the 4 domains of the Chronic Respiratory Disease Questionnaire (CRDQ) - a disease specific measure (dyspnea, fatigue, emotional function, mastery) and the 2 summary measures (physical (PCS) and mental (MCS)) component scales of a generic survey (SF-36) and the physical function subscale of the SF-36. **RESULTS:** Fatigue scores improved by 0.9 ± 0.3 units (p = 0.02) for the aerobic group and 0.8 ± 0.4 units (p = 0.07) for the strength training group. These differences were not significantly different from one another. No other domains of the CRDQ were found to increase significantly in either group. PCS scores improved by 5.7 ± 2.5 units (p = 0.05) in the aerobic training group, but only by 0.7 ± 2.9 units (p = 0.82) in the strength training group. MCS scores did not improve significantly for either group. Physical function scores improved by 3.3 ± 1.4 units (p = 0.04) in the aerobic training group, but only by 0.5 ± 1.2 units (p = 0.70) in the strength training group. **CONCLUSIONS:** These results suggest that an aerobic training program may be a better training modality to improve health related quality of life in patients with COPD.

3663 Board #110 June 3 8:00 AM - 9:30 AM
Supplemental Oxygen Enhances the Effects of Interval Training On Exercise Capacity in Cystic Fibrosis

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PURPOSE: to examine the effect of interval exercise training with supplemental O₂ on VO₂ kinetics and endurance time in individuals with cystic fibrosis (CF).

METHODS: Using a single blind design, adults with different severities of CF were randomly assigned to a room-air group (n=4, FEV₁ = 43(31-109) % of predicted) or supplemental O₂ group (n=5, FEV₁ = 45(31-86) % of predicted). The training program consisted of interval training on a cycle ergometer, 2 days a week for 8 weeks at an intensity of 30% and 75% of the initial peak work rate (WR). All subjects performed a pulmonary function test, incremental symptom-limited cardiopulmonary exercise test on a cycle ergometer, and a submaximal constant WR exercise test at 30% and 70% of the initial peak WR. VO₂ kinetics assessed by mean response time (MRT) and physiological responses during low and high constant exercise were assessed before and after the exercise program. Within each group, data were compared using the Wilcoxon sign rank test.

RESULTS: Breathing supplemental O₂ during the training program improved the total duration of high intensity interval training by 93% (p<0.05) in the supplemental O₂ group between week 1 and week 8 (15±3 vs. 29±2 min, p<0.05), with no change in the room-air group (17±4 vs. 25±9 min). The improved in VO₂ kinetics (MRT) was significantly greater in the supplemental O₂ group than the room-air group following exercise training, 40(36-58) to 32(26-53) versus 42(28-67) to 36(26-58) min, respectively, p<0.05. Endurance time to exhaustion in high intensity constant load exercise improved following exercise training in the supplemental O₂ group [11 (11-14) vs. 27 (14-30) min, p<0.05], and did not change in the room-air group [10 (7-20) versus 18 (8-27) min].

CONCLUSIONS: The provision of supplemental O₂ during exercise training yields higher training volume and improves VO₂ kinetics and endurance capacity in CF patients. Supported by the Cystic Fibrosis Hopesource Foundation in Ireland

G-33 Free Communication/Poster - Research Methods

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
 Room: Hall F

3664 Board #111 June 3 8:00 AM - 9:30 AM
Relationship between Body Weight and Youth Fitness Tests with Absolute and Relative Load
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A physical fitness test gets its information by test takers performing under a load, e.g., carrying one's own body while running, lifting a weight, and using a handgrip device. The load of one's own body weight (BW) varies from person to person and the loads of weights or devices are constant. Therefore, the former can be called a "relative load" and the latter can be called an "absolute load." The relationship of these loads in regards to test takers' weight in youth fitness testing have not been carefully examined.

Purpose: To examine the role of BW in the youth physical fitness tests with absolute and relative load.

Method: A subset of raw data from the 2012 National Youth Fitness Survey were used for the study, in which a total of 1,640 children and youth (M±SD: Age = 9.07±3.70 yr.; height = 136.98±22.90 cm; weight = 39.55±20.68 kg; BMI = 19.58±5.04) were tested for two sets of tests with body weight as the load (relative load), consisting of maximal endurance time on a treadmill test, modified pull-up, and plank, and without body weight as the load (absolute load), using handgrip strength and leg extension (combined). After analyzing the data using descriptive statistics by age and sex, the correlations between BW and absolute and relative load tests were computed.

Results: Descriptive statistics (M±SD) of the tests and their correlations (r) with BW were summarized below:

	Endurance Time (sec)	Pull-up (#)	Plank (sec)	Handgrip (kg)	Leg extension (pounds)
Male	663.30±152.44	6.32±6.38	63.86±49.58	45.8463±21.42	113.88±65.16
Female	636.83±122.74	3.56±4.15	58.08±40.92	39.3208±14.33	104.25±50.67
Total	649.52±138.31	4.94±5.55	60.96±45.52	42.57±18.49	109.02±58.47
Male	-.49	.12	.22	.79	.70
Female	-.47	-.21	.12	.79	.67
Total	-.47	-.01	-.18	.78	.69

Conclusion: BW has a negative correlation with relative load fitness tests and has a positive relationship with absolute load fitness tests. The question then is which load should be used in physical fitness testing, absolute or relative one? While more studies are needed to answer this question, it seems that absolute load is more appropriate for performance-related fitness since the best performance in a sport competition is the key interest while relative load is more appropriate health-related fitness since one's own health is the main focus.

3665 Board #112 June 3 8:00 AM - 9:30 AM
The Importance Of Accurate Measurements In Voluntary Wheel Running In Mice
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PURPOSE: Accuracy of data collection is essential in reducing variability in voluntary wheel running which could potentially hide statistically significant results. When measuring physical activity in rodents, a large portion of each collection period is unobserved and thus, systematic checks to reassure functionality must be a priority. The purpose of this study was to create a procedure that would determine if a running wheel was accurately functioning based on the measured data.

METHODS: The TAMU IACUC approved all procedures. SENCAR breeder pairs were mated and at 3 weeks of age, the female pups were co-caged. At 4 weeks of age, two running wheels were mounted in each cage, with an odometer attached to the top of the cage to record daily distance (km/day), duration (mins/day), and to calculate speed (m/min). At 14 weeks of age, the number of manual rotations required to reach a 0.01 km change on the odometer was determined with the number of rotations averaged across three trials. Each wheel's position in relation to the computer pick-

up was then adjusted until the total spins to reach a 0.01 km odometer change were as close to 61 (calculated to be the true distance of 0.01 km) as possible. Resulting average daily distance, duration, and speed were compared to the amount of rotations before and after adjustment using a one-way ANOVA.

RESULTS: Wheel rotations needed to reach 0.01 km before adjustments to the wheel were significantly higher (p=0.002) than after adjustments (74.7±15.3 vs. 64.5±6.6 rotations, respectively). Before adjustments, rotations had varying correlations with distance (R²=0.080; p=0.18), duration (R²=0.027; p=0.44), and speed (R²=0.50; p<0.0001). After adjustments, all correlations were lower and insignificant with distance (R²=0.0034; p=0.79), duration (R²=0.0032; p=0.51), and speed (R²=0.0091; p=0.66). **CONCLUSIONS:** Completing ongoing and regular manual checks on the functionality of running wheels will allow for higher accuracy and lower variance in data, especially running speed, which could otherwise hide significant differences between treatment groups.

3666 Board #113 June 3 8:00 AM - 9:30 AM
New Analysis Software To Evaluate Performance
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Vienna CPX-tool is newly developed software that evaluates cardiopulmonary exercise test by assessing the transitions (T) between 3 phases of energy supply, i.e., T1 and T2. We integrated 3 calculation methods (angle, regression and error variance). Each allows for estimation of threshold indicators (IND) of blood lactate turn point 1 (LTP₁), first ventilatory threshold 1 (VT₁) and ventilatory equivalent of oxygen (V_E/V_{O₂}) for T1 and LTP₂, VT₂, V_E/V_{CO₂}, and heart rate turn point (HRTP) for T2. Since each T is based on a common physiological mechanism, we assume that an accurate calculation method would yield a small range of power output (PO) estimates IND within each T. **PURPOSE:** The aim of the present study was to compare the 3 methods via the Vienna CPX-tool. **METHODS:** Sixty-five incremental cardiopulmonary exercise tests were analyzed for PO estimates of LTP₂, VT₂, lowest turn point of V_E/V_{CO₂} and the HRTP with any of the three calculation methods. To compare the results with the PO at the maximal lactate steady state (MLSS), the following criterion was used: a valid MLSS prediction was provided if the difference between the PO estimate and the PO at the MLSS was within a range of ± 4% from the maximum PO resulting from the incremental test. Pearson's chi-square was used to test for the effects. To determine the association between the variables, pairwise comparisons were calculated via Bonferroni-Holm tests. **RESULTS:** Prediction frequencies were only significantly different between the angle and regression for LTP₂, as well as the angle and regression and regression and error variance in VT₂. **CONCLUSION:** The implemented calculation methods had a prediction accuracy of ~75-80% using a ± 4% criterion. Based on the present results it is not possible to identify a single best method whereby angle seems to be the most robust variable. To improve calculations and estimations of the above listed variables should be the leading priority for future research endeavors.

3667 Board #114 June 3 8:00 AM - 9:30 AM
Effect Of Neighborhood-unit Definition On The Relationship Between Physical Activity And The Built Environment
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 (No relationships reported)

PURPOSE: Substantial evidence demonstrates that built environment features, like density, connectivity, land-use, pedestrian/transit infrastructure, and recreational facilities, can influence physical activity. However, inconsistent findings remain in terms of significance, direction and strength. The purpose of this paper was to determine if the lack of a standardized definition for a neighborhood unit contributes towards these inconsistencies. **METHODS:** Published literature (PUBMED & SCOPUS) was abstracted to identify studies examining the relation between physical activity and Geographic Information Systems (GIS)-based built environment measures. Data were abstracted to determine the various definitions of neighborhood units used for GIS built environment measures. Each tested association was coded per the presence or absence of a significant finding. Logistic regression was used to estimate the odds of reporting a significant association (p<0.05) between GIS built environment measures and physical activity outcomes, by neighborhood unit definition. Models adjusted for study sample size. **RESULTS:** Among 165 articles (published articles since Jan 2013), 26.8% used Euclidean buffers of varying radii (400-3000m) to

define neighborhoods, 28.4% used network buffers, and 44.8% used administrative units of different shapes and sizes (e.g., census tracts). Relative to studies using large administrative units to represent a neighborhood, those using buffers of 400-500m (OR: 3.2, 95% CI: 1.4, 5.8), and 800-1000m (OR: 2.9, CI: 1.3, 7.1), had greater odds of reporting a significant association between GIS built environment measures and physical activity outcomes. Among those using buffers, no significant differences were found between Euclidean vs. network buffers (OR: 1.07, 95% CI: 0.46, 4.29). **CONCLUSIONS:** Researchers aiming to accurately estimate the effect of the neighborhood built environment on physical activity should consider using 400-1000m buffer-based GIS indicators. Using network vs. Euclidean buffers may not be essential for characterizing the neighborhood environment for physical activity research. Future analyses should examine differences by physical activity measures (objective vs. subjective) and by built environment constructs. Supported by NIH R01DK101593

3668 Board #115 June 3 8:00 AM - 9:30 AM
Validation Of A Multi-electrode Bioelectrical Impedance Analyzer With A Dual-energy X-ray Absorptiometer

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Reported Relationships: N. Meier: Contracted Research - Including Principle Investigator; Biospace Co, Ltd.

Sarcopenia, the loss of muscle mass, strength, and function due to ageing, is a major health concern for the growing older adult population. One challenge for prevention, diagnosis, and treatment of sarcopenia is the need for a dual-energy X-ray absorptiometry (DXA) analyzer to measure appendicular lean mass (ALM). DXA is the recommended measurement of muscle mass for sarcopenia, but is expensive and exposes subjects to radiation. Therefore, inexpensive, safe, and widely available alternative measurements, such as bioelectrical impedance analysis (BIA), need to be identified and validated to be practically utilized in clinical settings. **PURPOSE:** The purpose of this study is to validate the multi-frequency BIA with 8 tactile electrodes (InBody 720) with the gold-standard DXA scan (Hologic Horizon W). **METHODS:** Participants were 277 older adults from 65 to 96 years old without history of cancer and severe medical or mental conditions. Individuals completed a 12-hour fast, refrained from activity that morning and wore scrubs. BIA and DXA analyses were taken immediately after each other. **RESULTS:** Correlation between the two methods for fat free mass (FFM), ALM, and percent body fat (PBF) were 0.93, 0.86 and 0.92, respectively, after adjusting for age and sex. Mean Percent Error (MPE) (DXA - InBody) and Mean Absolute Percent Error (MAPE), measures of prediction accuracy, were -13% and 13% for FFM, -12% and 13% for ALM, and 16% and 17% for PBF. Prediction equations were developed for improved estimation, in which age was coded in years and sex was coded as 1 for male and 0 for female:

DXA FFM = 0.83 (BIA FFM) + 0.025 (Age) + 2.0 (Sex) + 0.36 (R²=0.96)

DXA ALM = 0.74 (BIA ALM) - 0.025 (Age) + 1.84 (Sex) + 4.15 (R²=0.92)

DXA PBF = 0.71 (BIA PBF) - 0.089 (Age) - 3.3 (Sex) + 23.5 (R²=0.91)

DISCUSSION: The BIA body composition variables are highly correlated with DXA variables. However, we found consistent overestimation of FFM and ALM and underestimation of PBF in BIA compared to DXA based on MPE and MAPE analyses, which were incorporated in the development of FFM, ALM, and PBF estimation equations.

Supported by unrestricted research grant by Biospace Co, Ltd.

3669 Board #116 June 3 8:00 AM - 9:30 AM
A Useful Equation For Predicting Visceral Adipose Tissue Volume From Anthropometric Measurements

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Abdominal circumference (AC) at the umbilical region is used to define metabolic syndrome (MS) in Japan. The AC is based on a cross section of the abdominal visceral adipose tissue (VAT) area. However, recent studies indicate that using a single-slice image may lead to an erroneous conclusion as to individuals' VAT accumulation levels. Therefore, relying only on AC may be an inadequate method for evaluating individual VAT accumulation levels and defining MS. **Purpose:** To develop a new equation model for predicting VAT volume using anthropometric values and to clarify the association between metabolic risk factors and actual and predicted VAT volume values. **Methods:** The cross-sectional data of 214 participants (derivation group) were used to develop an equation model for VAT volume, and data from 66 of the participants (validation group) were used to validate this anthropometric model for predicting VAT volume.

We collected anthropometric measurements and measured metabolic risk factors: blood pressure, HDL cholesterol, triglyceride and fasting glucose. VAT volume was determined by continuous T1-weighted abdominal magnetic resonance images. **Results:** Using multiple regression analyses, we determined the best prediction equation for abdominal VAT volume with a VAT variance of 47% as follows: VAT volume (cm³) = (74.18×AC) + (47.03×age) + (117.79×BMI) - 8792.733. In our validation group, the correlation coefficient between the predicted and actual VAT was 0.71 (P < 0.01). Also, the predicted VAT volume correlated significantly with blood pressure and fasting glucose, even though we did not observe significant correlations between AC and these risk factors. **Conclusions:** The predicted VAT volume from our equation model was significantly related to metabolic risk factors. This study suggests that the equation model has potential to assess VAT accumulation levels in the field and in clinical settings where CT or MRI is not available.

3670 Board #117 June 3 8:00 AM - 9:30 AM
Data Imputation Improves Sedentary Behavior and Physical Activity Estimates in Low Wear Time Accelerometer Data

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(No relationships reported)

Missing accelerometer data from low participant wear time underestimates sedentary behavior (SB) and physical activity (PA) measurements. Yet, it remains unclear if imputing data for low participant wear time improves SB and PA estimates.

PURPOSE: To determine if a data imputation technique improves SB and PA estimates in accelerometer data with low participant wear time. **METHODS:** One-hundred participants wore an accelerometer at the hip for ≥22.0 hours/day, at least 4 days including 1 weekend day, to capture habitual SB, light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) levels. After removing sleep time (RAW; 15.9±3.5 hours/day), random 60-minute blocks of data were removed from the RAW data set until participants had a unique data set with wear time adherence at 10 hours/day. A minute-by-minute, mean data imputation technique was used to impute estimates of SB, LPA, and MVPA in place of the missing data for the 10-hour adherence level. A series of paired t-tests with a Bonferroni correction (alpha level=0.006) compared the estimates of SB, LPA, and MVPA to the RAW data set at the 10-hour adherence level. Similarly, imputed estimates of SB, LPA, and MVPA were compared to the RAW data set at the 10-hour adherence level. **RESULTS:** SB, LPA, and MVPA were underestimated by 163.7 (95% confidence intervals [CI]: 156.0, 171.5; p<0.0001), 138.4 (CI: 129.1, 147.9; p<0.0001), and 27.2 (CI: 24.3, 30.1; p<0.0001) minutes/day at 10-hours of wear compared to the RAW data set, respectively. When utilizing the data imputation technique at the 10-hour adherence level, SB and MVPA were underestimated by 16.8 (CI: 8.7, 24.9; p<0.0001) and 17.1 (CI: 14.5, 19.6; p<0.0001) minutes/day compared to the RAW data set, respectively. LPA at the 10-hour adherence level was overestimated by 33.9 (CI: 25.9, 41.9; p<0.0001) minutes/day compared to the RAW data set after utilizing the data imputation technique. **CONCLUSION:** A minute-by-minute, mean data imputation technique improved SB, LPA, and MVPA estimates in accelerometer data with low wear time adherence. Future studies should examine the impact of data imputation techniques on accelerometer data with low participant wear time.

G-34 Free Communication/Poster - Training and Recovery

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3671 Board #118 June 3 9:30 AM - 11:00 AM
Effects Of Different Pull Up Training Strategies On Pull Up Scores

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(No relationships reported)

PURPOSE: The ability to perform pull ups is important for improving mission readiness and for career advancement and retention for tactical athletes such as military, fire, and police. The purpose of this study was to investigate different strategies for improving pull ups. **METHODS:** Healthy adults were recruited via the internet and randomized into one of four training groups: traditional (5 sets of repetitions to failure, n=17), additional

loading (5 sets of repetitions to failure with additional 10% body weight, $n=7$), eccentric-only (5 sets of 6-second-eccentric-phase-only repetitions to failure, $n=6$), and control (no pull up training, $n=9$). Participants assessed pull ups at baseline, week 6, and week 12. Over 12 weeks, participants followed general training guidelines and performed pull up specific training twice per week. Changes in number of pull ups were compared with ANCOVAs, using body mass as the covariate.

RESULTS: There were no differences between training groups on changes in pull ups at any point. All intervention groups improved significantly more than the control group from baseline to week 12 ($p < 0.05$). On average, intervention participants improved from 9.3 (+ 5.7) repetitions at baseline to 12.9 (+ 7.0) repetitions at week 6, to 15.3 (+ 8.4) repetitions at week 12. The eccentric training group had the highest drop-out rate and required the greatest time commitment.

CONCLUSIONS: On average for all intervention participants, the improvements in pull ups were large, with a 39% improvement by week 6 and a total of 65% improvement over baseline at week 12. Eccentric training requires more time to complete and potentially decreases adherence to a training program and thus may be a less efficient training program. Any mode of pull up training, performed twice per week, using the basic structure of five sets of maximal repetitions, is effective at improving pull up performance.

3672 Board #119 June 3 9:30 AM - 11:00 AM
Continuous Maximal Vertical Jumping Until Exhaustion Negatively Affects Landing Impact Severity: Effective Duration Measure

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Non-contact ACL injuries account for ~75% of all knee injuries. Landing criteria have been recommended as a prevention strategy: proper knee and hip flexion angles, minimize knee abduction and land softly on both feet simultaneously. However, when fatigued, individuals have been shown to adopt higher risk landing strategies.

PURPOSE: Evaluate landing impacts during maximal vertical jumping (MVJ) until exhaustion using a novel measurement method. **METHODS:** 14 male and 14 female, recreational athletes performed a MVJ every 5 s until exhaustion. We monitored 3D lower limb kinematics and vertical ground reaction forces (VGF) with parallel force plates. Effective duration (ED) is calculated as the VGF impulse during landing (first ground contact to the bottom of crouch when vertical velocity becomes zero) divided by the peak VGF, and represents the magnitude of the peak force relative to the downward momentum that was arrested during the landing. A decreasing ED would be associated with less hip, knee and/or ankle flexion during a landing and would pose a higher risk for instability and injury at the knee. For example, a peak GRF of 1779.9 N would need to be exerted for 0.122 s (ED), to equal the total impulse (217.4 Ns) of the entire landing curve. Jump height was also recorded and normalized to body mass and time was expressed as a percent of trial duration (%trial = 0, 20, 40, 60, 80, and 100%).

RESULTS: There was a main effect of time and gender on both jump height and ED. Males jumped 53% higher than females but both genders had a significant decrease in jump height with fatigue. Females maintained an ED that was an average of 14.5% longer than males, but both demonstrated progressive and significant decreases in ED in response to fatigue (18% decrease by the end of the trial). **CONCLUSION:** This measure was found to provide an excellent representation of the impact severity, independent of the height jumped, so it was an effective single measure that could monitor the adverse effects of fatigue on the risk of knee joint injury over the course of the trials. Effective duration shows promise for instantaneous feedback of landing impact injury risk so that athletes at risk can be identified and trained to maintain safe landing mechanics in the face of fatigue.

3673 Board #120 June 3 9:30 AM - 11:00 AM
11-wk Preparation With Polarized Compared To Pyramidal Intensity Distribution Is Not Superior In Sub-Elite Rowers

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Polarized intensity distribution (POL) is discussed to be superior to pyramidal distribution (PYR) in high performance endurance sports. POL is characterized by relatively high training volume performed in zone (Z) 1 (low intensity; < 2 mmol/L blood lactate) and Z3 (high intensity; > 4 mmol/L blood lactate), with far less volume in Z2 (close to lactate threshold). PYR is characterized by greater volume in Z2 than in Z3, albeit similar total volume. **Purpose:** The aim of this prospective study was to evaluate whether the gains in performance was superior with POL when compared to

traditional PYR in sub-elite rowers during the final 11 weeks of a preparation period.

Methods: Fourteen internationally competing German male rowers participated in the 11-wk intervention and pre-post testing (age: 20 ± 2 y, VO_{2max} : 66 ± 5 mL/min/kg). The sample was split into a PYR and a POL group by varying the percentage spent in Z2 and Z3 and matched for overall training and rowing volume including strength, unspecific endurance and other training (e.g. stretching). The actual training and intensity distributions were calculated from all athletes' official training diaries and heart rate. To quantify the level of polarization, an index was calculated as follows: Pol-Index = $\log(Z1/Z2*Z3)$. Main outcome variable was average power in 2000 m ergometer test (P2k) (Concept 2). **Results:** PYR and POL did not significantly differ regarding specific training volume (1334 ± 67 km and 1255 ± 264 km) or total volume (5953 ± 315 min and 5919 ± 1216 min), but POL had a significantly higher percentage of Z3 intensities ($6 \pm 3\%$ vs. $2 \pm 1\%$; $p < .005$) and lower amount of Z2 ($1 \pm 1\%$ vs. $3 \pm 2\%$; $p < .05$) than PYR while Z1 was similar ($94 \pm 3\%$ vs. $93 \pm 2\%$, $p = .37$). P2k significantly improved from 443 ± 30 W to 445 ± 26 W ($p = .023$), but no changes were found between groups or between measurements within groups. 6/7 (86%) of the rowers with a Pol-Index > 2 improved P2k by more than 1.3%, being the estimated error of measurement for this specific test. **Conclusion:** POL was not significantly superior to PYR during 11 wk of preparation in 14 rowers. However, results suggest that POL could be beneficial and advantageous, if it is particularly pronounced.

3674 Board #121 June 3 9:30 AM - 11:00 AM
A Study of Sling Exercise Training for Judo Athlete to Improve Technique of Seoi-nage

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(No relationships reported)

Purpose: As an important and the most frequently used Judo skill, the technique of Seoi-nage requires Judo athlete to disturb the balance of the opponent, and maintain his own stability and balance at the same time. This lies on the strong support of core muscles. As we known, sling exercise training (SET) is an effective method for core stability training, which can enhance core strength and stability and improve the ability of balance control. However, very few studies are found about the application of SET in the Judo training. The purpose of the study is to investigate how SET affects the technique of Seoi-nage for Judo athletes.

Methods: A total of 14 health male Judo athletes has participated in the study. They are all athletes of National Rank 2 from a sports university. They are randomly divided into two groups, the SET group (S, $n=7$) and the control group (C, $n=7$). The S group use the SET program particularly designed for them, while the C group take only conventional free-hand training, which has the comparable load as the S group. They take the training for 6 weeks, three times per week, and each time lasting 15-20 minutes. Before and after the training, technical specifications of Seoi-nage are recorded and analyzed by the video analytical system. The kinematical parameters include the level of the trunk maximum flexion angle (TMFA), maximum angular velocity (MAV), the leg speed in stage of the entering, and the time to finish Seoi-nage. The quality score and the number of Seoi-nage performed within 30 seconds are also measured. The data are processed by the SPSS 13.0. One-way ANOVA is used.

Results: After 6w training, we got the following results. (1) The S group has significant increases ($P < 0.05$) in the averaged TMFA from 20.1° to 28.4° and the MAV from $177.1^\circ/\text{sec}$ to $197.0^\circ/\text{sec}$. (2) The mean speed of leg in stage of the entering is 0.12 sec, significantly improved ($P < 0.05$) compared with the group C, which is 0.15 sec. (3) Both the averaged quality score and number of Seoi-nage completed within 30 seconds are very significantly improved ($P < 0.01$), from 3.1 to 3.6, and from 10.4 to 12.5, respectively.

Conclusion: 6w- SET can improve the kinematical parameters and performance of Seoi-nage for male Judo athletes. It seems that SET is a useful exercise for training of Judo athletes.

3675 Board #122 June 3 9:30 AM - 11:00 AM
Effectiveness and Feasibility of Integrating Video Feedback into Practice to Improve the Collegiate Softball Hit

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(No relationships reported)

Feedback about performance is standard coaching practice to improve acquisition of an athletic skill. Video feedback improves performance during golf and tennis swings; thus may improve performance during softball swings. Still shots with written instructions (task cards) guide peer assessment; yet the benefits for self-assessment are unknown. **Purpose:** To determine if self-assessment of performance using task cards and video feedback will improve hitting mechanics in collegiate softball players more than standard coaching alone.

Methods: Nineteen collegiate DIII softball players (age 19.6 ± 1.3 years; years of experience 12.5 ± 2.3) were randomized into a control or intervention group. The intervention group used task cards and delayed video feedback of their at bats during each hitting practice for four weeks. The control group received standard coaching

only. Data were collected at: pre-intervention (T1), immediate post-intervention (T2), and delayed post-intervention (T3). Five random hits were coded as “met=1” or “not met=0”. Met was defined as: weight centered between feet during each phase of swing and 1) pre-swing: chin on front shoulder, hands at back armpit, 2) contact: lead with knob of bat, strong lead leg, 3) follow-through: chin on front shoulder. The phase of the hit was coded as “not met” if all criteria were not achieved.

RESULTS: A main effect of time was found for pre-swing (P=0.014), with improvements occurring between T1 and T3 (P=0.009). No other main effects or interaction effects were found for hitting. (Table 1)

CONCLUSIONS: Task cards and delayed video feedback did not improve hitting mechanics more than standard coaching. Regardless of group assignment, all players improved in the pre-swing phase by the end of regular season games. The improvement in pre-swing suggests an improved ability to make contact with the ball because the batters’ pre-swing stance puts them at an advantage to reach a variety of pitches (i.e. inside, outside, high, low).

	T1	T2	T3
Pre-swing	.30 (.37)	.51 (.45)	.59 (.43)
Contact	.85 (.30)	.76 (.41)	.87 (.19)
Follow-through	.90 (.23)	.83 (.23)	.87 (.20)

3676 Board #123 June 3 9:30 AM - 11:00 AM
Effects Of Aerobic Exercise Using Swiss-ball Or Chair Compared With Walking.

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PURPOSE: To clarify the physiological effectiveness of various movement on aerobic exercise using Swiss-ball (SB) or chair, we compared the exercise intensity between walking and aerobic exercise using SB or chair.

METHODS: Nine healthy men performed walking and aerobic exercise using SB or chair. Respiratory metabolism and heart rate were measured during walking and aerobic exercise using BB. Subjects walked at 4 speeds (4 km/h, 5 km/h, 6 km/h and 7 km/h) on treadmill ergometer. During aerobic exercise using SB, subject was sitting on the SB and bouncing with upper and lower limb movements. During aerobic exercise using chair, subject was sitting on the chair and exercising with upper and lower limb movements. The movements consisted of four patterns of upper and lower limb movements.

RESULTS: The exercise intensity during aerobic exercise using SB (4.8±0.6 Mets) was significantly higher (p<0.001) compared with aerobic exercise using chair (3.6±1.1 Mets). There was no difference between aerobic exercise using SB and chair on the heart rate (SB: 118±12 beats/min, Chair: 110±14 beats/min). The exercise intensity in aerobic exercise using SB were nearly identical with walking at 6 km/h (4.5±0.4 Mets). In contrast, the exercise intensity and heart rate in aerobic exercise using chair were nearly same as walking at 4-5 km/h (3.3±0.4 Mets - 3.8±0.5 Mets).

CONCLUSIONS: The exercise intensity and heart rate during aerobic exercise using SB or chair was nearly identical with moderate-intensity walking. The aerobic exercise using SB or chair can be alternative to walking for people who cannot walk.

3677 Board #124 June 3 9:30 AM - 11:00 AM
Time Course for Physiological Adaptations with Hypobaric Exposure: A Research-Pedagogical Project

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PURPOSE: The purposes were: 1) determine physiological change following a brief sojourn training period at altitude; 2) through pedagogy, facilitate student proficiency in methods of testing and interpretation in determining rate of change in adaptation. **METHODS:** A pre-post testing measurement design utilizing twelve (n=12) volunteers from the Midwestern State University Cycling Team was used. Subjects signed an Informed Consent, approved by the Institutional Review Board for Humans as Subjects at Midwestern State University. Measures were sub-categorized into Resting and Exercise. A Repeated Measures ANOVA determined differences between pre and post-tests. Alpha was set *a priori* at p < 0.05. **RESULTS-Physiological:** Subject means and standard deviation (SD) for descriptive measures were: age, 21.56 (2.83) y; height, 161.83 (34.68) cm; weight, 69.36 (8.37) kg; body fat, 6.6 (1.98) %; maximal oxygen consumption, 70.41 (8.61) ml*kg⁻¹*min⁻¹; peak lactate, 14.25 (2.56) mM; maximal power, 372.22 (55.12) watts. Significant (p<0.05)

changes in baseline vs. altitude exposure were seen in average heart rate, 164 vs 162 (b*min⁻¹), respectively and average blood lactate 6.01 vs 5.83 (mM) respectively, across the workload continuum. Maximal oxygen consumption (Max VO₂) and time to exhaustion (TE) after altitude exposure improved (increase and decrease, respectively) over baseline. Hematocrit, hydration status via urine specific gravity (USG), fasting blood glucose (mg*dL⁻¹) and kilocalorie (Kcal) consumption were not significantly altered during five days of altitude exposure. **RESULTS-Pedagogical:** Students showed proficiency in the following: anthropometry, blood pressure, electrocardiograph (ECG), urine specific gravity (USG), blood glucose, blood lactate, Max VO₂. In addition, students were involved in research literature review and article summation. Following the research data collection, the students were shown statistical procedures for research analysis. **CONCLUSION:** This project involved a research component and a pedagogical component. Physiologically, exposure to altitude showed trends toward positive performance measures after five days of exposure. Pedagogically, this project allowed for experiential learning for undergraduate students and involvement in research.

3678 Board #125 June 3 9:30 AM - 11:00 AM
Velocity-based Training: Exploring The Potential Implications Of Training With Absolute Versus Relative Velocities

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 (No relationships reported)

Although training intensity is commonly adapted by modifying the *relative* load (e.g. % 1RM), *absolute* velocities are also targeted to facilitate speed- and power-oriented training objectives. **PURPOSE:** Examine the variation in *relative* loads and *relative* velocities used to perform a bench press at 6 *absolute* velocities. **METHODS:** Thirty men completed three bench press tests: 1RM, max velocity with 2.5kg bar, and 6 sets of 4 reps with loads of 15-90% 1RM. Participants were instructed to lower and lift the bar as fast as possible. Mean and peak concentric barbell velocity was computed via a linear position transducer. The average mean velocity of each 4-rep set and the relative load lifted were used to create participant-specific regression equations that would capture each individual’s load-velocity relationship. These equations were then used to estimate the % 1RM that would have been used to move the bar with the group’s mean velocity with loads of 15-90% 1RM). These “target” velocities were also expressed as a relative percentage of the maximum velocity (% Vmax) achieved by each participant during the 2.5kg test. The variation in %1RM for each velocity was described by the standard deviation and range amongst participants. A similar approach was used to estimate the % Vmax that would have been achieved using a range of loads (15-100% 1RM). **RESULTS:** Lower % 1RM and higher mean velocities were associated with the largest variation in training intensity across participants (Table 1). **CONCLUSION:** Using specific *absolute* mean velocities as “targets” could result in substantial variation to the corresponding % 1RM and % Vmax across a group of athletes. To accommodate the abilities of each performer, it may be important to use *relative* velocity targets.

Absolute Velocity (m/s)	Estimated %1RM			Relative Load (%1RM)	Estimated %VMax		
	Mean	SD	Range		Mean	SD	Range
1.70	11	11	-32-27	15	42	6	33-57
1.30	33	8	-1-45	30	32	5	25-44
1.00	49	7	23-58	45	25	4	19-35
0.75	62	5	43-71	60	18	4	13-27
0.50	76	4	63-83	75	12	3	6-19
0.25	87	4	82-96	90	6	3	1-12
0.10	98	4	89-105	100	3	1	1-6

3679 Board #126 June 3 9:30 AM - 11:00 AM

Does Time of Day in Which Exercise Training is Performed Alter Fitness and Health Outcomes in Women?

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(No relationships reported)

While there is much anecdotal evidence suggesting the importance of time of day (TOD) in which exercise training is performed, there is a paucity of controlled comprehensive studies examining the influence of TOD on training-induced adaptations. **PURPOSE:** to determine the effect of TOD on mediating training-induced changes in exercise performance, cardio-metabolic health, and body composition in active normal weight women. **METHODS:** 27 healthy active females (BMI = 24 ± 3 kg/m²; 42 ± 8 yrs) were recruited for this study and randomized to either exercise training in morning (AM) or evening (PM) for 12 weeks. In following recent ACSM guidelines, we employed a multimodal training paradigm (Resistance, Interval, Stretching, and Endurance, RISE). Baseline exercise performance was assessed via abdominal, upper and lower body muscular strength (situps, pushups, 1 RM bench and leg presses), power (jump squats and bench throws), aerobic power (5km cycling time trial), flexibility (sit and reach), and balance (stork stand), cardiovascular health (blood pressure, and augmentation index (AIx)), body composition (DEXA: Fat free mass, fat mass, abdominal/visceral fat, %body fat), hunger/satiety ratings (visual analog scales), and cardio-metabolic profile (energy expenditure, fasting lipids, glucose, insulin). **RESULTS:** At baseline, no differences existed between groups in any variable. Training resulted in significant ($p < 0.05$) improvements in exercise performance, cardio-metabolic health, and body composition. However, there were significant interactions ($p < 0.05$) of TOD x training for DBP (-10 ± 1 v. -5 ± 5 mmHg), RMR (-130 ± 65 v. -12 ± 36 kcal/d), FM (-1.0 ± 0.2 vs. -0.3 ± 0.2 Δkg), Abfat (-2.6 ± 0.3 v. -0.9 ± 0.5 Δkg), 1RM BP (8 ± 2 v. 12 ± 2 Δlb), Pushups (9 ± 1 v. 13 ± 2 Δreps), BT power (10 ± 6 v. 45 ± 28 Δwatts), SJ power (135 ± 6 v. 39 ± 8 Δwatts), AM vs. PM, respectively. **CONCLUSIONS:** The multimodal RISE protocol improved performance, cardiovascular health, and body composition, with the TOD altering the magnitude of exercise training-induced adaptations. Specifically, training in the AM resulted in greater improvements in diastolic blood pressure, fat mass, abdominal fat mass, and lower body peak power. Whereas, training in the PM resulted in greater gains in upper body muscle strength, endurance, and power. Support: Isagenix.

3680 Board #127 June 3 9:30 AM - 11:00 AM

Differences in Physiological Responses Between Traditional and 3v3 Game Sessions Among Elite Developmental Ice-hockey Players

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(No relationships reported)

Small sided games are commonly used in team sports to incorporate live play and high repetition skill execution. There is little data with regard to the physiological requirements of small sided vs. traditional game format in ice-hockey. **PURPOSE:** Use player mounted sensors (PMS) to compare the accelerations (ACC) and heart rate (HR) between traditional (TRAD) and 3v3 cross-ice games among elite, national-level youth ice-hockey players. **METHODS:** 29 elite ice hockey players (15.2 yrs \pm .27, 177.4 cm \pm 7.1, 72.9 Kg \pm 10.7) who participated in USA Hockey National Player Development Camp consented to procedures approved by the EMU human subjects committee. Players wore Zephyr Bioharness-3 (Zephyr, MD) PMS across their chest. The PMS recorded HR and ACC at 10 Hz over the seven on ice sessions of the five-day camp. This included three practice sessions, three games (G1, G2 and G3) and one 3v3 training session. PMS were downloaded to Omnisense software (Zephyr, MD) and data was exported from Omnisense to WKO4 (Peakware, CO) for storage and analysis. Peak ACC across multiple time frames (5, 10, 20, 30, 45, 60 sec, 5, 10, 20, 40 min) were quantified. Heart rate was quantified and used in conjunction with ACC to determine exertion profiles for each on-ice session. MANOVAs for peak ACC and HR at each time point across games and 3v3 with magnitude and time as main effects were performed using SPSS 23.0 (IBM, NY). **RESULTS:** No differences were observed between sessions for 5 sec, but 10 sec ACC was lower for 3v3 vs G1 and G2 ($p < .05$), but not G3. No sig differences were observed for 20-60 sec ACC ($p > .05$), but small effects were present at all time frames ($\eta^2 = 0.021 - 0.077$). No sig differences were observed for 5 min ACC, but 10, 20 and 40 min, were all significantly higher for 3v3 than G1, G2 or G3 ($p < .05$). For HR, no sig differences or effects ($\eta^2 < .01$) were present for any time frame less than 5 min. HR was higher for 5, 10, 20 ($p < .05$) but not 40 min, for 3v3 vs G1, G2 and G3. **CONCLUSIONS:** Reduced 10 sec ACC for 3v3 indicates a reduced reliance on phosphagen system vs TRAD games while

higher ACC and HR for 10, 20 and 40 min indicates that 3v3 is more reliant on aerobic systems than TRAD games. Insignificant differences, with small effects, for 20 - 60 sec between TRAD games and 3v3 indicate there may be practical differences that are less distinct than for other time frames.

3681 Board #128 June 3 9:30 AM - 11:00 AM

Three Weeks of CrossFit Training Does Not Contribute To Overtraining Syndrome in Recreationally Trained Males: A Pilot Study

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(No relationships reported)

CrossFit® (CF) is currently one of the most popular health and fitness activities. However, CF faces strong opposition and criticism claiming it causes injury. **PURPOSE:** The purpose of this study was to investigate if CF participation contributes to overtraining syndrome. A secondary purpose was to determine if there are differences between CF original methodologies and real-world practice. **METHODS:** Six recreationally trained males (height, 182.8 ± 8.6 cm; weight, 84.3 ± 12.4 kg, and age, 25.0 ± 5.4 years) were randomized into two groups, theoretical (TH) or real-world (RW) prior to the intervention. Both groups completed pre-testing assessment of body composition, physiological, biochemical, psychological, and performance-based data. Both groups participated in CF training 5 days/week. The TH group completed training designed to follow original CF methodology while the RW group followed programming designed by a randomly selected CF affiliate. Prior to and at the end of each week blood was collected for serum analyses and select joint range-of-motions (ROM) were measured. Additionally, prior to each training session, resting heart rate (RHR), blood pressure (BP), muscle soreness (DOMS), and select training variables were collected. Following the completion of each training session, HR and perceived exertion (RPE) were collected. **RESULTS:** There are no significant differences in physiological, biochemical, immunological, psychological, or performance outcome variables assessed in this study for both between groups and pre-post testing (all $p > .05$). However, there are differences in intervention programming between TR and RW groups. In practice, there were significantly less element priority sessions in practice compared to what is recommended (40% vs 0%; $\chi^2 = 8.25$; $p = .016$). Element priority sessions had significantly lower associated training heart rates (127.4 vs 167.0 , 172.4 bpm; $F = 8.63$; $p = .001$) and ratings of perceived exertions (9.4 vs 14.8 , 14.7 ; $F = 15.26$; $p = .000$) than other session designs common in CF. **CONCLUSION:** These data suggest that short-term CF participation does not contribute to the development of overtraining syndrome in recreationally trained males.

3682 Board #129 June 3 9:30 AM - 11:00 AM

The First Twenty Exercise Training Program and Fire Academy Recruits' Fitness and Health

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(No relationships reported)

PURPOSE: To examine the effects of a novel high-intensity training program on fire academy recruits' health, fitness, and performance. **METHODS:** 13 participants were recruited from a fire academy and were randomly assigned to the control (CG, n=6) or intervention group (IG, n=7). Due to attrition 10 male recruits (23.8 ± 2.7 years) completed the study (CG, n=3, IG, n=7). The CG was asked to continue their current exercise habits. The IG was provided a 10-week online-based periodized training program developed by firefighters specifically for firefighters that included nutritional and mental readiness education. Participants completed pre/post-intervention assessments including a timed simulated fireground test (SFGT). A feasibility analysis was also completed for the IG. Due to the small sample size and group differences at baseline, descriptive statistics were calculated and each participant was reviewed as an individual case study. The Wilcoxon Signed Rank Test was used to compare pre- and post- changes among groups. **RESULTS:** The IG showed marked improvement on SFGT performance (40% to 86% passing); four improved their passing time. The IG significantly increased estimated VO_{2max} ($p = 0.028$), improved body composition (decreased fat mass and body fat %, $p = 0.028$), and increased grip strength ($p = 0.018$). With a small sample size we were unable to discern if the intervention improved recruit fitness and performance compared to the control group or other covariates, however, the CG showed no statistically significant changes. Though the IG completed ~75% of the assigned workouts, there may be a better way to implement this intervention. Participants mentioned they'd like group workouts led by a certified strength and conditioning coach/peer fitness trainer as opposed to workouts completed on their own. **CONCLUSIONS:** This study showed that a high-intensity training program improved fireground performance, aerobic fitness, body composition, strength, and agility among fire academy recruits. A larger randomized controlled trial is necessary to further investigate program effects among this population.

Abstracts were prepared by the authors and printed as submitted.

3683 Board #130 June 3 9:30 AM - 11:00 AM
Effect Of An Eighteen-week Cessation Of Physical Training On Army Rotc Cadets

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 (No relationships reported)

During summer break, ROTC cadets are not required to participate in mandatory physical training. **PURPOSE:** To investigate the effect of an eighteen-week cessation in regimented physical training on body composition measurements and cardiorespiratory endurance in a cohort of Army ROTC cadets. **METHODS:** Two testing sessions were completed in the spring and fall, by 35 cadets (males n=29, age=22.9±3.8 vs. 23.1±4.0yrs, height=175.1±5.9 vs. 175.0±5.9cm, weight=76.5±9.7 vs. 77.7±9.1kg and females n=6, 21.4±1.5 vs. 21.6±1.5yrs, 162.7±5.6 vs. 162.5±5.9cm, 63.0±5.4 vs. 64.1±5.6kg, for the spring and fall respectively). Body composition was assessed using circumference and 3-site skinfold measurements. Percent body fat (%BF) was calculated using Brozak formula. Cardiorespiratory endurance was assessed by completion of maximal oxygen uptake ($\dot{V}O_{2max}$) test on a motorized treadmill using a modified Åstrand protocol. **RESULTS:** Body mass was significantly increased in both male (spring: 76.5±9.7kg vs. fall: 77.8±9.1kg; p<0.05, Δ=1.3kg) and female (spring: 63.0±5.5 kg vs. fall: 64.1±5.7kg; p<0.05, Δ=1.1kg) cadets. There was a significant increase in the sum of three skinfolds and %BF in male cadets (spring: 43.0±13.3mm & 12.4±3.8% vs. fall: 49.8±11.8mm & 14.3±3.3%; Δs =6.8mm & 1.9%, respectively, p<0.05), but not in female cadets. Lean body mass remained unchanged from spring to fall testing sessions (p>0.05). Body Mass Index was significantly increased in male (spring: 24.9±2.7 vs. fall: 25.3±2.4; p<0.05) and female cadets (spring: 23.7±1.5 vs. fall: 24.2±1.9, p<0.05). Time on treadmill decreased significantly in male cadets (spring: 12.3±1.3min vs. fall: 11.5±1.5min; p<0.05). Significant declines in relative $\dot{V}O_{2max}$ results were seen in male cadets (spring: 51.1±4.2 vs. fall: 49.4±3.3ml/kg/min; p>0.05, Δ=1.8ml/kg/min). There were no significant changes for time on treadmill or relative $\dot{V}O_{2max}$ for female cadets. There was a significant interaction for post-test blood lactate with the female cadets increasing from 7.7±2.1 to 9.7±1.5mmol and male cadets decreasing from 10.6±2.0 to 9.0±2.6mmol.

CONCLUSION: An eighteen-week training cessation from physical training negatively effected body composition in both male and female Army ROTC cadets and cardiorespiratory endurance in male cadets.

3684 Board #131 June 3 9:30 AM - 11:00 AM
Training Unloading During Winter Break Improves Fitness in Male Rugby Players

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When athletes experience training distress, a break in training may facilitate recovery and improve performance. Conversely, when team training is interrupted, such as occurs during winter break in collegiate athletes, deconditioning may result. In the current study, physiological responses to exercise were made before and after an unstructured winter break in male collegiate rugby players. **PURPOSE:** The purpose of the study was to examine detraining effects that occurred when structured training was interrupted for four weeks. **METHODS:** Fourteen (n=14) male club rugby players underwent exercise testing to assess aerobic capacity ($\dot{V}O_{2max}$), strength (maximal bench press and leg squat), speed (10 yd dash), power (vertical jump), and body composition (body weight and % body fat by underwater weighing). A subject orientation of the testing was performed for all tests, and the treatment data were collected just prior to, and after the winter school break. T-tests were performed on pre- and post-winter break values. **RESULTS:** There was no evidence of detraining after four weeks of unstructured training. No changes were observed in bench press strength (183 versus 188.6 lbs) or speed (1.69 versus 1.69 seconds) across the break. However, performance measures for aerobic capacity (45.45 versus 47.70 ml/kg/min), squat strength (269.6 versus 308.2 lbs) and vertical jump (22.52 versus 23.94 inches) all showed significant improvements following the break. Additionally, there were significant increases in body weight (176.96 versus 178.63 lbs) and percent fat (12.76 versus 15.27% fat). **CONCLUSION:** Four weeks of unstructured training over the winter school break appears to have provided a recovery period that allowed for increases in physiological function despite increases in body fat.

3685 Board #132 June 3 9:30 AM - 11:00 AM
No Acute Effect of Sled Towing on Sprint Acceleration or Maximum Speed

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 (No relationships reported)

Sled towing is a popular method of overload training in many field sports. The initial acceleration and top speed phases are components in developing peak velocity in athletes. Acute training may lead to postactivation potentiation (PAP), which occurs when subsequent muscle performance is enhanced following a preload stimulus. However, this is highly dependent on rest time. **PURPOSE:** To investigate acute sprinting in the acceleration and maximum speed phases following different rest periods after sled towing. **METHODS:** Eleven male field sport athletes (age=23.00±2.79yrs, height=177.45±6.34cm, mass=82.52±8.79kg) completed a standardized warm-up then performed a baseline 30 meter (m) sprint (measured with acceleration and maximum speed splits). They were then attached to a waist harness and towed a sled equal to 30% of their bodyweight for 30m with maximal effort. Following a random rest period (2, 4, 6, 8, or 12min), they performed another maximal effort bodyweight sprint without the sled. **RESULTS:** A 4x6 (split x condition) ANOVA revealed that baseline split times (split 0-5m 1.14±0.05s, split 5-10m 0.77±0.04s, split 10-20m 1.30±0.06s, split 20-30m 1.25±0.07s) were not different than split times for any rest condition (collapsed across rest conditions, split 0-5m 1.14±0.75s, split 5-10m 0.78±0.03s, split 10-20m 1.33±0.07s, split 20-30m 1.27±0.07s). **CONCLUSIONS:** Sled towing did not increase or decrease acute maximal effort bodyweight acceleration or maximum speed sprint times. The different rest periods did not elicit a PAP effect, which may be attributed to less than optimal loading.

3686 Board #133 June 3 9:30 AM - 11:00 AM
The Effect of Reduced Training Volume during Tapering on Kicking Response in Taekwondo Competitors

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PURPOSE: The purpose of the study was to evaluate the effect of training volume during tapering on kicking performance in college Taekwondo competitors trained under a periodization block model. **METHODS:** Participants were eight men and four women of the taekwondo team at the University of Costa Rica. All individuals completed a 13-week macrocycle loading phase (10 weeks of load and 3 weeks of taper). Following the loading phase, participants were paired by gender and randomly assigned to either a condition in which they kept the same training volume or a condition where training volume was reduced by 50% using a linear pattern. Kicking motion time was measured by instructing individuals to perform a circular kick to a target located at 1.10m high followed by another kick to a target located at 1.60m high. Kicking time response was obtained by recording the time required to kick a random sequence of 10 targets. The "Fitlight Trainer system" was used to time both dependent variables. Measurements were recorded at the beginning of the loading phase, the sixth week of the load period and twice a week during each of the three weeks of the tapering phase. Effect sizes (ES) were computed and analysis of variance (ANOVA) tests were used to detect significant interactions. **RESULTS:** No significant interactions were found on kicking motion-time (Pre = 1.39 ± 0.09s vs. Post = 1.26 ± 0.06s) and kicking time response times (Pre = 9.63 ± 1.01s vs. Post = 8.47 ± 0.51s) in the group following the same training volume and the group with reduced training volume (Pre = 1.35 ± 0.10s vs. Post = 1.26 ± 0.11; Pre = 9.42 ± 1.52s vs. Post = 9.57 ± 1.78s, respectively). ANOVA results showed that regardless of the training volume, during the tapering phase improvements were observed on kicking motion time (p = 0.03) and kicking time response (p = 0.04), with the best performance observed at the end of the third week of the tapering phase. The 50% training volume reduction produced a higher ES on kicking motion time (1.50) and kicking time response (3.32) compared to no reduction in training volume (0.86 and 0.04, respectively). **CONCLUSIONS:** The reduction of volume training during tapering under a periodization block model improved kicking performance on taekwondo competitors. In the analyzed conditions, tapering must extend at least three weeks.

3687 Board #134 June 3 9:30 AM - 11:00 AM
Effects of a 3-week Core Training Program on Different Unstable Platforms

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 (No relationships reported)

The untested InertiaCore Balance Trainer (ICT) is designed to improve core function. Users engage the core musculature to maintain balance on the unstable device; its stability is adjusted by adding weight. This flexibility makes the ICT appropriate for all fitness levels. **PURPOSE:** To compare the effects of a 3 wk core-training program completed on the ICT or a stability ball (SB). **METHODS:** Thirty-one active college age students (19.4 ± 1.4 y and 65.2 ± 11.0 kg) were divided into the ICT and SB groups, each of which completed various medicine ball throws, crunches, and Russian twists. Subjects trained 3 d·wk⁻¹ for 3 wk; medicine ball weight and repetitions increased during the program's midpoint. Changes in core power and strength were measured across time with the Front Abdominal Power Throw (FAPT) and a Cybex dynamometer. Data were analyzed using repeated measures ANOVAs. Dependent t-tests were used to examine changes across time within groups. **RESULTS:** The ANOVAs revealed no significant main effects between the time points or groups for any dependent variable. The dependent t-tests revealed that SB training significantly increased Cybex flexion and extension power by 2.2% (138.3 ± 38.1 to 141.4 ± 37.6; p=0.047) and 5.6%; (118.3 ± 49.2 to 124.9 ± 50.8; p=0.018), respectively, while ICT training produced no significant changes. A significant interaction was found for flexion power (p=0.036), indicating opposing trends between the two groups across time. A similar relationship was found for flexion work, but the interaction only approached significance (p=0.059). **CONCLUSION:** The ICT did not improve core function relative to the SB. This study focused on unstable training, but using more weight on the device, thereby increasing stability and resistance, may alter outcomes.

3688 Board #135 June 3 9:30 AM - 11:00 AM
Effects Of An Eight-week Swingfit Training Program On Balance, Muscular Strength, And Muscular Endurance.

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PURPOSE: The purpose of this study was to determine the impact of an eight-week SwingFit training program on balance and strength. **METHODS:** Twelve active, low-risk stratified individuals were recruited as subjects. The experimental group consisted of seven females (25 ± 11yrs; 163.4 ± 6.5cm; 62.9 ± 7.8kg) and five males (29 ± 14yrs; 175.9 ± 4.4cm; 75.3 ± 5.4kg). Pre- and post-training assessments were completed for balance, strength and muscular endurance. Balance was assessed using the Biodex Balance System SD using the static balance assessment. Grip strength was assessed using the Takei hand dynamometer. Hip/leg strength was assessed using a Takei back & leg dynamometer. Muscular endurance was measured using a SwingFit® seated pullup test. **RESULTS:** Overall stability improved significantly (p<0.05) from 1.03 ± 0.49 to 0.74 ± 0.13. Muscular endurance improved significantly (p<0.05) from 27.2 ± 7.7 reps to 35.5 ± 0.3 reps on the SwingFit seated pullup test. Hip & Leg strength increased significantly (p<0.05) from 69.6 ± 30.7 kg to 78.1 ± 32.4 kg. The combined grip strength (right hand + left hand) increased significantly (p<0.01) from 61.2 ± 19.1 kg to 70.8 ± 22.3 kg. **CONCLUSIONS:** The SwingFit training program has been demonstrated to be an effective option for improving balance, as well as muscular strength and endurance in an eight-week training program. Future research may examine the impact of longer duration training programs and/or comparing the SwingFit program to other more established methods of training.

3689 Board #136 June 3 9:30 AM - 11:00 AM
Changes In Heart Rate Variability And Training Load In Elite Football Players

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Heart rate variability (HRV) is a popular and accessible monitoring tool utilized ubiquitously in the field to measure autonomic nervous system activity, readiness to train, and training adaptations. Acquisition of this information is essential for coaches,

practitioners and athletes in order to effectively monitor positive training adaptations, nonfunctional over-reaching, injury and illness risk. However, longitudinal data assessing HRV changes with respect to training load in elite football is lacking. **PURPOSE:** To investigate changes in HRV and training load across several weekly training blocks in elite football. **METHODS:** Six male professional footballers (three defenders, three midfielders) from an English Premier League squad agreed to participate in this study. HRV was assessed with the ithlete application (HRV Fit Ltd, UK) using an Apple iPad2 (Apple Inc, CA), and a Polar T31 heart rate monitor (Polar Electro Ltd, Finland). HRV was calculated for each participant prior to the daily training session. Physical training load was monitored using a Global Positioning System (GPS) to quantify total distance (TD), high speed distance (HSD), training load (TL), impacts, maximum speed (MS), accelerations and decelerations, and energy expenditure (EE). Training sessions were separated into five equal training blocks (weeks 1 - 3, weeks 4 - 6, weeks 7 - 9, weeks 10 - 12 and weeks 13 - 15). **RESULTS:** There was a significant decrease in TD, HSD, TL, impacts and EE and a significant increase in MS, accelerations and decelerations across the five training blocks (p ≤ 0.03). However, there was no significant change in HRV (p = 0.27). **CONCLUSION:** The significant change in TL across the 15 week training period, despite no change in HRV may be due to the heterogeneity that exists in elite football players, where some athletes show smaller reductions in HRV in response to training compared to others. Subsequently it is important that individual changes in HRV are interpreted alongside additional monitoring methods (e.g. wellness, training load) to ensure that quantification of training adaptation, readiness to train and overreaching is accurate.

3690 Board #137 June 3 9:30 AM - 11:00 AM
Acute Effects of Plyometric Exercise on Blood Glucose

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Short duration, high intensity exercise has been implemented in various weight-loss programs. Although traditional plyometric training is not commonly prescribed for weight loss, exercises such as jumping are popular in commercial exercise programs. However, the effect of plyometric exercise on blood glucose levels is unknown. **PURPOSE:** To investigate the effect of relatively high intensity plyometric exercise on glycemic control. **METHODS:** Thirteen subjects (6 females age=21.8 ± 1.0yrs; height=163.7 ± 7.8cm; mass=60.8 ± 6.7kg and 7 males age=22.0 ± 2.6yrs; height=182.3 ± 3.6cm; mass=87.4 ± 12.5kg) volunteered to participate. Inclusion criteria was the ability to achieve 80% of their age predicted max heart rate (APMHR) following the plyometric exercise. Subjects wore a heart rate monitor and completed two random conditions on two separate days, consisting of either five sets of 10 maximal effort countermovement squat jumps (SJ) with 50 seconds rest between sets or quiet sitting (SIT) for the time equated to the SJ duration (~4min). Immediately after each condition, subjects drank 75g of anhydrous glucose in 100ml of water. Blood glucose measurements were taken via finger prick and analyzed by an Accu-Chek Performa device pre and immediately post SJ or SIT, and 5, 15, 30, and 60 min post. **RESULTS:** A 2x6 (condition x time) ANOVA revealed a significant interaction where SJ blood glucose levels were lower at 15 (114.0 ± 14.6mg/dl) and 30 (142.1 ± 22.5mg/dl) min post compared to SIT (15min 130.8 ± 14.0mg/dl & 30min 159.3 ± 21.0mg/dl). Pairwise comparisons revealed that 5 (106.1 ± 9.5mg/dl), 15 (114 ± 14.6mg/dl), 30 (142.1 ± 22.5mg/dl), and 60 (146.5 ± 34.1mg/dl) min were significantly greater than baseline (93.8 ± 8.8mg/dl) for SJ and for SIT 5 (106.1 ± 12.8mg/dl), 15 (130.8 ± 14mg/dl), 30 (159.3 ± 21mg/dl), and 60 (144.6 ± 19.1mg/dl) min baseline (94.7 ± 8.1mg/dl). **CONCLUSIONS:** The current plyometric protocol attenuated post-exercise blood glucose levels at 15 and 30 minutes post SJ at 80% APMHR when compared to SIT. This may be due to increased physiological stress applied to the muscles, thus increasing muscular glucose uptake. Reaching 80% APMHR might be the desired physiological stress level to stimulate a change in glycemic control.

3691 Board #138 June 3 9:30 AM - 11:00 AM
Effects Of Lifestyle Modifications On Serum Testosterone Levels In Overweight And Obese Men

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PURPOSE: Testosterone is associated with lots of physiological functions in men. Obesity results in reduced serum testosterone levels in men. Previously, we demonstrated that combination of dietary modification and regular aerobic exercise increased serum testosterone levels in overweight/obese men. However, the differences in the effects on serum testosterone levels between dietary modification and regular aerobic exercise are unknown. The aim of this study was to compare the effects of dietary modification and regular aerobic exercise on serum testosterone levels in overweight/obese men.

METHODS: Twenty-four overweight/obese men completed 12-week dietary modification class (well balanced 1680 kcal/day diet: diet group) and twenty-seven overweight/obese men completed 12-week regular aerobic exercise intervention (1-3 days/week, 40-60 min/day: exercise group). Before and after the intervention, we measured serum testosterone levels in overweight/obese men.

RESULTS: At baseline, there were no significant differences in all parameters between both groups. Body mass was significantly decreased in both groups (both $P < 0.01$), and the magnitude of weight loss was greater in diet group than exercise group ($-7.8 \pm 2.0\%$ vs. $-2.1 \pm 0.6\%$, $P < 0.01$). While, serum testosterone levels were significantly increased only in exercise group, and we found a significant difference in the percentage change in serum testosterone level (diet group: $-0.3 \pm 8.6\%$, exercise group: $11.6 \pm 3.1\%$, $P < 0.01$). Moreover, in diet group, we found a significant correlation between percentage change in body mass and that in serum testosterone levels ($r = -0.77$, $P < 0.001$), but not in exercise group ($r = -0.16$, n.s.).

CONCLUSIONS: We demonstrated regular aerobic exercise significantly increased serum testosterone levels, while dietary modification did not change serum testosterone levels in overweight/obese men. Moreover, percentage change in serum testosterone levels did not correlate to that in body mass in exercise group. Thus, these results suggest that regular aerobic exercise increases serum testosterone levels independent of the change in body mass in overweight/obese men. These findings may provide a new insight into the role of regular aerobic exercise for prevention and/or treatment of obesity-induced health disorders.

3692 Board #139 June 3 9:30 AM - 11:00 AM
Comparison Of HR And BP Among A Non-exercise Session And Before HIIE And MICE Sessions

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Understanding changes in cardiovascular post-exercise values requires the accurate measurement of pre-exercise values. Exercise anticipation can elevate heart rate (HR) and blood pressure (BP). However, no study has compared these variables among a non-exercise session and before high intensity interval exercise (HIIE) and moderate intensity continuous exercise (MICE) with equivalent workloads. The development and implementation of a pre-exercise HR and BP measurement protocol that controls for the anticipatory response could provide a more precise understanding of acute HR and BP responses to exercises of different intensities. **PURPOSE:** To compare HR and BP among a non-exercise session and immediately before HIIE and MICE sessions. **METHODS:** Healthy participants ($n = 14$, 21.5 ± 2.1 yrs, 171.0 ± 9.4 cm, 72.6 ± 11.4 kg) reported to the laboratory on four occasions. Session 1 included HR and BP assessment, session 2 consisted of a maximal exercise test, and sessions 3 and 4 consisted of HR and BP assessments before either HIIE or MICE in a random order. Participants were previously informed that HIIE and MICE would be equivalent in total workload. HR and BP were measured using an oscillometric automated device (Omron 10 series, Illinois, USA) after 10 minutes of rest. The average of three readings taken 60 seconds apart was used for all measurements. **RESULTS:** Repeated measures ANOVAs compared HR and BP among sessions ($p < .05$). Systolic blood pressure was not significantly different among baseline (111.6 ± 8.6 mm Hg), HIIE (108.9 ± 7.4 mm Hg) or MICE (111.3 ± 8.0 mm Hg) ($F_{(2,26)} = 1.15$, $p = .33$). Diastolic blood pressure was not significantly different among baseline (74.4 ± 6.8 mm Hg), HIIE (71.7 ± 6.6 mm Hg), or MICE (72.7 ± 4.5 mm Hg) ($F_{(2,26)} = 1.55$, $p = .23$). Mean arterial pressure was not significantly different among baseline (86.8 ± 6.9 mm Hg), HIIE (84.1 ± 6.1 mm Hg) or MICE (85.6 ± 4.9 mm Hg) ($F_{(2,26)} = 1.66$, $p = .21$). HR was not significantly different among (70.6 ± 11.0 bpm), HIIE (68.6 ± 12.5 bpm) or MICE (70.4 ± 12.6) ($F_{(2,26)} = 0.39$, $p = .68$). **CONCLUSION:** This study demonstrates that non-exercise associated HR and BP can be similar to pre-HIIE and pre-MICE HR and BP with equivalent workloads. Study findings indicate that using a protocol similar to ours may account for exercise anticipation before exercise sessions.

3693 Board #140 June 3 9:30 AM - 11:00 AM
Sprint Interval Training and Associated Improvements in VO2max Amongst College Age Women

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Aerobic exercise has been shown to induce positive physiological outcomes. Research into the effects of high intensity interval training (HIIT) is rapidly growing, with specific interest in sprint interval training (SIT). Current research on SIT emphasizes its applications to young, recreationally active males. **PURPOSE:** The present investigation focuses on SIT in college age, recreationally active females thus addressing the dearth of research in women. **METHODS:** Participants ($n=11$) were randomly assigned into one of three groups: two intervals (2INT), three intervals (3INT), or endurance group (END). All groups cycled three times a week for eight weeks for a total of 24 sessions. 2INT sprinted two 20 second bouts and cycled five

minutes total. 3INT sprinted three 20 second bouts and cycled ten minutes total. END cycled for 20 minutes at 60% of their VO_{2max} . VO_{2max} was measured pre and post intervention. **RESULTS:** While there were no significant differences in VO_{2max} within or between groups (2INT 43.3 ± 1.2 v. $46. \pm 0.9$ ml $kg^{-1}min^{-1}$, 3INT 43.1 ± 5.6 v. 44.6 ± 6.3 ml $kg^{-1}min^{-1}$, END 37.0 ± 6.9 v. 37.4 ± 7.7 ml $kg^{-1}min^{-1}$), it is important to note that the 2INT group improved their VO_{2max} by an average of 8% and the 3INT group by 2.3%. The END group remained unchanged. **CONCLUSIONS:** The findings of this study suggest that women engaging in SIT have the potential to increase their VO_{2max} in a time efficient manner.

3694 Board #141 June 3 9:30 AM - 11:00 AM
Comparison Between Unilateral and Bilateral Plyometric Training on Single and Double Leg Jumping Performance

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The phenomenon of bilateral deficit in jumping implies that greater muscle power can be developed when performing maximal single leg jumps, compared with two-leg jumps. Thus, it may be hypothesized that training with single leg plyometric exercises would be more effective compared to an equivalent volume of double leg plyometric training. **PURPOSE:** To compare the effects of unilateral and bilateral plyometric training on single and double leg jumping performance. **METHODS:** Fifteen moderately trained subjects (age: 19.6 ± 2.1 yrs, height: 172 ± 9 cm, body mass: 65.6 ± 10.6 kg) were randomly assigned to either a unilateral (U, $n=7$) or a bilateral group (B, $n=8$). Both groups performed maximal effort plyometric leg exercises two times per week for 6 weeks (6 exercises per session, 3 sets of 10 repetitions per exercise), as well as 3 sets of knee extensions and flexions at 70%-90% of their 1 repetition maximum. The U group performed all plyometric and knee flexion/extension exercises with both legs, while the B group performed half the repetitions with each leg, so that the total exercise volume was the same. Jumping performance was assessed by double and single leg countermovement jumps (CMJ) and drop jumps (DJ) from 30 cm, measured using an optical measurement system (Optojump). Reactive strength index (RSI) was calculated from DJ data (jump height and ground contact time). Results were analyzed using a 2 x 2 ANOVA with repeated measures in one factor and Tukey's post-hoc test. **RESULTS:** CMJ with both legs significantly improved equally in the U and B groups by $12.1 \pm 7.2\%$ and $11.0 \pm 5.5\%$ ($p < 0.001$), respectively. However, single-leg CMJ, quantified as the sum of dominant and non-dominant single leg CMJ, only improved in the U group ($19.0 \pm 7.1\%$, $p < 0.001$) and was unchanged in the B group ($3.4 \pm 8.4\%$, $p = 0.80$). Similarly, RSI for single leg only improved in the U group (from 0.95 ± 0.21 to 1.17 ± 0.25 m s^{-1} , $p = 0.002$), but not in the B group. **CONCLUSIONS:** Plyometric training with single leg exercises was more effective in increasing both single and double-leg jumping performance, compared to bilateral training.

3695 Board #142 June 3 9:30 AM - 11:00 AM
An Integrated Perspective on Firefighter Recruit Academies: Examining the Sustainability of Fitness Gains

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Research indicates that 16-week firefighter recruit academies yield pre-post program fitness gains. However, timelines of academy training protocols have been questioned, as the majority of fitness gains are observed after the first eight weeks of the program. Further, no research has examined the effect of recruit academies through an integrated lens, with physiological and psychological variables assessed concurrently. **PURPOSE:** To examine the effect of a firefighter recruit academy on measures of fitness and stress-recovery state. **METHODS:** Recruits enrolled in a Midwest region academy program ($N = 15$; 2 females; 29.0 ± 4.6 yrs; 181.7 ± 7.2 cm; 86.8 ± 11.5 kg) completed all measures at three time points throughout the 16-week academy: week 1 (T1), week 8 (T2), week 16 (T3). To assess fitness (i.e., muscular strength, estimated VO_{2max} , body fat percentage [%]), recruits completed handgrip dynamometry, Forestry Step Test, and skinfold measurements. To assess stress-recovery state, recruits completed a 52-item questionnaire on perceptions of stress and recovery (RESTQ-Sport). Repeated measures multivariate analysis of variance (RM MANOVA) tests were conducted to examine the effect of time on fitness (3 levels) and stress-recovery state (2 levels). An alpha of .05 was used to determine statistical significance. **RESULTS:** The RM MANOVA test for the effect of time on fitness was significant ($F_{(2,12)} = 6.438$, $p = .013$, $\lambda = .482$). *Post hoc* pairwise comparisons demonstrated a

significant increase in fitness between T1 and T2 ($p = .005$), and a significant decrease in fitness between T2 and T3 ($p = .020$). In addition, the RM MANOVA test for the effect of time on stress-recovery state was not significant ($F_{2,12} = 1.884, p = .194, \lambda = .761$). **CONCLUSIONS:** Results of the study indicate that current firefighter recruit academies may not generate sustainable fitness gains from onset to graduation. This conclusion is supported by the non-significant stress-recovery state results, as previous research has established a dose-response relationship between acute training load and stress-recovery state. Thus, the periodization of firefighter recruit academies may need careful examination to ensure a progressive physiological and psychological training stimulus is applied throughout the program to achieve sustainable outcomes.

3696 Board #143 June 3 9:30 AM - 11:00 AM

Relationship between Training Volume and Dietary Status in Triathletes A Preliminary Study

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PURPOSE: Optimal sports training, especially for long endurance athletes, is dependent on favorable genetic, environmental and behavioral profiles. Dietary intake is central to and interacts with each of these domains. Therefore, the purpose of this preliminary study was to explore potential relationships between dietary intake and training volume in triathletes over a competitive season. **METHODS:** Participants were 18 male (36.6 ± 10.7 years old) and 19 female triathletes (31.8 ± 6.8 years old). Body fat percent, determined through dual-energy x-ray absorptiometry, for male and female triathletes was $12.5\% (\pm 4.5\%)$ and $21.3\% (\pm 5.0\%)$ respectively. Training volume was determined by exercise duration and intensity over 24 weeks. Nutrient intake was assessed through a seven-day dietary recall. **RESULTS:** Average daily energy intake for males was $2776 (\pm 774)$ kcals and $1987 (\pm 386)$ kcals for females. Relative contribution to total energy intake of fat was 25% for males and 28% for females, protein was 19% for males and 16% for females, and carbohydrates was 52% for males and 53% for females. For males, bivariate correlations revealed that total kcals ($r = 0.81$), protein ($r = 0.86$), and carbohydrates ($r = 0.72$) were significantly associated with total training volume. For females, only protein had a significant association ($r = 0.62$). Preliminary analyses using multiple linear regression indicated that for males the independent variables (kcals, protein, carbohydrates, fat) explained 79% of the variance in total training volume ($p = .045$) while controlling for age. However, none of the predictors were significant at a univariate level. The multiple regression for females indicated that the independent variables (kcals, protein, carbohydrates, fat) explained 82% of the variance in total training volume ($p = .015$) while controlling for age. Protein was the only significant predictor of total training volume for females ($\beta = .860; t = 3.18; p = 0.02$). **CONCLUSIONS:** Given the high training volumes associated with triathlon training it is important to consider the potential relationships among energy and nutrient intake and training volume. Further studies are required to better understand the potential influence energy and nutrient intake may have on triathlete performance.

3697 Board #144 June 3 9:30 AM - 11:00 AM

Relationship Between Fatigue Index And Obla Before And After Muscular Endurance Training

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The Thorstenson test has been well established as a valid assessment of fatigability by providing a Fatigue Index (FI) of the knee extensors. The Onset of Blood Lactate Accumulation (OBLA) has also been shown to have a significant influence on the development of fatigue during high intensity exercise bouts. Improvements in OBLA have been seen during muscular endurance resistance (MER) training resulting in enhanced exercise performance. However, the relationship between OBLA and FI remains unclear. **PURPOSE:** The purpose of the current study was to investigate the relationship between OBLA and FI as well as examine if improvements in FI could be achieved through MER training. **METHODS:** 17 endurance trained males (age: 23.4 ± 4.92 years and BMI: 23.5 ± 3.11) were recruited to participate in a 6 week study. Subjects were randomly assigned to either an experimental (EX) or control (CON) group: 9 EX and 8 CON. Both groups continued their current aerobic training for the duration of the study. Baseline measures included OBLA, using a cycle ergometer, 1 repetition maximum (1RM) for: leg press (LP), leg curl (LC), and leg extension (LE). The Thorstenson protocol was also performed using a dynamometer. In addition, the EX group performed supervised MER training (12 to 15 repetitions for

4 sets for LP, LC, and LE) for four weeks. T-test were used to determine if between group differences existed using delta scores (post-pre). Pearson's correlation was used to assess the relationship between OBLA and FI. **RESULTS:** No significant group differences were observed in all baseline measurements ($p > 0.05$). There were no significant group differences for OBLA (mmol/L) (EX: -7.24 ± 12.09 vs. CON: 3.54 ± 9.21) and FI (%) (EX: -0.06 ± 17.62 vs. CON: 1.68 ± 10.97) ($p > 0.05$). Pearson's correlation revealed no significant relationship ($p > 0.05, r = < 0.01$) exists between FI and OBLA. **CONCLUSIONS:** Four weeks of MER training was unable to improve both OBLA and FI. It was also observed that no significant relationship existed between OBLA and FI. It can be speculated that the physiological stress associated with the Thorstenson protocol is only sufficient enough to require energy contributed from the phosphocreatine system and not the glycolytic system. Thus improvements in OBLA will have no effect on FI as it was assessed in this study.

3698 Board #145 June 3 9:30 AM - 11:00 AM

Effect of Ankle Exercise on Ankle Isokinetic Strength: A Meta-Analysis

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Ankle injury is one of the most common injuries that occur during sports activities in Korea. Ankle strengthening exercise (ASE) is often used in the rehabilitation of ankle injuries; however, the degree of ASE effect and the effect of moderating variables are not known. **PURPOSE:** The purpose of this study was using meta-analysis to determine the effectiveness of ASE on ankle isokinetic strength. **METHODS:** Articles were searched from 1998 to 2015 using online database: RISS, NDSL and NAL (National Assembly Library in Korea). Search terms included phrases such as "ankle", "exercise", and "ankle strength", "ankle rehabilitation", "ankle isokinetic". Comprehensive Meta-Analysis version 2 software was used to calculate the weighted mean effect sizes (ES) and 95% CI and to conduct moderator analyses. ES calculations were based on a comparison of change scores from control and intervention groups using a random effects model. Cochran's Q statistic and I² were used to assess heterogeneity of ESs. Moderator variables included participants' sex, age, type of exercise, intervention duration, and ankle action. **RESULTS:** Overall, 111 ESs were calculated from 29 studies. The results showed a large and positive weighted mean ES of 0.78 (95% CI = 0.64, 0.92). The ESs were heterogeneous, $Q = 309.62, df = 110, p < .001, I^2 = 64.47$, which supported a further examination of moderator variables. Intervention duration (Qbetween = 8.68, $df = 2, p = .013$) and sex (Qbetween = 10.30, $df = 2, p = .006$) influenced the overall ES. Duration of 12 weeks (ES = 1.36) had a higher ES than other durations (.60 and .78 for 8 weeks and 6 weeks, respectively). There were larger effects on studies with only females (1.18) than studies with only males (0.76) and both males and females combined (.46). Age, type of exercise, and ankle action did not influence the overall ES. **CONCLUSIONS:** ASE was determined to be an effective training method to enhance ankle strength with a greater effect from studies with longer interventions and females.

3699 Board #146 June 3 9:30 AM - 11:00 AM

Impact of a Firefighter Recruit Training Academy on Movement Quality & Balance Ability

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Approximately 55% of the annual injuries to firefighters are classified as sprains and strains and may be related to movement quality and/or balance ability. The Functional Movement Screen™ (FMS™) and Y-Balance Test (YBT) have previously been associated with musculoskeletal injury risk among athletic populations. Although research has reported fitness-related changes in firefighter recruits during a 16-week training academy, the responses of the FMS™ and YBT are unclear. Whether any changes in movement quality and balance are retained after a 22 week, post-academy probation period are unknown. **PURPOSE:** To determine the changes in FMS™ and YBT during a 16-week recruit academy and subsequent 22-week active-duty probationary period. **METHODS:** Twenty-seven male firefighter recruits volunteered to participate (29.3 ± 4.1 yrs, 179.8 ± 4.6 cm, 87.2 ± 9.7 kg). FMS™ and YBT measures were collected at start and end of the 16-week recruit training program and again at week 38. The FMS™ was scored on a 0–21 scale. The YBT scores for each limb were formed by normalizing the reach distances to limb length, summing these distances in each direction, and dividing by three. The scores for right and left limbs were then averaged to create a composite score (%). Two separate (FMS™ and YBT) repeated measures ANOVAs and follow-up pairwise analyses were used to identify

significant differences across weeks. An alpha of $p < 0.05$ determined statistical significance for all analyses. **RESULTS:** Significant main effects were identified for both FMS™ ($F_{2,55} = 44.9, p < 0.001$) and YBT ($F_{2,55} = 276.9, p < 0.001$). Pairwise analyses indicated that FMS™ significantly increased from week 1 to 16 ($p < 0.001$; 11.93 ± 1.8 vs. 13.7 ± 1.5) and from week 16 to 38 ($p = 0.002$; 13.7 ± 1.5 vs. 14.4 ± 1.3). There was not a significant change in YBT from week 1 to 16 ($p = 0.539$; $97.8\% \pm 5.7\%$ vs. $97.1\% \pm 3.8\%$), but YBT did significantly decrease from week 16 to 38 ($p < 0.001$; $97.1\% \pm 3.8\%$ vs. $91.9\% \pm 3.7\%$). **CONCLUSIONS:** Firefighter recruits exhibited better movement quality, but decreased balance after 38 weeks. The work of a firefighter may prompt a loss in balance ability, perhaps serving as a key risk factor slips, trips, and falls. Future research should examine longitudinal changes in other measures of fitness to elucidate the underlying mechanism(s) in decreased balance ability.

3700 Board #147 June 3 9:30 AM - 11:00 AM
Effects Of Rock Climbing Exercise On Physical Fitness Among College Students: A Meta-Analysis

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Nowadays, the sedentary lifestyle and lack of interest in participating in physical activity among the college students in China result in the declining their health and physical fitness. Rock climbing is a newly growing physical exercise which provides excitations and challenges and is attracting more college students to participate in this physical exercise in China. **PURPOSE:** The purpose of this meta-analysis was to determine the effects of rock climbing on the physical fitness among college students. **METHODS:** Conducting a thorough electronic search and selection, nine studies were included in this meta-analysis, and the rock climbing intervention periods ranged from 4 to 24 weeks (3-6 times/week and 60-120 minutes each time). Ten variables included in this meta-analysis were: Body fat percentage, VO_2 max, Heart rate, Hand grip strength, Lower limb pedaling power, Vertical jump, Push-ups, Pull-ups, Sit-ups and Sit-and-reach. The effect sizes (ES) and forest plots of these ten variables were calculated ($p < .05$) and generated, respectively.

RESULTS: Eight variables (Hand grip strength, ES = .81; Lower limb pedaling power, ES = .36; Vertical jump, ES = .73; Push-ups, ES = .84; Pull-ups, ES = 1.09; Sit-ups, ES = 1.16; Sit-and-reach, ES = 1.15; and VO_2 max, ES = .76) out of ten were significantly improved after rock climbing intervention, while ES values of Heart rate and Body fat percentage did not show significant improvement after the intervention.

CONCLUSIONS: Rock climbing as one of fast-growing exercises has some positive effects on the physical fitness among college students, and might be more effective if the college students engage in rock climbing in a longer term.

3701 Board #148 June 3 9:30 AM - 11:00 AM
Short and Long Term Effects of a Simulated Mixed Martial Arts Competition

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 (No relationships reported)

PURPOSE: Investigate the short (immediately and 30 min post-competition) and the long-term effects (24h post-competition) of passive rest on physical parameters, metabolic, hormonal and inflammatory responses following Mixed Martial Arts (MMA) competition.

METHODS: Twelve male mixed martial artists participated in three rounds of 3 min of MMA competition separated by 1 min of passive rest. Passive recovery was monitored for 24h post-competition. Blood samples, physical measures, arterial blood pressure, perceptual measures, lactate and heart rate (HR) were measured pre-competition, immediately, 30 min and 24h post-competition. During the period rest between rounds, perceptual measures, lactate and HR were recorded.

RESULTS: Blood lactate, HR were affected by the moment ($P < 0.001$), with lower values pre and 24h post-competition compared to post-1, 2 and 3 rounds. Systolic blood pressure changed across the moments with higher values at post-competition compared to 30 min and 24h recoveries. White blood cells count was affected by moments with higher values at post-competition compared to pre-competition, 30 min and 24h post-competition ($P < 0.001$) and higher values at 30 min compared to 24h recovery. Hemoglobin was also affected with higher values post-competition compared to pre, 30 min and 24h post-competition ($P < 0.001$) and higher values at pre compared

to 24h post-competition. Uric acid was affected across time with higher values at 30 min recovery compared to all other moments ($P < 0.001$). Cholesterol, glycemia, proteids, cortisol and testosterone were also affected by moment with higher values at post-competition compared to all other moments. No change in creatine kinase was detected but lactate dehydrogenase changed with lower values at pre compared to post-competition, 30 min and 24h recovery. CounterMovement Jump and Hand Grip were affected by the moment with lower values at post-competition compared to pre and 24h post-competition. Rating of Perceived Exertion was affected by the moment, with lower values at post-1 compared to post-2 and post-3 and lower values at post-2 compared to post-3.

CONCLUSIONS: Long-term recovery appears to promote better restoration of physiological changes (alterations), physical performance and psychometric measures than short-term rest.

3702 Board #149 June 3 9:30 AM - 11:00 AM
Effect of Plyometric Training on Explosive Strength And Sprint on Team Sports: A Meta-analysis

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Plyometric training (PT) has shown to improve vertical jump height in athletes. However, little is known about its effectiveness for improving strength and speed performance in team sports. **PURPOSE:** To determine the effect of PT on explosive strength and sprint performance in team sports. **METHODS:** The search for information was conducted in the following electronic databases: Ovid, SportDiscus, Medline, Academic Search, Pubmed, ProQuest, Science Direct and Springer Link. Studies employing a PT intervention and containing data necessary to calculate effect sizes (ES) were included in the analysis. Hedge's standardized mean difference effect size (ES) was calculated and ESs pooled using random-effects models. Non-overlapping 95% confidence intervals ($CI_{95\%}$) were considered statistically significant. Heterogeneity was assessed using Q and I^2 . **RESULTS:** A total of 31 studies with total of 50 ESs met the inclusion criteria for explosive strength and 18 studies with a total of 43 ESs for sprint performance. PT improved explosive strength (ES = 0.98, $CI_{95\%} = 0.77, 1.20, Q = 174.51, I^2 = 71.95$) in team sports and sprint performance (ES = -0.30, $CI_{95\%} = -0.59, -0.00, Q = 237.60, I^2 = 82.32$) only in soccer. The improvement occurred regardless of the training season and protocol used. Analysis of moderator variables demonstrated that the strategies to maximize the probability of obtaining significant ($p < 0.05$) improvements in explosive strength included a training volume > 9 weeks, at least 27 sessions, 3 to 6 exercises, 20 to 32 repetitions per exercise, 4 to 6 series, 4-min rest between sets, 50 to 150 vertical jumps, and a session duration of approximately 30-min. To improve sprint performance in soccer, moderator variables included training 8 to 10 weeks, 2 times a week, 4 to 6 exercises, 2 to 4 series, 5 to 10 repetitions, 1-min rest between sets, 50 to 200 vertical jumps per session, and a session duration of about 40-min. **CONCLUSIONS:** PT enhanced explosive strength in team sports and sprint performance in soccer. Post meta-analytical studies on a variety of sports are warranted to confirm the validity of the results of the present study. The findings of this meta-analysis suggest that PT should be considered by coaches to optimize explosive strength and speed performance in team sports athletes.

3703 Board #150 June 3 9:30 AM - 11:00 AM
A Comparison of Resisted and Assisted Sprint Training in Collegiate Sprinters

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 (No relationships reported)

Sprint time (ST) is the product of stride length (SL) and stride frequency (SF). Increases in either of these variables results in speed improvement. **PURPOSE:** To compare resisted (RST) and assisted sprint training (AST) on sprint performance. **METHODS:** Twenty (10 male, 10 female) collegiate sprinters and hurdlers were randomly divided into two training groups: RST (age: 21.8 ± 1.8 yrs, Ht: 1.73 ± 0.10 m, BM: 69.5 ± 12.8 kg) and AST (age: 22.2 ± 2.4 yrs, Ht: 1.76 ± 0.10 m, BM: 69.1 ± 9.9 kg). Each group trained 3 day/wk for 6 weeks. The RST group used a combination of weighted sled pulls, uphill sprinting and depth jumps. The AST group combined downhill running, towing, sprint ladders and single leg bounds. Prior to and following the training interventions SL and ST (10 meter sprint time) were recorded at sprint distances of 30m, 60m, and 120m during the last 10 meters of each sprint distance. Pre-post training ST and SL were compared within training groups at each sprint distance using paired t-tests. Additionally, a gain score was calculated by taking the difference between the post and pre test scores. The gain scores for SL and ST were

compared between training groups via independent t-tests at each sprint distance. RESULTS: For the RST 30m, ST (1.18±0.08s vs 1.14±0.08s, p<0.01) and SL (2.06±0.08m vs 2.09±1.14m, p<0.01) were significantly improved. For the AST, 30m ST (1.19±0.08s vs. 1.18±0.08s, p<0.01) and SL (2.10±0.13m vs. 2.11±0.13, p=0.04) were significantly improved. No improvements in ST or SL were detected for either the RST or AST groups at the 60m sprint distance. For the RST 120m, ST (1.13±0.07s vs. 1.12±0.08s, p<0.01) was significantly improved. For the AST 120m, ST (1.12±0.07s vs. 1.11±0.07s, p<0.01) and SL (2.30±0.08 vs. 2.33±0.08, p<0.01) were significantly improved. At the 30M interval, the RST demonstrated significant improvements in SL and ST as compared to the AST (p<0.01). However, at the 120M interval, the AST demonstrated a significant improvement in SL as compared to the RST (p<0.01). CONCLUSION: Within the parameters of this study, RST and AST methods have proven effective at improving sprint performance. It appears that RST protocols may be of greatest benefit for improving sprint performance at shorter distances, while AST protocols may be of greater benefit at longer sprinting distances.

3704 Board #151 June 3 9:30 AM - 11:00 AM
Head Accelerations Associated with Six Standard Judo Throws and Break Falls

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The contact sport of judo involves throwing an opponent in a variety of ways, with potential risk of concussive head impacts. When being thrown, a judo practitioner executes a break fall, theoretically protecting the head from injury. However, little research has directly measured head accelerations of a person executing a break fall in response to various throws in judo. PURPOSE: Quantify and compare head accelerations associated with six standard judo throws and corresponding break falls. METHODS: In random and repeated design, 14 judo martial artists (13 male, 1 female; age = 28 ± 9 yrs; stature = 177 ± 6.7 cm; mass = 80.3 ± 9.4 kg; rank = brown or black belt) performed five sets of six standard judo throws & corresponding break falls. The six throws were layback throw (tomoe-nage), hand throw (tai-otoshi), leg sweep (harai-tsuri-komi-ashi), shoulder throw (seoi-nage), forward leg sweep (deashi-braai), and thigh throw (uchi-mata). The participant being thrown wore a headband-mounted tri-axial accelerometer, measuring linear (g) and rotational accelerations (krad·s⁻²) of the head when performing a break fall corresponding with one of the six throws. Minimum threshold for registering acceleration was 16 g. RESULTS: Repeated measures one-way ANOVA and post hoc compared magnitude and frequency of accelerations of the head when performing a break fall corresponding with each of the six throws. When utilizing the linear acceleration criterion >80 g for risk of concussion, as suggested by some experts, none of the six judo throw/break fall combinations resulted in a significant head impact (incidence rate = 0%). However, when comparing all registered accelerations above 16 g threshold, hand throw (1 impact, 1.4 % incidence rate, 27.94 g, 2.8 krad·s⁻²), forward leg sweep (1 impact, 1.4 % incidence rate, 20.58 g, 1.59 krad·s⁻²), and thigh throw (7 impacts, 10% incidence rate, 28.16 ± 4.92 g, 3.94 ± 1.83 krad·s⁻²) had higher frequency of occurrence and magnitude of acceleration than other throws (p<0.01). Thigh throw had highest incidence rate of any throw (p<0.01). CONCLUSION: The judo thigh throw (and break fall) had the highest incidence of sub-concussive head accelerations in the category of 20-40 g. However, none of the judo throws and associated break falls resulted in any impact considered high risk for concussion.

3705 Board #152 June 3 9:30 AM - 11:00 AM
Impact of Percentage-based Versus Autoregulated-based Load Prescription on Maximal Strength

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Researchers and practitioners use the resistance training-specific rating of perceived exertion (RPE) scale for individualization of training load prescription. However, an intervention to compare traditional percentage-based load prescription versus RPE-based loading for strength adaptations has not been conducted. PURPOSE: To compare changes in one-repetition maximum (1RM) strength of the back squat and bench press between percentage-based training (PBT) and autoregulated-based training (ABT) via RPE. METHODS: Eleven males (age: 23±4 yrs, body mass: 77.4±7.7 kg, body fat: 9.5±3.8%) with at least two yrs. of training experience and a minimum 1RM of 1.5 and 1.25x bodyweight on the squat and bench press respectively, were assigned to one of two groups: PBT (n=6) or ABT (n=5) for 8 weeks. Forty eight hours following pre-testing 1RM both groups performed the squat and bench press 3x/

wk. on non-consecutive days (i.e. Mon., Wed., Fri.) using the same number of sets and repetitions following an undulating resistance training program, which linearly increased load and decreased repetitions throughout. Weeks 1-3 consisted of 8, 6, and 4 repetitions on Mon., Wed., and Fri., while weeks 4-5 consisted of 7, 5, and 3 repetitions during the week, with 6, 4, and 2 repetitions being performed during weeks 6-7. Week 8 served as a taper with 4 and 3 repetition days on Mon. and Wed. and post-testing on Fri. Load increased during each week in PBT from 65, 70, and 75% in week 1 to 82.5-92.5% of 1RM in week 7. In ABT there was no prescribed load but subjects were instructed to select a load, in which the set ended with a 5-7RPE in week 1 and progressing to an 8-10RPE in week 7. A 2x2 repeated measures ANOVA was used with significance set at p≤0.05. RESULTS: There was a time effect (p<0.01) for 1RM squat (141.00±22.49 to 153.75±20.40kg; +9.46%), bench press (109.08±15.89 to 116.67±14.61kg; +7.22%), and total strength-TS (250.08±32.30 to 270.42±29.62kg; +8.39%) in PBT, and for 1RM squat (152.20±21.65 to 171.30±24.97kg; +12.52%), bench press (123.00±11.31 to 133.70±14.82kg; +8.58%), and TS (275.20±30.24kg to 305.00±37.61kg; +10.71%) in ABT. However, no significant group differences existed for squat (p=0.31), bench (p=0.11) or TS (p=0.16). CONCLUSION: Our findings indicate that both PBT and ABT are equally effective at increasing maximal strength.

3706 Board #153 June 3 9:30 AM - 11:00 AM
Greater Ankle Strength and Anaerobic Capacity in Female Marines Who Completed Military Occupational Specialty School

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 (No relationships reported)

Female Marines can now serve in all military occupational specialty (MOS). A cohort of female Marines participated in ground combat MOS schools as part of the Ground Combat Element Integrated Task Force (GCE ITF), which studied the integration of women into combat arms. It is important to identify characteristics of female Marines who successfully graduated from ground combat MOS schools.

PURPOSE: To explore physical and physiological differences between female Marines who did or did not successfully complete MOS school. METHODS: Female GCE ITF Marines (N=62, 22±3yrs, 163±6cm, 63±7kg) underwent the following assessments prior to ground combat MOS school: anthropometric, strength (average peak torque % body weight) with an isokinetic dynamometer (knee, shoulder, trunk) or hand-held dynamometer (ankle), maximal oxygen uptake (VO₂)/ lactate threshold (LT) during an incremental ramped protocol to exhaustion, and anaerobic power (AP)/capacity (AC) during a 30-second cycling protocol. Subjects were classified as graduated (N=45) or did not graduate MOS school, due to failed fitness testing or injury (N=16). Statistical significance was set a priori at alpha of 0.05. Between group differences were assessed with an independent t-test or Mann Whitney U test, as appropriate.

RESULTS: : Despite no significant anthropometric differences between groups, significant differences were found in right/left ankle evertor strength, right ankle invertor strength, AC, VO₂ max and VO₂ at LT (all p<0.05 - Table 1). CONCLUSIONS: Higher ankle strength and anaerobic capacity were observed in female ground combat MOS school graduates. These results may help female Marines optimize physical readiness for ground combat.

Table 1. Strength and physiology comparison of female Marines who did and did not graduate from MOS school

	Group comparison		p-value
	Graduated (n=45)	Not Graduated (n=16)	
Age (yrs)	23.0±3.7	21.3±1.4	0.292*
Height (cm)	164.2±5.3	163.1±4.7	0.424*
Weight (kg)	63.5±6.7	63.0±10.1	0.969*
Body Fat (%)	24.2±4.5	26.2±5.3	0.183*
Right Knee Flexion Strength (%BW)	109.9±18.9	103.4±17.4	0.800*
Left Knee Flexion Strength (%BW)	105.5±18.3	97.6±15.7	0.395*
Right Knee Extension Strength (%BW)	198.4±37.7	188.6±25.2	0.996*
Left Knee Extension Strength (%BW)	198.7±34.9	180.1±26.1	0.218*
Right Shoulder Internal Rotation Strength (%BW)	40.4±8.6	37.0±8.3	0.450*
Left Shoulder Internal Rotation Strength (%BW)	38.1±7.9	34.4±7.5	0.884*
Right Shoulder External Rotation Strength (%BW)	30.5±5.6	29.6±3.6	0.520*
Left Shoulder External Rotation Strength (%BW)	28.6±4.9	26.6±3.4	0.639*
Trunk Flexion Strength (%BW)	172.8±29.8	172.0±37.9	0.882*
Trunk Extension Strength (%BW)	263.1±60.7	269.0±76.8	0.995*
Right Ankle Eversion Strength (%BW)	35.1±7.2	32.2±6.3	0.029*
Left Ankle Eversion Strength (%BW)	36.3±9.7	31.6±7.9	0.027*
Right Ankle Inversion Strength (%BW)	35.5±7.6	32.7±8.9	0.047*
Left Ankle Inversion Strength (%BW)	33.9±7.2	31.8±7.2	0.195*
Anaerobic Power (W/kg)	11.0±2.2	10.9±0.7	0.177*
Anaerobic Capacity (W/kg)	6.8±1.5	6.3±0.9	0.035*
Maximal VO ₂ uptake (ml/kg/min)	44.9±3.2	43.2±3.4	0.016*
VO ₂ @ Lactate Threshold (ml/kg/min)	36.9±2.6	29.9±14.2	0.003*

mean±sd significant difference at p<0.05

* T-test † Mann Whitney U

3707 Board #154 June 3 9:30 AM - 11:00 AM
Effects Of Speed- And Circuit-based High-intensity Interval Training Excess Post-exercise Oxygen Consumption
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 (No relationships reported)

In the United States, there remains interest in developing efficient, effective ways for individuals to increase energy expenditure for weight management. Research has shown that high-intensity exercise elicits a higher excess post-exercise oxygen consumption (EPOC) throughout the day compared to steady-state exercise. Currently, there is no single research study that examines the differences in EPOC resulting from high-intensity interval training (HIIT) modalities. **PURPOSE:** The purpose of this study is to review the impact of circuit training (CT) and speed interval training (SIT) on EPOC in individuals who regularly exercise or are sedentary. **METHODS:** Twenty-six participants were recruited and divided into active and sedentary groups according to self-reported exercise participation status. Oxygen consumption (VO_2) was measured during and after two HIIT sessions and was used to estimate caloric expenditure. Mean VO_2 and caloric expenditure responses during and after exercise were then compared across modality and activity status using a 2-way RM ANOVA. **RESULTS:** There was no significant difference ($p > .05$) in caloric expenditure during exercise between active (83.52 ± 26.1) and sedentary (83.84 ± 31.9) individuals. There was also no significant difference ($p > .05$) in EPOC between sedentary (67.43 ± 29.6) and active (69.1 ± 32.8) individuals or between modalities for both groups (Active: 73.49 ± 21.2 SIT vs 64.68 ± 44.4 CT; Sedentary: 67.52 ± 31.6 SIT vs 67.33 ± 27.5 CT). However, there was a significantly higher ($p < .05$) caloric expenditure during exercise between modalities in both groups (Active: 98.79 ± 25.6 SIT vs 68.25 ± 26.5 CT; Sedentary: 89.57 ± 33.8 SIT vs 78.1 ± 30.1 CT). **CONCLUSION:** Regarding maximizing EPOC, individuals can choose either method of HIIT since both had similar effects on overall energy expenditure following exercise. However, it is recommended that individuals engage in SIT routines versus CT if the goal is to maximize overall caloric expenditure.

3708 Board #155 June 3 9:30 AM - 11:00 AM
The Effect Of Morning Or Evening Exercise On Cardiovascular Fitness And Body Weight
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 (No relationships reported)

PURPOSE: To compare the effect of 8 weeks of morning exercise or evening exercise on cardiovascular fitness and body composition in healthy women. **METHODS:** Fifty-five participants were randomized to either a morning exercise group (AM) (25.3 ± 4.1 yrs; 25.2 ± 4.7 kg/m²; 37.9 ± 7.6 %BF) or an evening exercise group (PM) (25.4 ± 6.7 yrs; 23.5 ± 3.9 kg/m²; 34.1 ± 6.1 %BF). The AM group completed exercise between 6:30-9:30am and the PM group between 6:30-9:30pm, both for 4 days per week (3 days supervised), 45 minutes per session, and for 8 weeks. All participants followed an exercise program of moderate-intensity treadmill walking (40-59% heart rate reserve [HRR]) and progressed to include vigorous-intensity exercise (60-89% HRR). Cardiovascular fitness was determined using a maximal treadmill protocol and indirect calorimetry. Body weight/composition was determined using a digital scale and dual-energy x-ray absorptiometry (DXA). **RESULTS:** Eighty-two percent of participants completed the study; 21 (78%) from the AM group and 25 (86%) from the PM group, with 94.75% of the prescribed exercise sessions completed. Using intent-to-treat analysis, there was not a group*period interaction for VO_2 peak or time-to-completion during the treadmill test ($ps > .05$); however, with groups combined, time-to-completion during the fitness test significantly improved ($F = 6.66$; $p = 0.013$). For completers in the AM group, 76% gained weight while 36% gained weight in the PM group. For completers, body weight increased by 0.79 ± 1.16 kg in the AM group ($F = 5.05$; $p = 0.0361$) and decreased by 0.21 ± 1.46 kg in the PM group. Intent-to-treat analysis showed a significant group*period interaction ($F = 5.12$; $p = 0.029$). This trend persisted with control of baseline body weight ($F = 5.02$; $p = 0.0301$). However, there was not a significant group*period interaction for total body fat (g) or fat-free mass (g) ($ps > 0.05$). **CONCLUSIONS:** Eight weeks of exercise may improve exercise performance but does not appear to be a function of time of day of exercise. However, these results suggest the possibility that evening exercise may be slightly superior for body weight maintenance. As these differences are small and body composition did not differ between groups, caution should be used when interpreting these data; however, additional research may be warranted.

3709 Board #156 June 3 9:30 AM - 11:00 AM
Improvements In Recruit Fitness During A 6-week Firefighter Training Academy
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Firefighting is a unique and dangerous career in that, unlike some sports and careers that primarily focus on one training goal, firefighters (FFs) must train both aerobic and anaerobic systems. The leading cause for death of on-duty FFs is sudden cardiac events. Emphasizing physical training early in a firefighters career (academy training) has the potential to impact fitness and perceptions of the importance of fitness, and hence to decrease the risk of sudden cardiac events. **PURPOSE:** Examine physical fitness parameters, assessed during the first and last week of a 6-wk firefighter (FF) training academy, in male recruit FFs from 2004 through 2016 to establish the effectiveness of the training regimen employed by the Illinois Fire Service Institute (IFSI). **METHODS:** Participants were male FF recruits ($N = 383$; 26.2 ± 4.2 yrs, $M \pm SD$) from the IFSI who completed baseline fitness measures including measures of weight, estimated $\text{VO}_{2\text{max}}$ (1.5-mi run), muscular endurance (60-s sit-ups, 60-s push-ups, bench press), and flexibility (sit and reach). Following the 6-wk fire academy, which included daily physical training, recruit FFs repeated the fitness test battery. **RESULTS:** Results indicated significant improvements ($M_{\text{diff}} \pm SE$; all $P_s < 0.001$) for weight (1.12 ± 0.14 kg, Cohen's $d = 0.08$), 1.5-mile run (0.92 ± 0.04 min, $d = 0.57$), 60-s sit-ups (5.11 ± 0.25 reps, $d = 0.60$), 60-s push-ups (13.21 ± 0.38 reps, $d = 1.08$), bench press [i.e., 38.6 kg; 2.56 ± 0.26 reps, $d = 0.23$], and flexibility (2.15 ± 0.19 cm, $d = 0.28$). **CONCLUSIONS:** Following a 6-wk training academy, including daily physical training, recruit FFs made significant improvements in weight, BMI, estimated $\text{VO}_{2\text{max}}$, three measures of muscular endurance, and flexibility. Since the majority of on-duty deaths can be attributed to stress or overexertion-related cardiac events, it is important to recognize the importance of a varied fitness regimen for FFs' health as well as performance. All areas of fitness need to be examined with training modalities and performance goals that are consistent with the physical demands of firefighting.

3710 Board #157 June 3 9:30 AM - 11:00 AM
The Effect of Time of Day of Training on Health and Fitness Outcomes in Men
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 (No relationships reported)

As subjective evidence continues to suggest a link between time of day (TOD) of exercise training and potential health and fitness outcomes, it is essential to explore this prospective influence in controlled comprehensive studies. **PURPOSE:** To determine the effect of TOD on mediating training-induced changes in exercise performance, cardio-metabolic health, and body composition in active normal weight men. **METHODS:** 26 healthy active males ($\text{BMI} = 26 \pm 3$ kg/m²; 44 ± 8 yrs) were recruited for this study and randomized to either exercise training in morning (AM) or evening (PM) for 12 weeks. Following current ACSM guidelines, a multimodal training paradigm was used (Resistance, Interval, Stretching, and Endurance, RISE). Baseline exercise performance was assessed via abdominal, upper and lower body muscular strength (situps, pushups, 1 RM bench and leg presses), power (jump squats and bench throws), aerobic power (5km cycling time trial), flexibility (sit and reach), and balance (stork stand), cardiovascular health (blood pressure, and augmentation index (AIx)), body composition (iDEXA: Fat free mass, fat mass, abdominal/visceral fat, %body fat), hunger/satiety ratings (visual analog scales), and cardio-metabolic profile (energy expenditure, fasting lipids, glucose, insulin). **RESULTS:** At baseline, no differences existed between groups in any variable. Training resulted in significant ($p < 0.05$) improvements in exercise performance, cardio-metabolic health, and body composition. Furthermore, there were significant interactions ($p < 0.05$) of TOD x training for fasting glucose (1.83 ± 2.05 v. 1.75 ± 1.48 Amg/dL), LDL-C (6.50 ± 5.78 v. -3.57 ± 2.80 Amg/dL), and total cholesterol (4.17 ± 0.88 v. -3.26 ± 2.86 Amg/dL) levels, AM vs. PM, respectively. In addition, non-significant trends were found for resting metabolic rate (increase in AM, $p = 0.07$) and fasting triglycerides (lower in PM, $p = 0.06$). **CONCLUSION:** The multimodal RISE protocol improved performance, cardiovascular health, and body composition, with the TOD altering the magnitude of cardio-metabolic training-induced adaptations. Specifically, training in the AM

exhibited a trend of increasing RMR, while training in the PM resulted in greater improvements in fasting total cholesterol, LDL-C, and triglycerides in healthy men. Supported by Isagenix.

3711 Board #158 June 3 9:30 AM - 11:00 AM
Personalized Exercise Training Maximizes Comprehensive Training Responsiveness in Adults At-Risk for Cardiovascular Disease
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PURPOSE: Previous research has identified considerable variability in training responsiveness among individuals exposed to regular exercise. While examining the considerable heterogeneity in exercise-induced changes in cardiorespiratory fitness and common cardiometabolic risk factors, it has been identified that an individualized and evidence-based approach to exercise prescription may be necessary to optimize training efficacy and reduce training unresponsiveness. The purpose of this study was to compare comprehensive training responsiveness between two exercise training programs: personalized vs. standardized. **METHODS:** Sedentary men and women (n=46, ages 44 to 83 yrs) were randomized into a non-exercising control group or one of two exercise training treatment groups: 1) standardized group (exercise intensity prescribed according to heart rate reserve) or 2) personalized group (exercise intensity prescribed according to ventilatory thresholds). Exercise training was performed 60-75 min/day on 3 days/wk for 13wk. Maximum oxygen uptake, systolic blood pressure, HDL cholesterol, triglycerides, and blood glucose were measured pre/post intervention, and percent change for each measure was calculated. Based on percent change for each measure, participants were assigned scores (responder: 1, non-responder: 0), and a comprehensive response to training score (scale 0-5) was determined. **RESULTS:** Training responsiveness as evidenced by the responder composite score was greater (p<0.05) in the personalized treatment group (4.71 ±0.47) when compared to the standardized treatment group (2.86 ±0.66). There were similar (p>0.05) responder composite scores across men and women for both the personalized (men=4.75; women=4.67) and standardized (men=2.75; women=3.00) treatment groups. Training responsiveness was also similar (p>0.05) across age for both treatment groups. **CONCLUSION:** Our findings demonstrate that personalized exercise training maximizes comprehensive training responsiveness. These preliminary results are promising for exercise physiologists and other health professionals who prescribe exercise for populations at-risk for cardiovascular disease and other chronic conditions.

3712 Board #159 June 3 9:30 AM - 11:00 AM
The Influence of Foam Rolling on Recovery From Exercise Induced Muscle Damage
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 (No relationships reported)

With the increased popularity of foam rolling (FR) as a recovery tool, it is important to establish the exact manner in which the practice is useful. **PURPOSE:** The purpose of this study was to examine the impact of FR on recovery from exercise-induced muscle damage. **METHODS:** In a between-group design, 37 males performed 40x15m sprints, inducing muscle damage. Immediately following sprinting and in the four days following, perceived muscle soreness, hip ROM, vertical jump, and agility measures were recorded. 18 subjects (mean±sd; age 22.4±2.0 yrs; BMI 26.9±4.2 kg m⁻²) foam rolled prior to testing each day (FR), while 19 (mean±sd; age 23.2±3.2 yrs; BMI 26.3±4.0 kg m⁻²) served as a non-foam rolling control (CON). Measurements recorded during the five days of recovery from the repeated sprint protocol were compared to those obtained during three baseline days of familiarization the prior week. The area under the curve (AUC) was calculated by summing all five scores and these data were compared by condition using a two-tailed Mann-Whitney U test (alpha level = 0.05). **RESULTS:** Perceived soreness, hip ROM, and vertical jump were not significantly different between groups (p>0.05). Agility, specifically the difference in time from baseline to complete the agility T test, was significantly lower in the foam rolling condition (p<0.05). AUC was higher in CON (2.88 s±2.45) than FR (0.33 s±2.16). Mean values for agility changes from baseline in CON were 0.52 s, 0.82 s, 0.78 s, 0.45 s, and 0.32 s on the day muscle damage was induced, and then the four days following, respectively. Mean values for agility changes from baseline in FR on those days were 0.11 s, 0.17 s, 0.06 s, 0.12 s, and -0.13 s. **CONCLUSIONS:** FR expedites recovery of agility following exercise-induced muscle damage instigated by a repeated sprint protocol. FR may be useful for athletes requiring adequate agility who need to recover quickly from intensive bouts of exercise. Supported by: Performance Health (Hygienic Corporation, Akron, Ohio) supported this project with donations of foam rollers.

3713 Board #160 June 3 9:30 AM - 11:00 AM
Cold-water Immersion During Halftime Does Not Affect Second-half Physical Performance In A Football Match
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In football matches, cold-water immersion (CWI) is often practiced during halftime to recover from fatigue and maintain performance in the second-half. **PURPOSE:** To develop and validate a 90-min long simulated football match using a football simulated protocol (FSP) and to observe performance changes in the second-half responding to an application of a 5-min CWI during halftime. **METHODS:** Twenty male elite footballers (athletic career: 9 ± 1 years) visited a regular outside natural-grass football pitch three separate days. On the first day, baseline values of two-legged maximal vertical jump, 20-m sprint, arrowhead agility test, and accuracy scores of short-pass and long-kick were assessed. On the second and the third days, participants performed nine repetitions of a 5-min long FSP, consisted of football related activities (walking, jogging, sprinting, cutting, jumping, side-stepping, and kicking) to complete the first- and second-half. On the second and third days, calorie expenditure and heart rate (HR) were also recorded. During halftime, participants were received one of conditions (CWI: bare feet immersed up to 8 cm below from the tibial tuberosity at 7.5 °C or control: sitting on a bench: in a counterbalanced order) for 5-min. To test condition effects over time, time points were divided as T1 (first 15-min of the first-half) through T6 (last 15-min of the second-half), thus 2 × 6 mixed model ANCOVAs (covariate: baseline values) and Tukey-Kramer post hoc tests were performed (p<0.05). **RESULTS:** A total value of calorie expenditure (1,245 Cal) and an average value of HR at a time point (163 bpm) in our study were similar to typical football matches. Participants spent less calories during T1 (186 Cal) and T4 (191 Cal) than to T2 (213 Cal) or T3 (224 Cal), and T4 (212 Cal) or T5 (219 Cal), respectively. An application of CWI during halftime did not change any performance in the second-half (maximal vertical jump: F_{5,209}=0.44, p=0.82; 20-m sprint: F_{5,209}=0.6, p=0.7; arrowhead agility test: F_{5,209}=0.26, p=0.93; short-pass: F_{5,209}=1.75, p=0.12; long-kick: F_{5,209}=1.19, p=0.31). **CONCLUSIONS:** Our football simulated match can be used as experimental or practical purposes. Halftime CWI does not affect performance in the second-half. Water temperature or duration of application may explain the ineffectiveness of CWI.

3714 Board #161 June 3 9:30 AM - 11:00 AM
Effects of External Counter Pulsation (ECP) on Physical Recovery after Strenuous Exercise
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External Counter Pulsation (ECP) therapy is a non-invasive treatment that enhances blood flow and delivers oxygenated blood to the extremities through the sequential compression of the lower limbs during diastole. While ECP has been used to treat patients with chronic angina pectoris/congestive heart failure, there has been little research on the impact of ECP on healthy individuals. **PURPOSE:** To determine if ECP therapy impacts recovery and ability to perform after strenuous exercise. **METHODS:** Fifty-seven amateur athletes, 27 males and 30 females, aged 38.9 ± 11.6 years, participated in three two-hour study visits over three consecutive days. During each study visit subjects engaged in a 20 min lower-body exercise circuit while wearing a weighted vest containing 12-15% of their body weight and then completed a 10k time trial using an indoor cycling trainer. Balance and jump tests were conducted both before the exercise circuit (PRE) and following the cycling time trial (POST). Balance was the amount of postural sway over 20 sec for both right and left leg, measured using a force plate. Jump explosiveness was ground time between consecutive jumps, measured using a contact mat. Subjects who were randomly assigned to the treatment condition then received 30 min of ECP therapy, while control subjects passively recovered for 30 min while wearing thigh and calf cuffs from the ECP machine. Repeated measures ANOVA was used to examine within group differences. **RESULTS:** Average cycling time significantly decreased from visit 1 to visit 3 for the ECP group compared with the control group (1,524 to 1,432 vs. 1,499 to 1,479 sec; p<0.05). Although balance for both groups improved, the ECP group significantly improved their balance as compared to the control group from POST visit 1 to PRE visit 2 (74.8 to 67.9 vs. 75.2 to 73.6; p<0.05). Jump explosiveness was maintained from POST visit 1 to PRE visit 2 for the ECP group, while performance on this test decreased significantly for the control group over the same period (.403 to .404 vs. .363 to .393; p<0.05). **CONCLUSION:** ECP therapy after strenuous exercise improved cycling time trial performance, improved balance, and maintained jump explosiveness. Mechanisms through which ECP impacts performance are possibly enhanced recovery by means of vasodilation and increased blood flow.

3715 Board #162 June 3 9:30 AM - 11:00 AM
Does Foam Rolling Increase Pressure Pain Threshold Of Ipsilateral Lower Extremity Antagonist And Contralateral Muscles?
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 (No relationships reported)

Sports medicine professionals often prescribe foam rolling as an intervention to treat myofascial restrictions. Of particular interest, is the effect foam rolling has on the ipsilateral antagonist muscle and contralateral muscles. Recent research has observed ROM changes in these muscles after a foam rolling intervention. To date, no studies have examined how foam rolling effects the pressure pain threshold (PPT) levels of the ipsilateral antagonist and contralateral muscles. **PURPOSE:** To examine the acute effects of a foam rolling intervention on ipsilateral antagonist and contralateral muscle group PPT levels. **METHODS:** Twenty-one healthy participants (mean age 27.52±8.9 years) (M=13, F=8) were recruited for this study and signed an IRB consent. Participants underwent pretest and immediate posttest PPT measures after a 2-minute video-guided foam roll intervention to the left quadriceps. PPTs were measured using a digital algometer to the ipsilateral left hamstrings and right quadriceps. Pretest and posttest measures were calculated using the paired *t*-test. Statistical significance was considered *p*< 0.05 using a two-tailed test. **RESULTS:** A significant difference was found between pretest to posttest measures for the ipsilateral hamstrings (*t* (20) = -6.2, *p*<0.001) and contralateral quadriceps (*t* (20) = -9.1, *p*<0.001) suggesting an increase in PPT. **CONCLUSIONS:** These findings suggest that foam rolling of the quadriceps musculature may have an acute effect on the PPT of the ipsilateral hamstrings and contralateral quadriceps muscles. Individual may feel less discomfort due to a higher PPT. The ipsilateral decrease in hamstring PPT may have occurred through reciprocal inhibition and agonist pain perception from rolling on the left quadriceps. The cross-over effect of decreased right quadriceps PPT may have been from a more global neurophysiological response. Clinicians must consider these results to be exploratory and future investigations examining this intervention on PPT is warranted.

3716 Board #163 June 3 9:30 AM - 11:00 AM
Downhill Running Followed by Foam Rolling Has No Effect on the Cost of Running
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Purpose: Downhill running (DHR) causes muscle soreness that may affect running performance. Foam rolling (FR) is a potential recovery tool for reducing soreness and attenuating performance decrements. Running economy (RE), which quantifies the efficiency of running, is a key factor in distance running ability. It is unclear whether DHR affects RE in trained runners and whether FR is an effective recovery method for DHR-induced soreness. Furthermore, RE may be assessed in several ways, including O₂ cost (VO₂) and energy cost (EC, kcal*kg⁻¹*min⁻¹). These measures may be more accurate with allometric scaling of body weight (alloVO₂ and alloEC; body weight in kg^{0.66}). Thus, our purpose was to evaluate changes in RE with DHR and FR or placebo using 4 definitions of RE.

Methods: Subjects did submaximal running to assess RE 2-4 days before (SUBMAX1) and 48 hours after (SUBMAX2) DHR. Immediately after DHR, they performed FR or placebo (sham compression tights [T]). In a randomized crossover design, subjects repeated these tests 2-4 weeks later. RE during SUBMAX was calculated as VO₂, alloVO₂, EC, and alloEC. Muscle soreness was measured on a 0-10 verbal scale before DHR and SUBMAX2.

Results: Eight trained runners completed the study (VO_{2max} 57±7 ml*kg⁻¹*min⁻¹, age 30.6±7 years, 4 females). Soreness at SUBMAX2 was greater than at SUBMAX1, showing that DHR induced soreness in all subjects (*p* = 0.012). Subjects had lower soreness at SUBMAX2 with FR than T (*p* = 0.025). However, there were no significant effects of time or treatment on VO₂, alloVO₂, EC, or alloEC (*p* > 0.05 for all comparisons).

Conclusion: Downhill running causes muscle soreness but does not affect running performance as evaluated through RE. FR reduces DHR-induced soreness compared to a placebo. While allometric scaling and energy cost definitions of RE may be better indicators of running performance than the traditional VO₂, none of the measures of RE are affected by DHR-induced muscle soreness.

3717 Board #164 June 3 9:30 AM - 11:00 AM
An Examination of Self-Myofascial Release vs. Instrument Assisted Soft Tissue Mobilization Techniques on Vertical and Horizontal Power in Recreational Athletes
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Self-Myofascial Release (SMR) and Instrument Assisted Soft Tissue Mobilization (IASTM) both relieve adhesions and restrictions in muscle tissue. These tools are popular however there is limited research as to their efficacy on improving athletic performance.

PURPOSE: The objective of this study was to determine if using pre-exercise SMR or IASTM would improve performance on measures of vertical and horizontal power. The researchers also examined if any differences in perceived pain existed between the two manual therapy interventions. **METHODS:** A total of 29 male and 22 female college students volunteered to participate in the study. Subjects were required to meet the American College of Sports Medicine recommendations for physical activity. Subjects were randomly assigned to receive either IASTM via Tecnica Gavilan or SMR via The Stick. Vertical power was assessed by a vertical jump test and horizontal power was measured by a 40 yd sprint. In the first session, body fat percentage and baseline measurements for the vertical jump and 40 yd sprint were collected. During the second session, the subjects received either SMR or IASTM prior to their vertical jump test and 40 yd sprint. Subjects were asked to rate the level of pain they perceived after the massage intervention using a visual analog scale. Subjects then repeated the vertical jump and 40 yd sprint tests. A dependent *t*-test was used to determine differences in pain between the two massage interventions. A 2 x 2 ANCOVA was used to determine if differences existed between genders and the two types of manual therapy. **RESULTS:** There was no interaction (*p* > .05) between the massage intervention and gender for both the vertical jump and 40 yd sprint tests. There was a significant main effect for vertical jump and SMR (*p* = .04). Gender also had a significant main effect for both the vertical jump (*p* = .04) and the 40 yd sprint (*p* = .02). There were no significant differences between massage interventions for the 40 yd sprint times (*p* = .73). There were no significant differences in perceived pain between the massage interventions (*t* (49) = -1.60, *p* > .05). **CONCLUSION:** The use of SMR prior to exercise may be beneficial in improving vertical power in recreational athletes, and was not perceived to be more painful than IASTM. However, neither SMR nor IASTM improved horizontal power.

3718 Board #165 June 3 9:30 AM - 11:00 AM
The Impact of a 30 vs. 60 Second Passive Recovery Period on Vertical Jump Performance
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The vertical jump (VJ) test is commonly utilized to determine how high a person can jump and what their resulting power will be. Thus, it is important that the VJ test is administered correctly for a person to jump as high as possible. The standard time between subsequent jumps is usually 30 seconds (secs) with a completion of 3-6 jumps. But, if an individual is not fully recovered before their next jump, it is possible that jump may be lower vs. the first or earlier jumps. If a longer recovery period is granted between each jump, the individual may potentially jump as high as or even higher than their previous attempts. However, to the best of the researchers' knowledge, the impact of a 30 vs. 60 secs passive recovery period on VJ performance has not been assessed. **PURPOSE:** To investigate the potential differences between a 30 vs. 60 secs passive recovery period on VJ performance in no less than average fit college-age males. **METHODS:** After having descriptive data (ie. Ht., Wt., BF%, age) recorded, 31 average fit college-age males had their reach height measured and then participated in an 8 min dynamic warm-up. Subjects were then given a 4 minute passive recovery (PR) period after the warm-up and then completed 4 familiarization jumps (ie. trials) using a VJ measurement device. After another 4 min PR period, subjects completed 2 series of jumps (ie. 4 trials apiece) in a counterbalanced order with either 30 (THIR) or 60 (SIXT) secs of PR between each jump. The THIR and SIXT jump series were separated by 4 min of PR. Excluding the first jump/trial for each series, the highest jump for THIR vs SIXT were compared using Paired-Samples *t*-Tests with significant differences occurring at *p* < 0.05. **RESULTS:** No significant differences (*p* = 0.44) occurred between SIXT (70.01 + 10.36 cm) and THIR (69.97 + 9.86 cm). **CONCLUSION:** The current results suggest that 30 or 60 secs of passive recovery between jumps is optimal recovery for peak performance to occur during the vertical jump test using average fit college-age males. However, further research may

be necessary to assess the impact of 30 vs. 60 sec passive recovery on vertical jump performance using averagely fit college-age females. Also, future studies may need to examine the effects of a shorter recovery period vs 30 or 60 seconds on vertical jump performance in male and female athletes.

3719 Board #166 June 3 9:30 AM - 11:00 AM
Effects Of Manual Inter-structural Release For Posterior Shoulder Tightness On The Humeral Head Position

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 (No relationships reported)

PURPOSE: The aims of this study were to determine if inter-structural release for posterior shoulder tightness on the position of the humeral head with respect to the center of the glenoid cavity. **METHODS:** Twenty-four healthy adult males participated in this IRB-approved study. Inclusion criteria were; age between 18 and 50 years old, and Japanese males. Exclusion criteria were; a history of surgery on the glenohumeral joint, and current pain in the glenohumeral joint. The subjects were allocated randomly to (1) stretch (S) group who performed the sleeper and cross body stretch, (2) combined stretch and manual release (R) group who performed the same stretch and received manual release to the posterior deltoid, or (3) control (C) group. An intervention period was set at four weeks. The manual release technique was intended to release loose connective tissue between the structures, e.g. the posterior deltoid and infraspinatus, was performed to achieve complete superior gliding of the posterior deltoid. We expect that normal alignment of the humeral head relative to the glenoid and normal end feel in maximal glenohumeral internal rotation at 90 degrees abduction can be achieved. The main outcome measures included range of motion in flexion, horizontal adduction, internal and external rotation at 90 degrees abduction. Secondary outcome was the alignment of the humeral head relative to the glenoid cavity and the distance between the acromion and humeral head. Statistical analyses included two-way analysis of variance and Bonferroni method as a post hoc test. The level of significance was set at $\alpha=.05$. **RESULTS:** The R group showed significant improvements in flexion by 17.2 ± 9.5 ($P=0.043$) and in total arc by 16.4 ± 9.5 ($P=0.038$). The R group (10.1 ± 7.7) showed significant improvements than the C group (0.1 ± 5.0) in horizontal flexion ($P=0.041$). No significant differences were observed between the S and R groups. **CONCLUSION:** Limitations of this study were small sample size and reproducibility of the manual technique. To conclude, the shoulder range of motion and the humeral head position had no correlations.

3720 Board #167 June 3 9:30 AM - 11:00 AM
The Effect Of Between Innings Cooling Or Compression On Baseball Pitching During Competitive Game

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In baseball, pitching effectiveness is critical for team success. Previous research has identified that short-duration cooling in between simulated innings was effective for maintaining velocity and improved perceptions of recovery. This combination is thought to improve overall pitching effectiveness. **PURPOSE:** A pilot study to assess the effect of short-term, between innings, cryotherapy and/or compression on perceived exertion and recovery of pitchers during a live college baseball game. **METHODS:** NCAA Division II baseball pitchers were studied during Fall season scrimmages. Participants were familiarized with the Rating of Perceived Exertion (RPE) and Perceived Recovery Scale (PRS) prior to game play. Participants dressed in game day attire and warmed up in their usual manner. After each inning, RPE was recorded upon entering the dugout. Between innings, participants received one of two treatments: 1) cryotherapy and compression or 2) compression alone (of the equal weight to the cryotherapy and compression) applied to his shoulder and elbow for four minutes, regardless of the length of time between innings (unless this time was less than four minutes). Each pitcher indicated his PRS before re-entering the game to pitch. Time of each inning pitched from warm up pitch to last pitch, rest time, and total pitches thrown were recorded. RPE was measured following the final inning pitched as well as 3 days later prior to throwing the next bullpen. Repeated measures ANOVA were used to determine if RPE or PRS were significantly different between innings. **RESULTS:** Five players participated. One player was excluded because he did not pitch more than one inning. There were no significant differences between RPE or PRS between treatment conditions. Individual RPE values remained constant or declined in subsequent innings with treatment in four of the five players. PRS improved in subsequent innings during the cold treatment. **CONCLUSIONS:** Sample size was likely too small to detect differences. This pilot study may indicate that with more subjects and/or innings pitched, cold and/or compression could be effective modalities

for improving perceived exertion and recovery during a collegiate game. Further studies need to be conducted during the competitive season to include a greater number of players and innings pitched.

3721 Board #168 June 3 9:30 AM - 11:00 AM
The Effects of a Protein and Carbohydrate Recovery Beverage on Muscle Protein Accretion in Trained Weightlifters

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Human skeletal muscle expresses significant plasticity of phenotype in response to an applied stimulus. Skeletal muscle in response to a resistance training stimulus undergoes a transformative process where cellular signaling pathways lead to increases in contractile proteins that overtime express themselves in muscular hypertrophy. Diametrically opposed to these anabolic signaling pathways are the cellular survival and homeostatic regulatory pathways that are integrated with energy availability and balance. Attempting to shift the balance between the anabolic and catabolic pathways is the basis for adaptation-recovery and can be altered via training and the use of recovery methods including nutritional interventions.

Purpose: To examine the effects of a recovery supplement containing protein and carbohydrate given immediately after each training session on muscle protein accretion in trained weightlifters.

Methods: 10 trained male weightlifters completed a 12-week training protocol implementing block periodization. A double blind placebo protocol was utilized to compare effects between treatment and placebo groups. The treatment group received a protein and carbohydrate recovery beverage and the placebo group received a calorie free beverage. Muscle biopsies were obtained pre and post the 12 week training intervention training and samples were analyzed for the specific muscle proteins (mTOR, AMPK, pmTOR, pAMPK) and gene expression of myosin heavy chains 1, 6 and 7.

Results: Pre and post increases were found for total mTOR ($p=0.044$) for the treatment group but not for pmTOR ($p=0.385$), AMPK ($p=0.159$), and pAMPK ($p=0.430$). No statistical difference was found pre and post for gene expression of myosin heavy chain 1 ($p=0.08$), 6 ($p=0.08$) or 7 ($p=0.37$) for the treatment group.

Conclusion: These findings indicate that a protein supplementation has positive effects on total mTOR accretion and was trending towards a positive effects on myosin heavy chains 1 and 6 in trained weightlifters. This data indicates a potential acute anabolic effect from the consumption of a protein and carbohydrate recovery beverage following training in trained male weightlifters.

3722 Board #169 June 3 9:30 AM - 11:00 AM
Effect Of Recovery Methods On Blood Lactate Clearance After Strenuous Exercise On Brazilian Jiu-jitsu Athletes

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Introduction: Blood lactate (BLa) is a frequently measured parameter during performance testing and is produced by high intensity exercise. High levels are associated with impaired muscle function and reduced exercise performance. Previous studies showed that active recovery (A), performing low intensity aerobic exercise post exercise, is more effective at clearing lactate than rest/passive recovery (P). Whole-body Cryotherapy (WBC) has recently gained popularity for improving recovery after strenuous exercise as an alternative to traditional ice-water therapy. Subjects enter a specially designed cabin in which liquid nitrogen lowers the temperature of the air (-110 to -140°C) for a short period of time, usually 3 min. **Purpose:** Our purpose was to determine which recovery, A, P, or WBC, was most effective at reducing BLa in Brazilian Jiu-Jitsu athletes. **Methods:** Five males (37.8 ± 3.82 yrs) participated in this study. Baseline BLA, heart rate (HR), rate of perceived exertion (RPE) and measures of pain were recorded before, during and after the workout. A 5 min dynamic warm-up preceded the circuit: 8 power clean and press with 95 lbs x 8 reps; 10 pull-ups; box jumps for 30 seconds; renegade row for 30 sec; full squat with 95 lbs x 10 reps; inverted row, 10 reps; medicine ball slam 30 sec; treadmill run 7 mph, 15% incline, 1 min. After the circuit, subjects sat for 5 min to allow BLa to peak, then it was measured using a finger prick and results recorded. Subjects randomly performed one of three recovery methods: 1) P - sit - 15 min; 2) A - 15 min cycling 40% HRmax; or 3) WBC - stood in Cryochamber 3 min. Blood lactate was obtained every five min for 15 min. Data were analyzed using SPSS 19.0. **Results:** Mean values for BLA (mmol/L) at 5 min ($P=16.52\pm 2.10$; $A=13.2\pm 2.29$; $WBC=16.78\pm 2.72$). BLa for A recovery was significantly less than P or WBC ($p=0.003$). At 10 min ($P=16.76\pm 0.68$; $A=11.74\pm 2.72$; $WBC=11.62\pm 1.48$) and 15 min ($P=16.34\pm 4.0$; $A=11.62\pm 1.48$; $WBC=8.98\pm 2.73$) BLa levels were significantly less for A and WBC than P ($p=0.003$). There was no significant difference ($p > 0.05$) between A and WBC recovery

for 10 and 15 min. **Conclusion:** The results of this study indicate that initially, A recovery was the most effective in clearing blood lactate, but WBC was as effective as A at 10 and 15 min, and A and WBC were more effective than P at 10 and 15 min of recovery.

3723 Board #170 June 3 9:30 AM - 11:00 AM
Effects of Acute Foam Rolling on Quadriceps Performance and Short-term Recovery from Fatigue

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 (No relationships reported)

Foam rolling is a common technique among fitness professionals and athletes. However, the effect of this technique on performance and short-term recovery remains unclear. **PURPOSE:** To examine the effects of acute foam rolling on quadriceps performance and short-term recovery from exercise-induced fatigue. **METHODS:** 10 recreationally active, right leg dominant, male university students (height: 173 ± 0.70cm, mass: 70.81 ± 1.33kg, age: 23.9 ± 0.28yrs) participated in a randomized, counterbalanced, crossover study that was held over three weeks. Maximal Voluntary Contraction (MVC) pre-test, fatigue-inducing protocol and MVC post-tests were conducted. Foam rolling (FR) and Control (CON) intervention took place before each MVC test. In FR, the hamstrings, iliotibial band, and quadriceps muscles were rolled for 1 minute per set, twice, with a 30 second rest between sets and muscle groups. **RESULTS:** No significant differences were found between FR and CON for concentric (FR: 219.250 ± 11.18, CON: 220.90 ± 11.18, p=0.918) and eccentric (FR: 238.40 ± 16.61, CON: 254.00 ± 16.61, p=0.515) MVC, as well as between pre and post-MVC for concentric (Pre: 221.70 ± 8.34, Post: 218.45 ± 7.75, p=0.307) and eccentric (Pre: 249.05 ± 12.00, CON: 243.35 ± 12.20, p=0.337). No significant interaction was found between conditions and time for MVC performances (concentric: p=0.987; eccentric: p=0.646). Post-test MVC decreased by 1.49% (concentric) and 3.46% (eccentric) in FR, and 1.43% (concentric) and 1.17% (eccentric) in CON. No significant differences were found between FR and CON for muscle soreness (MS), fatigue, and rate of perceived exertion (RPE) during MVC pre-test (MS: FR: 17.3 ± 11.53, CON: 22.8 ± 14.41, p=0.358; Fatigue: FR: 2.8 ± 1.55, CON: 2.6 ± 1.07, p=0.741; RPE: FR: 3.0 ± 1.41, CON: 3.2 ± 1.62, p=0.772), after fatigue protocol (MS: FR: 75.3 ± 23.51, CON: 78.7 ± 21.55, p=0.945; Fatigue: FR: 8.3 ± 1.70, CON: 7.7 ± 1.89, p=0.501; RPE: FR: 8.3 ± 1.70, CON: 8.1 ± 1.85, p=0.801), and during MVC post-test (MS: FR: 38.3 ± 21.77, CON: 36.2 ± 18.08, p=0.817; Fatigue: FR: 4.4 ± 1.35, CON: 4.2 ± 1.55, p=0.762; RPE: FR: 4.9 ± 0.88, CON: 4.7 ± 1.34, p=0.853). **CONCLUSION:** Results indicated that acute foam rolling do not significantly affect isokinetic MVC performance or improve short-term recovery of fatigue-induced quadriceps.

3724 Board #171 June 3 9:30 AM - 11:00 AM
The Effectiveness of Compression Socks on Recovery from Maximal Aerobic Exercise

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PURPOSE: The purpose of the present investigation was to determine the effect of compression socks on recovery from maximal aerobic running for college aged subjects.

METHODS: Moderately fit college aged student subjects (N=16) were recruited to participate in the present study. Specific anthropometric measurements were first recorded, including appropriate fitting for compression socks. Subjects completed two sets of maximal graded treadmill exercise tests to exhaustion using the McConnell Treadmill Protocol including a control phase and a compression phase. During the control phase, two treadmill maximal tests were conducted with 24 hours of recovery separating them. During the compression phase, subjects completed two treadmill maximal tests, wearing compression socks during their 24 hours of recovery. At least 7 days separated the compression and control phases, and a cross over design was utilized. During each treadmill test, heart rate, RPE, and Vo₂ were recorded at baseline and every three minutes. Blood lactate values were measured before and after each exercise session.

RESULTS: Blood lactate levels measured 24 hours following a maximal exercise bout were significantly lower (p < .05) when compression socks were worn for the 24 hours when compared to a control phase (2.31 mmol/L; 3.59 mmol/L, respectively). Blood lactate levels 20 minutes following the maximal exercise bout were not significantly different (p > .05) when wearing the compression socks compared to the control phase (5.51 mmol/L; 5.77 mmol/L, respectively).

CONCLUSIONS: Pre-exercise lactate levels were significantly lower while wearing compression socks, which indicated an improvement in short-term (24 hour) aerobic exercise recovery. Compression socks have a positive effect on short term recovery from maximal aerobic exercise for moderately fit college aged individuals.

3725 Board #172 June 3 9:30 AM - 11:00 AM
Pilot Study: The Influence Of Menthol On Recovery From Exercise-induced Muscle Damage.

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PURPOSE: Menthol is a cold receptor agonist found in various products claiming to relieve muscle soreness, but menthol's influence on recovery from exercise-induced muscle damage requires clarification. The purpose of this study was to compare serial measures of muscle soreness and performance following exercise-induced muscle damage between a Menthol (M), Placebo (P) and Control (CON) condition. It was hypothesized dependent variables would not differ between conditions (null hypothesis).

METHODS: 38 males with a mean (SD) age, weight and height of 24.0 (4.0) yrs, 79.5 (16.1) kg and 1.74 (0.12) m were randomized to M (n=11), P (n=8), and CON (n=19). Participants were familiarized with a testing battery (TB) including: perception of lower body muscle soreness; 0-10 pain response to 30N of pressure applied to right quadriceps/hamstrings/calf; hip flexion/abduction range of motion; vertical jump; Agility T-test. Muscle damage was induced on Monday using 40x15m sprints with a 5m deceleration zone. Participants in M applied Biofreeze™ (4% menthol gel) twice daily to the lower body, whilst P applied a gel that smelled like Biofreeze™ but contained no menthol. CON did not undergo any intervention. Participants completed TB daily from Monday to Friday. Dependent variables were calculated as they changed from baseline and the area under the curve was then calculated by summing Monday to Friday scores. The area under the curve values were then compared by condition using the Kruskal Wallis test (alpha level = 0.05).

RESULTS: A significant difference in agility time (s) was observed by condition (p=0.0044) and Dunn's post-hoc test indicated that menthol caused less decrement in agility performance following exercise-induced muscle damage compared to both CON and P (p<0.05). No other significant differences were observed between conditions.

CONCLUSIONS: Menthol application may help to preserve agility performance after exercise-induced muscle damage, however the mechanism of action is not clear. Further data collection is required to strengthen Monday to Friday comparisons and observe the time-course of recovery by condition. *Performance Health (Hygienic Corporation, Akron, Ohio) supported this project with donations of Biofreeze and Placebo gel.*

3726 Board #173 June 3 9:30 AM - 11:00 AM
Comparison Of Recovery Measures Following Cardiorespiratory Fitness Testing In Young Children

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 (No relationships reported)

Post exercise heart rate recovery measures have been used as a predictor of fitness and mortality in adult populations. Less is known about the predictive value of oxygen consumption and heart recovery responses to clinical and field cardiorespiratory fitness testing in young children. **PURPOSE:** To compare oxygen uptake (VO₂; ml·kg⁻¹·min⁻¹) and heart rate (HR; beats·min⁻¹) recovery responses (mean ± SD) from the FitnessGram Progressive Aerobic Cardiovascular Endurance Run (PACER) test to recovery measures from a progressive maximal graded exercise test (GXT; treadmill) in 17 (9 boys) young (10-11 yr old) children. **METHODS:** Subjects completed the PACER and GXT in a randomized order 1 week apart while wearing a HR monitor and portable oxygen analyzer. VO₂ and HR recovery measures were determined at 1, 3 and 5 mins post completion of the PACER and GXT. **RESULTS:** There were no significant mean VO₂ measures between the PACER and GXT VO₂ at 1 min (14.5 ± 3.1 vs 16.1 ± 3.6), 3 min (8.0 ± 1.4 vs 7.9 ± 1.3), or 5 min (7.3 ± 1.4 vs 7.2 ± 1.6) of recovery. The GXT recovery HR (149.0 ± 31.0) recovery was significantly (p < 0.05) greater at 1 minute than the PACER recovery HR (136.0 ± 17.0), however there was no significance between the GXT and PACER HR at 3 min (115.2 ± 9.1 vs 110.8 ± 11.7) or at 5 min (108.5 ± 7.7 vs 107.1 ± 10.0) of recovery. **CONCLUSIONS:** The PACER resulted in similar absolute cardiorespiratory recovery responses in young children when compared with a criterion fitness test.

Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment

3727 Board #174 June 3 9:30 AM - 11:00 AM
Chronic Effects of Cupping Therapy on Balance, Flexibility and Muscular Power
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(No relationships reported)

Cupping is an alternative therapy used by athletes to purportedly improve performance or enhance recovery. Bell shaped cups are placed on the skin (above a targeted muscle) and air is withdrawn to create a vacuum against the skin surface. Blood flow is expected to improve under the cup area during the application and impact somatosensory integrity and performance. **PURPOSE:** To determine the effect of chronic Cupping Therapy (CUP) on unilateral hip flexibility, balance, and muscular power, 12 subjects (age 21.4± 1.2, ht. 167.6 ± 8.4 cm, and body mass 71.6 ± 18.2 kg, 7♀) participated. **METHODS:** Familiarization trials ensured reliability. Testing was conducted within 15 minutes after CUP for four consecutive days (1-4) with CUP randomly assigned to either leg on day one. Single foot balance was obtained with a sway index (SI) on the Biodex Balance System with unilateral trials for 20 seconds and 10 sec recovery repeated twice. Each test consisted of two measures of unilateral passive hip range of motion (degrees) obtained by goniometer with the subject in the prone (hip extension [HE]) and supine (straight leg raise test of hamstring [HF]) positions. Unilateral hamstring/quadriceps muscle power (MP) testing was conducted with a Biodex Isokinetic dynamometer (Watts = W) including five repetitions @ 60°/sec warm-up and 10 maximal repetitions at 120°/sec for the trial. CUP required the application of 6 plastic cups applied at -14 PSI bilaterally for 10 minutes at 30 mm lateral of the vertical midline of the posterior thigh above the hamstring muscle group. **RESULTS:** Statistical analysis by ANOVA (p<.05) with repeated measures revealed no significant difference among matched variables including: SI: .89, .99, .74, & .86 and 1.07, .78, .84 & 1.01; HE(degrees): 13.4, 14.3, 13.6, & 13.3, and 12.7, 14, 13.8 & 13.6; HF(degrees): 66.6, 62, 61, & 62.4 and 65.1, 62, 61, & 62; MP(W): 94, 53.4, 68.7, & 61.2 and 82.1, 40, 66.3, & 65.9 for CUP and No CUP treatments on days 1, 2, 3, and 4, respectively. **CONCLUSION:** The application of cupping therapy on four consecutive days with six treatment cups applied for ten minutes at a modest negative pressure provided no alteration in balance, flexibility or muscular power compared to no treatment over four days. The efficacy of cupping for enhancement of performance related measures is not supported by this study.

3728 Board #175 June 3 9:30 AM - 11:00 AM
The Effects of Acute Cupping Therapy on Balance, Flexibility and Muscular Power
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In the recent Rio Olympics, spectators witnessed round circles across the upper back of swimmer Michael Phelps and others. These circles were as the result of cupping therapy (CUP) received prior to competitive performances and drew widespread publicity, despite little scientific evidence to support the practice. **PURPOSE:** To evaluate the impact of acute CUP on muscular power, balance and flexibility, 12 subjects (age 21.4± 1.2, ht. 167.6 ± 8.4 cm, and body mass 71.6 ± 18.2 kg, 7♀) volunteered. **METHODS:** Familiarization trials preceded CUP by 48 hrs and included all of the following tests: single foot balance with a sway index (SI) on the Biodex Balance System with unilateral trials for 20 seconds and 10 sec recovery repeated twice. Flexibility included two measures of unilateral passive hip range of motion by goniometer with the subject in the prone (hip extension [HE]) and supine (straight leg raise test of hamstring [HF]) positions. Hamstring/quadriceps unilateral muscle power (MP) testing was conducted with a Biodex Isokinetic dynamometer (Watts = W) including five repetitions @ 60°/sec warm-up and 10 maximal repetitions at 120°/sec for the trial. Assessments were conducted within 15 minutes of CUP (PreC), as well as within 15 minutes post (Post15) and 60 minutes post (Post 60) CUP. CUP required the application of 6 plastic cups applied at -14 PSI bilaterally for 10 minutes at 30 mm lateral of the vertical midline of the posterior thigh above the hamstring muscle group. **RESULTS:** Statistical analysis by ANOVA (p<.05) with repeated measures revealed no significant differences among matched variables including: MP(W): 64, 62, & 59.4, and 63.8, 58.7, & 56.3; HED(degrees): 13.3, 13.4 & 13.8, and 12.3, 13.2, & 12; HF(degrees): 67.4, 65.8, & 63.8, and 66.5, 63.8, & 64.3 and SI: .94, .83, & .95 and 1.17, .96, & .76, for CUP and No CUP treatments, respectively. **CONCLUSION:** A single application of CUP did not yield changes in muscular power, flexibility or balance when assessed within 60 minutes of the treatment. These data fail to support the practice of cupping for improved strength, flexibility or balance.

3729 Board #176 June 3 9:30 AM - 11:00 AM
The Effect Of Foam Rolling On Exercise induced Muscle Fatigue
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PURPOSE: To evaluate the effectiveness of foam rolling (FR) on the rehabilitation of exercise-induced muscle fatigue (EIMF). **Methods:** Forty-two male college students (age: 24.5±2.5 yrs) were randomly divided into two groups: a control group (n=21) and a FR group (n=21) group. All subjects performed a bout of bottom-up squats for obtaining EIMF. All subjects were measured for peak torque (PT), peak torque/body weight (PT/BW), average peak torque (APT) and total work (TW) by using an isokinetic test system before, and 0.5h, 24h, and 48h after the squats. The only difference between two groups was that the FR group performed a 6-min FR exercise protocol before each post-EIMF protocol measurement (at 0.5h, 24h, and 48h). The data was analyzed by one-way ANOVAs with LSD post-hoc tests, and independent t-tests. **Results:** See below table for all results. At 0.5h after the EIMF protocol, PT, PT/BW, APT and TW significantly decreased in FR group and control group (all p<0.05), and there were no significant group differences in these variables. At 24h after the EIMF protocol, T, PT/BW, APT and TW tended to be higher in the FR group than in the control group, although there were no significant group differences. At 48h after the EIMF protocol, PT, PT/BW, APT and TW were significantly higher in the FR group than in the control group (all p<0.05), and nearly reached the pre-EIMF protocol values. **Conclusion:** Foam rolling resulted in a faster recovery in muscle strength and muscle work following a bout of bottom-up squats. The potential mechanism needs to be further investigated.

The Change of PT, PT/BW, And APT TW Between Control Group And FR Group

Variables	Before	0.5h After	24h After	48h After
Control PT (Nm)	207.38±43.36	156.52±42.80*	155.85±46.37 *	157.66±47.44 *
FR PT (Nm)	214.16±20.35	159.83±29.70*	166.16±36.19 *	192.78±41.95#
Control PT/BW (Nm/kg)	2.96± 0.4	2.30± 0.48*	2.27± 0.50 *	2.30± 0.59*
FR PT/BW (Nm/kg)	3.14± 0.58	2.39± 0.43*	2.46± 0.52 *	2.72± 0.54#
Control Average PT (Nm)	207.38±43.36	148.1±46.58*	153.97±47.50*	155.15±48.00 *
FR Average PT (Nm)	214.16±42.00	165.56±32.23*	172.36±40.62*	193.28±38.67#
Control Total Work (J)	1271.93±256.64	952.41±274.03*	945.56±251.82*	968.84±283.00*
FR Total Work (J)	1283.64±240.76	967.45±170.57*	1060.57±261.46*	1163.50±261.39#

N=21 for Control and N=21 for FR. *p<0.05, compared to Before. #p<0.05 compared to Control.

3730 Board #177 June 3 9:30 AM - 11:00 AM
Stretching Techniques and Their Effects on Sprint Speed for Wheelchair Athletes
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(No relationships reported)

Flexibility is an important health- and motor-fitness variable as it improves and maintains range of motion, reduces joint stiffness, reduces soreness, reduces the risk of injury, and improves mobility (Peck, 2014). Recent research has examined the effects of varied stretching modes on athletic performance in able-bodied populations but fewer empirical studies have been conducted on athletic performance in disability populations. **Purpose:** The purpose of this research project was to examine the effect of stretching mode on sprint speed among competitive wheelchair athletes. **Method:** Wheelchair rugby players with tetraplegia (N = 32.4±9.8 yrs, 76.78±13.8 kg, 161.2±17.2 cm, 13.1±9.5 yrs post injury) were randomly assigned to one of three different stretching techniques [proprioceptive neuromuscular facilitation stretching (PNF), static stretching, (SS) or dynamic stretching (DS)] on three testing dates. Timing gates (Brower TC Motion Start, Knoxville, TN) were used to assess sprint speed before warm-up, after warm-up (which included the assigned stretching mode, and after 75 minutes of rugby play. The best of the two sprint times was used to compare pre- and post- warm-up speeds as well as pre- and post-practice speeds. **Results:** Sprint speed improved from pre- to post-warm-up across each stretch condition. PNF yielded the greatest improvement (-0.10±0.22 s). As expected, sprint scores declined from pre- to post-practice with DS yielding the least change (0.02±0.19 s). **Conclusion** Regardless of stretch mode, short term performance can be improved

by PNF, SS, or DS stretching modes. Flexibility training may also help to offset fatigue in athletes during regular practice sessions. With the concern that increased fatigue could interrupt proper mechanics, these findings are applicable to both performance training and injury prevention.

3731 Board #178 June 3 9:30 AM - 11:00 AM
Effect Of Branched-chain Amino Acids, β -hydroxy- β -methylbutyrate, And Glutamine On Recovery From Resistance Exercise
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 (No relationships reported)

Adequate training recovery is essential for optimization of muscle performance, injury prevention, and avoiding overtraining. Consequently, athletes may benefit from interventions that accelerate recovery processes. **PURPOSE:** To evaluate the effects of concurrent supplementation with branched-chain amino acids (BCAA), β -hydroxy- β -methylbutyrate (HMB), and glutamine on recovery from weightlifting. **METHODS:** Fourteen trained participants (mean \pm SD: age = 21 \pm 2 y) completed two protocols (treatment and placebo), each consisting of two resistance bouts separated by 24 h rest. Sessions consisted of three sets to failure at an 8 - 12 repetition maximum load for six exercises. Muscle pain and ratings of perceived exertion (RPE) were assessed after each set using a 100-mm visual analog scale (VAS). Residual pain and ratings of perceived recovery (RPR) were assessed 24 h after initial workouts. Treatment included one 6-g BCAA plus glutamine (BCAA + G) supplement (Leucine, 2.5 g; Valine, 1.5 g; Isoleucine, 1 g; Glutamine, 1 g) and one 1-g dose of HMB respectively consumed 1 h or 30 min before exercise, and another BCAA + G immediately after exercise. An additional HMB supplement was ingested after 2 h and 6 h of recovery. Sugar pills replaced supplements as a placebo, and the order was randomized, counter-balanced, and double-blind. **RESULTS:** Treatment enhanced second-day performance for the leg extension (11 \pm 1 vs. 10 \pm 3; $p = .03$), latissimus pull-down (11 \pm 2 vs. 10 \pm 1; $p = .02$), and total repetitions (62 \pm 5 vs. 59 \pm 7; $p = .03$). Reduced residual pain (29 \pm 19 vs. 40 \pm 23; $p = .01$) and pain during the leg press (37 \pm 14 vs. 45 \pm 21; $p = .04$) and shoulder press (39 \pm 17 vs. 47 \pm 24; $p = .04$) were observed with treatment. RPE on the second day was reduced under the treatment for the leg press (55 \pm 20 vs. 62 \pm 16; $p = .02$) and leg extension (53 \pm 20 vs. 61 \pm 19; $p = .03$) exercises. RPR were similar between conditions ($p > .05$). **CONCLUSIONS:** Combined ingestion of BCAA, HMB, and glutamine may enhance muscle recovery 24 h after an exhaustive resistance bout. Reduced muscle pain and RPE under the treatment may have attributed to enhanced performance during subsequent workouts. Additional research is necessary to understand the effects of chronic supplementation and the mechanisms associated with individual supplements.

3732 Board #179 June 3 9:30 AM - 11:00 AM
Influence of Interval vs Continuous Exercise on Markers of Metabolic Rate During Exercise and Recovery
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 (No relationships reported)

Studies have shown that improvements in body composition after interval training are equivalent or superior to those resulting from continuous, moderate-intensity exercise training, although time and energy expenditure associated with interval training is lower. **PURPOSE:** To compare exercise and 3-hour recovery VO_2 , energy expenditure (EE), core temperature, and heart rate (HR), associated with 40 minutes of continuous, moderate-intensity exercise (50-60% of heart rate reserve [HRR]) (CON) with those associated with three models of interval training: 4 (I-4), 7 (I-7), and 10 (I-10), one-minute bouts of exercise at ~90% of maximal heart rate alternated with 1-minute recovery bouts at ~50-60% of HRR. **METHODS:** Nine healthy adults (5 females, 4 males, 23.8 \pm 2.8 years, 75.0 \pm 9.9 kg) underwent a submaximal exercise test to determine estimated VO_2 max. Exercise sessions were then completed in random sequence at least one week apart. **RESULTS:** Exercise VO_2 was 66.0 \pm 12.2 L for CON, 17.0 \pm 2.9 L for I-4, 30.4 \pm 6.9 L for I-7, and 44.3 \pm 10.4 L for I-10. EE for each exercise session was 323.5 \pm 60.1 kcal for CON, 84.2 \pm 19.5 kcal for I-4, 151.0 \pm 33.7 kcal for I-7, and 219.5 \pm 51.4 kcal for I-10. Average exercise HR was 133.8 \pm 4.1 for CON, 142.2 \pm 8.2 for I-4, 152.4 \pm 5.8 for I-7, and 152.4 \pm 5.7 for I-10. Recovery HR in first hour after exercise was higher after I-10 (82.3 \pm 6.4 beats/min) than after CON (75.4 \pm 8.4 beats \cdot min⁻¹) and I-4 (76.8 \pm 7.3 beats \cdot min⁻¹). Recovery HR in 2nd hour after exercise was higher after I-10 (70.8 \pm 8.1 beats \cdot min⁻¹) than after CON (66.7 \pm 6.7 beats \cdot min⁻¹) or I-4 (67.7 \pm 6.9 beats \cdot min⁻¹). Rate of EE was lower in 2nd hour after exercise for CON (1.04 \pm 0.15 kcal \cdot min⁻¹) than after I-10 (1.10 \pm 0.15 kcal \cdot min⁻¹) or I-4 (1.11 \pm 0.18 kcal \cdot min⁻¹). **CONCLUSIONS:** Though exercise VO_2 and EE associated with CON were significantly higher than those associated with any of the interval training sessions,

several markers of metabolic rate (HR, EE) were higher during recovery after I-10 than after CON. Differences in the recovery periods after interval training vs CON may partially explain reports that interval training results in similar or greater improvements in body composition when compared with continuous exercise, even with significantly lower exercise energy expenditure.

3733 Board #180 June 3 9:30 AM - 11:00 AM
The Effects of Various Methods of Self Myofascial Release on Muscular Power
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 (No relationships reported)

Myofascial release (MR) is purported to reduce friction between muscle and fascia, thus relaxing a muscle, improving local circulation, and stimulating the stretch reflex. Various forms of MR, including Self Myofascial Release (SMR) have evolved in an effort to improve function and performance. **PURPOSE:** The purpose of this study was to evaluate the effect of three different forms of SMR on muscular power. **METHODS:** 15 physically active adults (age: 27 \pm 4.4 yr., ht: 176.6 \pm 9.1 cm, body mass: 83.1 \pm 13.1 kg, 13 ♂) participated in a familiarization trial following informed consent. Familiarization consisted of proper methods of using 3 different modalities of SMR; foam rollers (FR), Myoballs (MB), and Tiger Tails (TT). Subjects performed the proper mechanics and execution of four tests of muscular power (MP): vertical jump (VJ), broad jump (Broad), right and left leg lateral bounds (LBR/LBL), and an 18.3 meter sprint (S). Subjects participated in four randomly assigned, crossover trials that were preceded by one minute of SMR with TT, MB, or FR on the quadriceps, IT Bands, gluteals, hamstrings, and calves. A control (C) trial was conducted with no SMR prior to the MP testing. Trials were separated by at least 48 hrs. Sprint time was recorded with concurrent, independent timing devices. For each MP test, 3 attempts were provided with the best score recorded for the trial. A recovery period of 15 seconds was given between each attempt, and 2 minutes were allowed between each test. One way ANOVA ($p < .05$) was applied to the data. **RESULTS:** VJ(cm): 51.8 \pm 8.3, 54.8 \pm 8.8, 55.3 \pm 8.6, and 54.3 \pm 10.4; Broad(cm): 215.9 \pm 29.9, 218.4 \pm 28.7, 221.7 \pm 28.9, and 218.9 \pm 28.4; LBR(cm): 176.5 \pm 21, 176.7 \pm 18, 178.3 \pm 18.7, and 176.5 \pm 17.2; LBL(cm): 173.4 \pm 12.1, 175.7 \pm 13.2, 177.2 \pm 14.4, and 177.2 \pm 16.5, and S(sec): 2.8 \pm .17, 2.8 \pm .12, 2.8 \pm .16, and 2.8 \pm .14 for C, FR, MB, and TT trials, respectively. Statistical analysis revealed no significant difference in MP among modalities. **CONCLUSION:** Although SMR did not improve measures of muscular power performance, it was not deleterious and may be considered a viable pre-activity preparation. Any potential benefits associated with SMR are subjective in nature and may be related to the relief of tension and DOMS.

3734 Board #181 June 3 9:30 AM - 11:00 AM
Cold Water Immersions For Recovery In Young Female Handball Players
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Cold water immersion (CWI) is a recovery method used frequently in sport. Multiple studies indicate a potential role for CWI after training and competition in various sports. However, a critical review of the medical literature reveals a paucity of studies regarding use of CWI specifically in team handball. As a high intensity sport, handball is characterized by significant eccentric loading of the lower extremity musculature and therefore requires effective post-competitive recover strategies. **PURPOSE:** To compare the effect of two CWI protocols on markers of recovery in female handball players. **METHOD:** Twelve female handball players (Age: 14 \pm 0.7 years, body mass: 58.44 \pm 7.8 kg, Height: 161 \pm 7.1 cm, fat %: 21.5 \pm 3) were involved in a "cross-over" experimental design. After three game training sessions (Avg Heart Rate 183 \pm 9, 180 \pm 8 and 180 \pm 8 bpm respectively), participants were enrolled into either a CnCWI protocol (n=12), (12 min water temperature 14 \pm 0.5°C), InCWI protocol (n=11), (4x 2 min water temperature 14 \pm 0.5°C+1min out of water) or a control group (CG) with passive recovery (n=9) (sit in the room). Counter-movement Jump test (CMJ), Visual Analog Scale (VAS-Pain) and thigh volume were measured pre- and post-training, post-immersion, as well as 24 hours and 48 hours after training + recovery protocol. **RESULTS:** Statistically significant differences were found in DOMS ($F(4,116) = 6.84$, $P < 0.001$, $\omega^2: 0.32$) in post-immersion CnCWI vs. CG (5.08 \pm 0.8 vs. 6.6 \pm 0.86, $P < 0.001$) and InCWI vs. CG (5 \pm 0.76 vs. 6.66 \pm 0.86, $P < 0.001$). In the post 24h CnCWI vs. CG (5.08 \pm 0.81 vs. 7.22 \pm 0.97, $P < 0.001$) and InCWI vs. CG (4.72 \pm 0.81 vs. 7.22 \pm 0.97, $P < 0.001$). In post 48h CnCWI vs. CG (3.83 \pm 0.7 vs. 7.22 \pm 0.83, $P <$

0.001) and InCWI vs. CG (3.90 ± 0.92 vs. 7.22 ± 0.83 , $P < 0.001$). With regards to the percentage of change in CMJ and thigh volume, no statistically significant changes were seen in any of the times of measurement. **CONCLUSION:** Both CWI protocols appear effective in reducing delayed onset muscle soreness at all times post-training in female handball players. CWI should be included after training sessions to enhance players' recovery for the next training day. CWI protocol could be used according to individual preferences as both protocols used in this study demonstrated similar effects on psychological indicators of recovery, such as pain.

3735 Board #182 June 3 9:30 AM - 11:00 AM

Effects Of A Short Intervention Of AIS And PNF On College Students' Shoulder Flexibility

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Both Proprioceptive Neuromuscular Facilitation (PNF) and Active Isolated Stretching (AIS) are widely used stretching techniques, but their difference in improving shoulder flexibility has not been evaluated.
PURPOSE: To compare the effects of a 2-wk AIS and PNF intervention on the flexibility of shoulder joints.
METHODS: Twenty male college physical education students (21.46 ± 1.18 yr., height: 172.91 ± 4.48 cm, mass: 74.37 ± 6.34 kg) without shoulder injury volunteered for the study. They were randomly divided into two intervention groups, one AIS and the other PNF intervention, with both met 5 times a week, 15 minutes each, for two weeks. Joint mobility (flexion and stretch) was measured by F-JDC type joint measurement scale before and after the intervention. Paired *t*-test and effect size (ES, Cohen's *d*) were calculated to determine the difference between AIS and PNF.
RESULTS: There was no statistical significant difference between the groups before the intervention. There were significant improvements in both groups ($P < 0.01$), but greater improvement was found in the post-intervention AIS group (flexion: 4.1 ± 0.86 ; stretch: 1.96 ± 0.003 ; $P < 0.001$).

Table: The change of shoulder flexibility before and after AIS and PNF

		Before	After	Difference	ES	P-value
AIS	flexion	$157.42 \pm 2.83^\circ$	$164.51 \pm 2.24^\circ$	$9.77 \pm 1.96^\circ$	2.78	<0.001
	Stretch	$34.37 \pm 1.44^\circ$	$37.91 \pm 0.92^\circ$	$5.72 \pm 0.56^\circ$	2.93	<0.001
PNF	flexion	$156.28 \pm 2.49^\circ$	$159.85 \pm 2.24^\circ$	$5.67 \pm 2.36^\circ$	1.51	0.003
	Stretch	$34.17 \pm 0.73^\circ$	$36.22 \pm 0.77^\circ$	$3.78 \pm 0.56^\circ$	2.73	<0.001

CONCLUSIONS: Both of the methods can improve the flexibility of the shoulder joints, but AIS shows more effective.
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Study was supported by Independent scientific research plan of Ministry of Education (20121088023)

3736 Board #183 June 3 9:30 AM - 11:00 AM

The Influence of Post-Exercise Cryotherapy on Circulating Testosterone

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Cryotherapy is commonly used to improve muscle recovery from exercised induced damage. Recent studies have shown that use of post exercise cryotherapy can blunt adaptations in muscle hypertrophy and strength but the mechanism as to why is unclear. **PURPOSE:** To examine the effects of post-exercise cold water immersion (CWI) on free circulating testosterone (T). **METHODS:** Ten well-trained men [one repetition maximum (1RM) to body mass ratio: 1.65 ± 0.15], completed two resistance training sessions (6 sets of 10 repetitions at 80% of their 1RM for a smith machine squat) separated by 72 hrs. After each session subjects were given one of two recovery interventions prescribed in a randomized and counterbalanced order. These interventions were 1) 60 min of seated passive recovery (CON) or 2) 15 min of lower body cold water immersion (15°C) followed by 45 min of seated passive recovery (CWI). Venous blood samples were taken pre (PR) and immediately post (IP) and at 15, 30, and 60 min post exercise and an ELISA was used to measure T. Hormone levels were compared between interventions across all time points using a mixed model MANOVA with Bonferroni post hoc test ($p < 0.05$). **RESULTS:** No significant differences in T were found between the CWI or CON at any time point: PR (15.24 ± 7.64 ; 14.25 ± 8.95 ; $p = 0.374$), IP (CWI = 20.45 ± 13.11 ; CON = 22.75 ± 22.22 ; $p = 0.514$), 15 min (CWI = 18.03 ± 9.33 ; CON = 20.21 ± 18.20 ; $p = 0.556$), 30 min

(CWI = 17.10 ± 11.75 ; CON = 16.42 ± 11.34 ; $p = 0.662$) and 60 min (CWI = 13.70 ± 7.82 ; CON = 16.55 ± 15.16 ; $p = 0.321$). Additionally, no significant differences were found between recovery interventions in T area under the curve (CWI = 1014; CON = 1091 $p = 0.588$). **CONCLUSIONS:** Post exercise T showed no significant differences after CWI, suggesting that diminished T response from CWI is not responsible for the mitigation of hypertrophy observed from chronic use of cryotherapy previously observed. Rather, changes in inflammatory markers or immune response post CWI may be the cause of this reduced hypertrophic responses. Future research exploring the relationship between cryotherapy and testosterone may benefit from investigating colder water temperatures or other forms of cryotherapy.

3737 Board #184 June 3 9:30 AM - 11:00 AM

Pneumatic Compression Device Speeds Recovery from DOMS in Comparison to Compression Sleeve

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Delayed onset muscle soreness (DOMS) is known to decrease range of motion (ROM), increase muscle swelling, and increase perception of pain in the affected muscle. Wearing compression garments during recovery from DOMS has been demonstrated to reduce both the recovery time and the peak disturbance in these variables when compared to no treatment. **PURPOSE:** To determine the effects of a pneumatic compression device (PCD) compared to a compression sleeve (CS) during a 5-day recovery period from DOMS of the elbow flexors. **METHODS:** Eight college-aged students participated in this crossover design study. Upper and lower arm circumference were measured to determine muscle swelling; pain during elbow flexion and elbow extension was measured using a 0 - 100mm visual analog scale to determine muscle soreness; flexion and extension ROM were measured to determine joint mobility. The muscle-damage protocol consisted of 4 sets of 25 repetitions of isokinetic concentric elbow flexion followed by eccentric elbow extension. Immediately following the muscle-damage protocol, subjects either wore a CS continually for five days or completed daily, 20-minute PCD treatments for 5 days. Swelling, ROM, and pain were measured pre- and post-exercise, and daily during the 5-day recovery period. Subjects rested for 7 days before completing another muscle-damage protocol and the remaining treatment. Repeated measures ANOVA was used to determine differences between treatments. **RESULTS:** PCD significantly reduced increases in upper arm circumference (1.7 vs. 2.0 cm), flexion pain (24.4 vs. 34.3mm), extension pain (30.8 vs. 41.4mm), and minimized reductions in flexion ROM (15.9 vs. 25 degrees) and extension ROM (2.5 vs. 4.1 degrees). There were no differences in lower arm circumference. Non-significant interaction effects between time and treatment suggest that the time course of DOMS recovery was similar between trials. However, because the PCD disturbances from baseline were lower, measurements returned to baseline earlier in the PCD trial. **CONCLUSIONS:** These findings suggest that daily treatments using a PCD further reduce peak disturbance and recovery time from DOMS of the elbow flexors when compared to a continuously-worn CS.

3738 Board #185 June 3 9:30 AM - 11:00 AM

Effects of Compression Socks on Muscle Recovery in Competitive Masters Endurance Athletes

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Purpose: Compression socks are a popular recovery modality in endurance sports. We investigated the efficacy of compression (COM) vs placebo (PLA) socks on perception of muscle fatigue/soreness and functional recovery in Masters athletes. **Methods:** Four competitive male triathletes participated (age: 49 ± 8 yr; height: 176 ± 14 cm; mass: 83.0 ± 13.3 kg; body fat: $23 \pm 7\%$; ≥ 18 mo run training, ~ 2.3 h/day, ~ 5.5 day/wk). During Visit 1, participants underwent calf circumferences (CIR) and dorsiflexion range of motion (ROM) measures, completed fatigue/soreness surveys, and performed a timed 1-mile run. Then, participants completed a fatiguing protocol (6 sets, weighted calf raises to failure) and were randomly assigned to wear either COM or PLA socks for 48-h. Visit 2 (48-h post) consisted of CIR/ROM measures, surveys, and 1-mile run. Participants were assigned the sock type not previously given and completed the same protocols during Visits 3-4. T-tests determined differences 48-h after fatigue with COM and PLA socks ($p \leq 0.05$). **Results:** Perception of muscle fatigue and soreness [scores: 1 (least)-10 (most); taken pre-, 24-h, and 48-h post] tended to increase 24-h [vs pre (fatigue: PLA: $+1.00$; COM: $+1.75$ points)(soreness: PLA: $+1.00$; COM: $+2.25$ points)] and 48-h [vs pre (fatigue: PLA: $+2.50$; COM: $+2.75$ points)(soreness: PLA: $+2.75$; COM: $+2.75$ points)] after the fatiguing protocol, but no significant differences existed between sock types ($p > 0.05$). Compared to pre-fatigue, calf CIR was similar (48-h post) with both socks

($p > 0.05$). Dorsiflexion ROM tended to decrease 48-h post-fatigue using both socks, but was not statistically significant [right (PLA: $p = 0.22$; COM: $p = 0.24$); left (PLA: $p = 0.06$; COM: $p = 0.19$)]. Additionally, 1-mile run time was not affected by COM (pre: 8.5 ± 1.9 min; 48-h: 8.5 ± 2.0 min; $p = 0.24$) or PLA socks (pre: 8.7 ± 2.0 min; 48-h: 8.3 ± 1.7 min; $p = 0.07$).

Conclusion: COM had no significant effects on objective and subjective measures of recovery after a fatiguing exercise. Interestingly, 50% participants reported "feeling like" COM helped them recover (vs. PLA). Large interindividual differences in perception of soreness existed among participants, highlighting the importance of collecting more data on Masters athletes to make conclusive recommendations on the use of these popular recovery modalities.

3739 Board #186 June 3 9:30 AM - 11:00 AM
Acute Effects of Two Different Foam Rollers on Range of Motion

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Self-myofascial release via foam rolling does not yield significant acute effects on muscular performance, but it can yield benefits to range of motion (ROM) similar to static stretching, without the negative effects to muscular performance. Additionally, exercising through larger ROM during resistance training will produce superior chronic benefits. **PURPOSE:** Therefore, the aim of this study was to determine if differences existed between the acute effects two different foam rollers had on hip and shoulder ROM. **METHODS:** Ten college students participated in a random cross over design study. Participants' hip and shoulder ROM were measured with a goniometer pre and post three different conditions: control, supernova (SN), and grid. The first session consisted of taking pre ROM measurements followed by 10 minutes of rest and post ROM measurements (control). Then the participants were familiarized with the foam rolling procedures that were used for the next two sessions. During the next two sessions the control trial procedures were repeated, except instead of resting between pre and post testing the participants foam rolled using one of the foam rollers. **RESULTS:** Repeated measures ANOVA followed by protected dependent t tests revealed that significant ($p < .05$) differences existed between control and SN, control and grid, but not between SN and grid ($p > .05$). Effect sizes revealed that when comparing mean differences from pre to post for SN and grid: a large effect was seen for shoulder extension ($d = -.80$) in favor of SN, moderate effects were observed for shoulder flexion ($d = -.50$) in favor of SN, hip flexion ($d = -.62$) in favor of SN, and hip abduction ($d = .57$) in favor of grid. **CONCLUSION:** Both foam rollers produced similar acute improvements to hip and shoulder ROM, which were significantly better than the control condition. When improvements to ROM are desired prior to resistance training, the use of either foam roller in this study would be preferred over static stretching or no mobility exercises.

Supported by UCO Student Research, Creative, and Scholarly Activities (RCSA) Grant

3740 Board #187 June 3 9:30 AM - 11:00 AM
Effect of Cooling on Postmatch Recovery in Elite Volleyball Players in Warm Conditions

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PURPOSE: The purpose of this study was to determine the effect of a single 14 min of contrast water therapy (CWT) or cold shower (CS) on recovery postmatch in elite volleyball players performed in warm conditions

METHODS: Ten volleyball players completed a 60 min simulated match play in the heat followed randomly by 1 of 3 recovery modalities: (a) CWT consisted of alternating cold (12°C) and hot (38°C) water immersion, (b) CS (20°C), and (c) Passive recovery (PAS; ambient temperature). Blood plasma markers levels (Lactate, Glucose, Fatty acids, Triglycerides, Total cholesterol, Urea, Apolipoproteins: apoB, apoA-I), inflammatory proteins (C-reactive protein, Orosomucoid, Albumin and Haptoglobin) were collected pre-match and immediately after recovery. Vertical jump, agility and speed performances, body temperature and perceived fatigue were also measured pre-match, and immediately after each recovery modality

RESULTS: Plasma concentrations of physiological biomarkers showed a significant changes after all recovery modalities, while concentration of Albumin remained unchanged in passive recovery compared to CWT and CS. After CWT, a significant improvement in lower-limbs power was observed during squat jump and agility performance ($p < 0.05$). Conversely, the CS resulted in a decrease of the lower-limbs power during counter-movement jump but improved start sprint speed. There was a

significant ($p < 0.05$) attenuation in RPE and perceived leg fatigue for all groups with CWT and CS being more successful than PAS (2 ± 0.9 ; 2 ± 1.0 ; 4 ± 1.9). However body temperature was significantly lower (-0.58°C) after CS compared with CWT and PAS modalities

CONCLUSIONS: There is no evidence that cold and contrast water immersions appear to promote better physiological responses. However the observed positive effect on perceived leg fatigue and temperature suggest that cold and contrast water therapy may be effective for players performing in the heat

3741 Board #188 June 3 9:30 AM - 11:00 AM
Effectiveness of Cross Taping as a Therapy for Delayed Muscle Soreness

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Decrease muscle soreness by medical tape is supported by the literature. Subjects: Twenty normal subjects ranging in age from 18 to 55 with no history of previous skin allergy and do not have any upper body injuries participated.

PURPOSE: To assess the efficacy of the cross tapes in muscle soreness.

METHODS: Subjects will perform the lowering phase of a bicep curl exercise using a dumbbell consisting of 3 sets 25 repetition, followed 90 seconds rest between each set. A grid shaped adhesive, a little larger than a stamp, called a cross tapes will be applied in the bicep of the dominant hand and the other hand as control for one week. The range of motion and pain for both arms will be measured before and after applied the tape.

RESULTS: The study findings show that there were statically significant difference between the ROM and the pain (pre, post) when the procedure is carried out over a period of two consecutive weeks (1 day per week) with large effect size (0.2) and strong power (0.96). However; there were no significant differences between the two groups (right, left arms) with medium effect size (0.1) and weak power (0.33).

CONCLUSIONS: Therefore, this study suggest that cross tapes may reduce delayed onset muscle soreness, however more research is needed. Future studies should include a larger number of subjects, more diverse cohort, an exercise that applies a greater intensity, and expands the time of research. CT is an advisable method to decrease DOMS and improved functional performance.

3742 Board #189 June 3 9:30 AM - 11:00 AM
Combined Effects of Cold Water Immersion and Compression Garment after Exercise on Muscle Damage Markers

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Cold water immersion (CWI) and compression garment (CG) are popular post-exercise treatments for reducing exercise-induced muscle damage. Although efficacy of CWI and CG has been already reported, combined effect of these post-exercise treatments remains unclear. **PURPOSE:** To investigate the effect of combined treatment of CWI and wearing CG after maximal eccentric exercise on recovery of muscular strength and indirect muscle damage markers. **METHODS:** Six males performed two trials (TRE, CON) in random order. In the TRE trial, the subjects performed 15min of cold water immersion (15°C) followed by wearing a lower body CG for 24 h after the exercise, whereas no post-exercise treatment was conducted in the CON trial. The exercise consisted of 10×6 maximal isokinetic (60°/s) eccentric knee extension using unilateral leg, and exercised leg was randomly selected in each trial to avoid repeated bout effect for the same muscle groups. Time course changes in maximal voluntary contraction (MVC) and isokinetic (60°/s) strength for knee extension, score of muscle soreness, muscle thickness of quadriceps femoris were evaluated before exercise and post-exercise period. Blood sample was drawn to investigate blood glucose and lactate, serum creatine kinase (CK) and myoglobin (Mb) concentrations before exercise, 3 h and 24 h after exercise. **RESULTS:** Total work volume during eccentric exercise did not significantly differ between the two trials ($P > 0.05$). MVC and maximal isokinetic strength were markedly decreased during post-exercise period in both trials ($P < 0.05$), and these responses were not significantly different between the trials. Serum CK and Mb concentrations were significantly elevated during post-exercise period in both trials ($P < 0.05$). However, area under the curve for Mb concentration during exercise and 3 h of post-exercise period significantly lowered in the TRE trial (196 ± 31 ng/ml) compared with the CON trial (260 ± 50 ng/ml) ($P = 0.04$). No significant difference was observed between trials for time-course changes in other variables.

CONCLUSION: CWI followed by wearing CG after maximal eccentric exercise did not facilitate recovery of muscular strength. However, exercise-induced increase in Mb was significantly attenuated when the combined treatment of CWI and CG was applied.

scale of 5 (best) to 1 (worst). **Results:** Twenty eight female soccer players (14.3-17.9 years) and 23 female basketball players (12.6-16.0 years) were included. Average VO_{2peak} was 48 and 47.9 ml/kg/min, respectively. Forward soccer players had a better VO_{2peak} comparing to other positions (goalkeepers=42.2, defenders=48.4, midfield=47.3, forwards=54.7 ml/kg/min). Soccer coach playing ability (average=4.21) and fitness estimation (average=3.96) did not correlate with VO_{2peak} results (Correlation Coefficient= 0.292, $p=0.13$ and 0.257, $p=0.18$ respectively). Center basketball players had the lowest and point guards the highest average VO_{2peak} (centers=34.2, forwards=44.6, guards=50.5 and point guard=53.1 ml/kg/min). Basketball coach playing ability (average=3.14) and fitness estimation (average=2.86) correlate with VO_{2peak} results (Correlation Coefficient= 0.464, $p=0.03$ and 0.547, $p=0.008$ respectively). **Conclusions:** Adolescent female soccer and basketball players at different playing positions exhibited different VO_{2peak} values as reported in the literature. Basketball coaches' estimation of aerobic fitness and general playing ability were associated with VO_{2peak} results whereas soccer coaches' estimation did not. VO_{2peak} may be considered as a parameter for team selection of ball game players game players, however in light of the inconclusive results, further research is required.

3747 Board #194 June 3 8:00 AM - 9:30 AM
Association Between Genu Valgus And Physical Activity, Adjusted To Chronological Age In Brazilian Males Adolescent

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(No relationships reported)

PURPOSE: Genu valgus interferes negatively in physical activities of moderate and moderate to vigorous intensity among Brazilian females adolescent students, which may be a negative factor for an active lifestyle. **Objective:** To analyze the association between genu valgus and physical activity level (PAL), categorized in: total, light, moderate, vigorous and moderate to vigorous intensity, adjusted to chronological age in male adolescent students.

METHODS: sample comprised 270 male students, 30 boys in each age group, aged 10-18 years (14.0 ± 2.6), and living in the city of Ilhabela, Brazil. Genu valgus was evaluated using a goniometer, measuring the intermalleolar distance (cm). Physical activity behavior in different intensities (minutes per week) was assessed by the International Physical Activity Questionnaire (IPAQ). Statistical analysis has used multiple linear regression adjusted to chronological age.

RESULTS: There was no association ($p>.05$) between intermalleolar distance and total ($\beta=.475$), light ($\beta=4.843$), moderate ($\beta=2.012$), vigorous ($\beta=.412$) and moderate to vigorous ($\beta=2.423$) physical activity level.

CONCLUSIONS: Genu valgus does not interfere in different levels of physical activity (total, light, moderate, vigorous and moderate to vigorous) among males adolescent students.

The association between genu valgus and physical activity level, adjusted to the chronological age in Brazilian males adolescent students

Males (n=270)				
IM: 3.15 ± 1.80 cm				
Variables	B	p	R ²	IC 95%
Total PA (min/w)	.475	.917	.014	-5.542; 9.493
Light PA (min/w)	4.843	.223	.05	-2.964; 12.65
Moderate PA (min/w)	2.012	.577	.005	-5.078; 9.101
Vigorous PA (min/w)	.412	.73	.007	-1.932; 2.755
MV PA (min/w)	2.423	.52	.005	-4.989; 9.836

$p < .05$; association between genu valgus and level of physical activity (PAL). IM: Intermalleolar distance; PAL: physical activity level; min/w: minutes per week; MV: moderate to vigorous.

3748 Board #195 June 3 8:00 AM - 9:30 AM
Association Between Waist-to-Height Ratio And Fitnessgram® BMI Classification In Sixth-grade Children

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FITNESSGRAM has established criterion standards for body composition and body mass index (BMI) according to gender and age in children. Standards for aerobic capacity (AC) have also been established to assess cardiorespiratory function. Waist-to-Height ratio (WHtR) has been shown to be a strong indicator of metabolic syndrome in youth. **PURPOSE:** The purpose of this study was to determine the association between WHtR and FITNESSGRAM BMI classification in sixth-grade children. **METHODS:** Subjects were 528 sixth-grade boys and girls, ages 11-13,

who completed each of the FITNESSGRAM components as a part of their yearly assessment. In addition to height and weight, subjects were also measured for waist circumference. AC was determined from one-mile run/walk times, age, gender and BMI. The percent of these students classified within the Healthy Fitness Zone (HFZ) were 46% for BMI, and 52% for AC. The percent of these students classified as High Risk were 43% for BMI, and 31% for AC. **RESULTS:** The correlation between WHtR and BMI was .92, and the correlation between BMI and AC was -.75. The correlation between WHtR and AC was -.70. Receiver Operating Characteristic (ROC) analysis indicated that a WHtR of 0.451 represents the best cut-off score for classifying girls within the HFZ for BMI, with 91% classified correctly, and AUC = .96. Also, a WHtR of 0.475 represents the best cut-off score for classifying boys within the HFZ for BMI, with 90% classified correctly, and AUC = .95. For determining High Risk classification for BMI, a WHtR of 0.476 represents the best cut-off score for classifying girls as High Risk for BMI, with 90% classified correctly, and AUC = .96. Also, a WHtR of 0.484 represents the best cut-off score for classifying boys as High Risk for BMI, with 94% classified correctly, and AUC = .97. **CONCLUSIONS:** WHtR is strongly associated with classification according to FITNESSGRAM BMI standards in sixth-grade children. These data suggest that a WHtR of .451 for girls and .475 for boys are the best criteria for HFZ classification for FITNESSGRAM BMI. Also, a WHtR of .476 for girls and .484 for boys are the best criteria for High Risk classification for FITNESSGRAM BMI. Reduction of WHtR may provide important benefits since children in the High Risk category are most likely to develop problems related to metabolic syndrome as adults.

3749 Board #196 June 3 8:00 AM - 9:30 AM
Correlation Between Varying Back Squat Depths On Speed And Vertical Jump Performance In North American High School Football Players

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The back squat exercise is perhaps the most popular and most effective exercise for developing lower body musculature. Development of the lower body musculature is paramount for increasing ground reaction forces which in turn can translate to increased explosiveness in movements such as sprinting or vertical jumping (VJ). For athletes in particular, developing lower body strength can be of utmost importance. There is however dispute over which back squat depth is most optimal. **PURPOSE:** This study attempted to determine which of two back squat depths (90 degree knee flexion or 45 degree knee flexion) would correlate with superior sprint times and VJ performance. **METHODS:** Participants were high school aged males on a North American football team (age: 15.1 ± 0.9 yrs, mass: 77.0 ± 13.2 kgs). Twenty three athletes performed the 36.6 meter (36.6M) sprint and VJ tests along with performing a 3RM back squat at 90 and 45 degrees of knee flexion on randomized separate days. A Pearson Correlation Coefficient (r) test was used to compare the squat scores with sprint times and VJ performance. **RESULTS:** Variable measures were 36.6M: 5.23 ± 0.26 secs, VJ: 59.6 ± 6.6 cms, 90° 3RM squat: 116.1 ± 21.0 kgs, and 45° 3RM squat: 132.1 ± 22.2 kgs. Low correlations were found at both knee flexion angles: 90° 3RM squat ($36.6M_r = -0.32$, $VJ_r = 0.33$, $p < 0.01$), and 45° 3RM squat ($36.6M_r = -0.31$, $VJ_r = -0.33$, $p < 0.01$). However, moderate correlations were revealed when comparing the 3RM back squat/body mass ratio with the participant's 36.6M sprint times ($90_r = -0.46$, $45_r = -0.46$, $p < 0.01$). **CONCLUSIONS:** Within the parameters of this study, low to moderate correlations were determined between back squat strength and sprint speed as well as VJ at both 90 and 45 degrees of knee flexion.

3750 Board #197 June 3 8:00 AM - 9:30 AM
Metabolic Cost of Battling Rope Exercise in Children

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Battling ropes (BR) are an effective mode of conditioning for adults, but the efficacy of BR exercise for children is unknown. **PURPOSE:** To examine the acute metabolic cost of BR exercise in children. **METHODS:** 15 boys (10.6 ± 1.4 yr) were tested for peak oxygen uptake (VO_{2peak}) on a treadmill and subsequently (≥ 48 hours later) performed a progressive 10 min BR protocol of 5 exercises (EX#: repetitions): standing side to side wave (EX1; 30), seated alternating wave (EX2; 60), standing alternating wave (EX3; 60), jumping jacks (EX4; 20) and double arm slams (EX5; 20). Each BR exercise was performed twice for 30 sec with a 30 sec rest interval between sets and exercises while connected to a metabolic system. A metronome was used to standardize cadence

and a 12.8 m rope (4.1 kg) was used for all trials. Comparisons between exercises were made using one-way ANOVA with repeated measures. **RESULTS:** Peak values for VO₂ and HR during the treadmill test were 47.4 ± 8.8 ml/kg/min and 195.1 ± 6.6 bpm, respectively. Mean HR and VO₂ values for both sets of each exercise during the BR protocol were 52.7% to 84.1% and 21.5% to 60.1% of HR_{peak} and VO_{2peak}, respectively. During the BR protocol, there were progressive increases in VO₂ and HR from EX1 to EX5. Results of pairwise comparisons of VO₂ and HR among five BR exercises are below (mean ± SD):

	EX1	EX2	EX3	EX4	EX5
HR (bpm)	103.3 ± 11	124.1 ± 15 ¹	148 ± 16 ^{1,2}	147 ± 14 ^{1,2}	164 ± 11 ^{1,2,3,4}
VO ₂ (ml/kg/min)	10.2 ± 2	12.7 ± 3 ¹	18.1 ± 3 ^{1,2}	23.1 ± 3 ^{1,2,3}	28.5 ± 3 ^{1,2,3,4}

p<0.05 ¹vs EX1; ²vs EX2; ³vs EX3; ⁴vs EX4

CONCLUSION: These data indicate that BR exercise can pose a moderate to vigorous metabolic and cardiovascular stimulus in children with the mean effects augmented with the use of exercises requiring greater muscle mass.

3751 Board #198 June 3 8:00 AM - 9:30 AM
Changes in VO₂max are Not Associated with Ventricular Morphology or Function in Female Youth Athletes
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(No relationships reported)

While the relationship between fitness changes and ventricular morphology and function has been studied in adults and in cross-sectional studies with children, we are aware of no prior research which has evaluated this relationship in female youth athletes longitudinally.

PURPOSE: To determine if changes in maximal aerobic capacity are associated with changes in ventricular morphology or systolic function in female youth athletes.

METHODS: 26 female soccer athletes (ages 13-18) underwent resting 2-D echocardiography and maximal aerobic testing at two time points 7 months apart to determine, maximal aerobic capacity (VO_{2max}), left ventricular (LV) end-diastolic diameter (LVEDD), right ventricular (RV) end-diastolic diameter (RVEDD), LV mass (LVM), RV area in diastole (RVAD), RV area in systole (RVAS), LV shortening fraction (LVSF), RV fractional area change (RVFAC), interventricular septal wall thickness (IVWT), and LV posterior wall thickness (LVPWT). Echocardiographic and fitness variables were compared at the two time points using paired Wilcoxon tests and Cohen's d. Linear regression models were used to predict changes in VO_{2max} using changes in echocardiographic variables as predictors.

RESULTS: During the study period, no significant change in VO_{2max} was identified (2.61 ± 32% v 2.62 ± 32%, p = 0.75, d=0.05). A significant decrease was identified in RVFAC (44 ± 10% v 36 ± 5%, p = 0.02, d=-0.61). No significant differences were identified in any other echocardiographic or fitness variables (p>0.05 for all). None of the changes in echocardiographic variables were significant predictors of change in VO_{2max} (β=-0.33 to 0.50, p>0.05 for all)

CONCLUSION: During the 7 month study period, no changes were identified in VO_{2max} or ventricular size. The reason for the significant decrease of RVFAC is unclear but could be due to increased afterload or decreased RV contractility. Also, none of the echocardiographic variables were significant predictors of change in VO_{2max} during the study period. While this suggests that changes in aerobic capacity may not be related to changes in ventricular size or function, it is also possible that the changes in these variables during the study period were not large enough to demonstrate meaningful relationships between them.

3752 Board #199 June 3 8:00 AM - 9:30 AM
Muscle Strength Thresholds For The Detection Of Cardiometabolic Risk Among Colombian Children And Adolescents: The Fuprecol Study
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PURPOSE: Evidence shows an association between muscular strength (MS) and health among youth, however low muscular strength cut-points for the detection of

high metabolic risk in Latin-American populations are scarce. The aim of this study was two-fold: to explore potential age- and sex-specific thresholds of MS, for optimal cardiometabolic risk categorization among Colombian children and adolescents; and to investigate if cardiometabolic risk differed by MS group by applying the receiver operating characteristic curve (ROC) cut point.

METHODS: MS was estimated by a handle dynamometer on 1,950 children and adolescents from Colombia, using the MS relative to weight (handgrip strength/body mass). A metabolic risk score was computed from the following components: waist circumference, triglycerides, HDL-c, glucose, systolic and diastolic blood pressure. ROC analysis showed a significant discriminatory accuracy of MS in identifying the low/high metabolic risk in children and adolescents and both gender.

RESULTS: ROC analyses showed a significant discriminatory accuracy for the identifying the low/high CMRI in both gender and age group (AUC=0.83 (95%CI: 0.71-0.95), p< 0.001; boys AUC= 0.84 (95%CI: 0.74-0.94), p< 0.001; adolescents girls AUC=0.79 (95%CI: 0.70-0.89), p< 0.001; boys AUC= 0.88 (95%CI: 0.68-0.92), p< 0.001). In children (9 to 12.9 years old), handgrip strength (kg)/body mass (kg) values at these points were 0.359 and 0.376 in girls and boys, respectively. In adolescents (13.0 to 17.9 years old), these points were 0.440 and 0.447 in girls and boys, respectively

CONCLUSIONS: In conclusion, the results suggest a hypothetical MS level relative to weight for having a low metabolic risk, which could be used to identify youths at risk.

3753 Board #200 June 3 8:00 AM - 9:30 AM
Maximal Oxygen Uptake Equations To Discriminate The Cardiometabolic Risk In Colombian Children And Adolescents: The Fuprecol Study
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PURPOSE: Associations between maximal rate of oxygen uptake (VO_{2max}) and cardiometabolic risk have not been adequately studied in Colombian children and adolescents. The aim of the present study was two-fold: (i) to determine the ability of eight different VO_{2max} equations to discriminate between low and high cardiometabolic risk; and (ii) to determine cardiorespiratory fitness (CRF) thresholds associated with a more favourable cardiovascular health profile in Colombian children and adolescents.

METHODS: CRF was estimated by the 20 m shuttle run test on 2,870 schoolchildren (54.5% girls) from Bogota (Colombia). We computed a metabolic syndrome score (MetScore) as the sum of the age-sex standardized scores of waist circumference, triglycerides, HDL-c, glucose, systolic and diastolic blood pressure.

RESULTS: Linear regression analyses showed that the Barnett et al. (b) and Mahar equations were negatively associated to MetScore showing the highest discriminatory accuracy for identifying the low/high cardiometabolic risk in both sexes and age group (9-12 and 13-17 years old). Therefore, we are proposing to use Barnett et al. (b) equation [Boys and girls: VO_{2max} = 25.8 x 6 x G + 1 x 0.2 x body mass + 3.2 x final speed] in Colombian youths to classify youths at metabolic risk.

CONCLUSIONS: The CRF cutoffs can be used as a quantitative marker of healthier cardiovascular profile Colombian in children and adolescents.

3754 Board #201 June 3 8:00 AM - 9:30 AM
Maturational Timing and Adolescent Swim Performance
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Beunen et al. (1978) found that the early maturers in their sample of non-athletic girls performed better on simple motor tasks than the late maturers early in adolescence, but that the late maturers performed better than the early maturers late in adolescence. Purpose: To determine if the same relationship between maturational timing and

performance exists when high-level athletes execute complex motor tasks. Methods: NCAA women swimmers (N = 254) completed an online questionnaire in which they provided age, height, weight, swimming history, and age at menarche (AaM). We divided the sample into early-, average-, and late-maturing groups using AaM. We utilized the USA Swimming (USAS) performance database to identify individual performances for each swimmer at three adolescent phases: (1) early adolescence (12 years old), (2) middle adolescence (15 years old), and (3) late adolescence (18 years old). Each performance in the USAS database equates to a standardized score called a Power Point Score (PPS). We selected the highest PPS for each swimmer at the three adolescent phases. We analyzed the data using a Two-way Mixed Design ANOVA. Results: Mean AaM values for the early-, average-, and late-maturing groups were 12.0 years (95% CI, 11.8 to 12.2), 13.4 years (95% CI, 13.3 to 13.5), and 15.4 years (95% CI, 15.2 to 15.6). We identified performances for 173 of the 254 respondents (68.1%) in the USAS database at all three adolescent phases. We detected a significant two-way interaction ($F_{4,334} = 5.8, P < 0.001$), which indicated that the effect of maturational timing on swim performance differed by adolescent phase. Mean PPS for the early, average, and late maturers during early adolescence was 496.4, 494.8, and 480.0, whereas mean PPS during middle adolescence was 664.4, 683.1, and 721.3. Thus, the late maturers improved more (62.6%) from early to middle adolescence than the average (47.0%) and early (45.2%) maturers. In contrast, swim performance improved to a similar extent for the three groups from middle to late adolescence. Conclusion: Our results extend Beunen et al.'s findings by showing that early-maturing swimmers have a performance advantage over late-maturing swimmers during early adolescence. But by middle adolescence, the late maturers have a performance advantage that is maintained into late adolescence.

3755 Board #202 June 3 8:00 AM - 9:30 AM

Which One Is The Decisive Factor To Cognition Performance In Preschool Children Aged 3.5 To 4.5 Years Old, Aerobic Fitness Or Agility?: A Cross-sectional Study In Shanghai, China

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Purpose: This cross-sectional study was to compare the associations of aerobic fitness and agility with cognition performance in preschool children. **Methods:** A total of 346 preschool children (age 3.5-5.5 yr old) with 201 boys and 145 girls were recruited from eight preschools in Yangpu, Shanghai, China. After enrolled in this study (Trial Registration: clinicaltrials.gov NCT00674544), the young children were asked to perform a comprehensive package of tests including physical fitness and cognitive function. Children's scores on the tests of 10-m Shuttle Run (time; this test can be used to determine speed and agility performance, and elite players will use less time than the subelite participants) and 20-m Shuttle Run (laps; this test can be used to determine aerobic fitness performance, and elite players will have more laps than the subelite participants), Verbal Intelligence Quotient (VIQ), Performance Intelligence Quotient (PIQ), and Full Intelligence Quotient (FIQ) were assessed. Correlation coefficients were determined by conducting Pearson product-moment and Spearman's rho analyses. Linear regression analyses were used to examine the associations of cognitive performance with aerobic fitness and agility in a sequential manner. Descriptive data were reported as mean±SD. Statistical significance was set at a p-value < 0.05. **Results:** After adjustment for age, gender, BMI, physical activity, nutrition status, sleep habits, and education, a negative relationship ($P < 0.001$) was found between the change in the 10-m Shuttle Run Test (times) and the change in PIQ, VIQ and FIQ, whereas a positive association ($P < 0.01$) was observed between the change in the 20-m Shuttle Run Test and the change in PIQ, VIQ and FIQ. However, after the 10m and 20-m Shuttle Run Tests were mutually adjusted with covariates to control the confound variables, only the negative association still remained in the changes between the 10m Shuttle Run Test and PIQ, VIQ and FIQ ($P < 0.001$), respectively. **Conclusions:** Compared with aerobic fitness, a high level of the agility fitness may be associated more with a high cognition performance (performance of the PIQ, VIQ, and FIQ). Further research is needed to examine the effect of the aerobic and agility fitness related interventions on the cognitive parameters in this population.

3756 Board #203 June 3 8:00 AM - 9:30 AM
Effects of Self-Regulation at Ventilatory Breakpoint on Children's Running Fitness during Physical Education Pedagogical Strategies

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Introduction: Exercising at ventilatory breakpoint (Vpt) with the use of Rate of Perceived Exertion (RPE) scale has been used widely in children but its effect on running fitness during Games Concept Approach (GCA) or Skill-based Approach (SA) pedagogical strategies during physical education lesson is unknown. **Purpose:** To investigate the effects of running fitness of exercising within the range of Vpt (RPE 4-6) via self-regulation by children during GCA and SA pedagogical strategies. **Methods:** 18 healthy children, 9 boys (age: 10years old, height: 138 ± 5.94cm, weight: 34.56 ± 7.3kg) and 9 girls (age: 10 ± 0.5years old, height: 135 ± 8cm, weight: 33 ± 10.45kg) were recruited. The intervention was conducted in a school for 12 sessions over a period of 6 weeks. Students were split into GCA or SA group. Two sessions were held in a week and each lasted for 45 minutes (5 minutes warm up, 15 minutes GCA or SA activities, 5 minutes break, 15 minutes GCA or SA activities and 5 minutes cool down). RPE and Heart Rate (HR) were recorded during the sessions. Physical activity was kept similar throughout the intervention period. The students ran a 1.6km before and after the intervention. **Results:** Paired-t test showed significant difference between pre and post 1.6km run test for GCA (pre: 693.67 ± 98.03 seconds, post: 614.89 ± 74.18 seconds, $p = 0.001$) and SA (pre: 817.11 ± 92.98 seconds, post: 712 ± 68.51 seconds, $p < 0.0005$). Independent-t test showed significant difference between GCA and SA in the 1.6km post run ($p = 0.011$) and HR (GCA: 159.03 ± 12.22, SA: 129.99 ± 17.23, $p = 0.001$) but not in RPE (GCA: 4.30 ± 1.16, SA: 3.73 ± 1.72, $p = 0.426$). Maximum HR (HR_{max}) percentage was higher in GCA (75.73% of HR_{max}) than SA (61.9% of HR_{max}). **Conclusion:** Faster timings in the 1.6km post run test results showed improvement in cardiovascular fitness for both pedagogical approaches, which may have been attained with sustained exercise intensity within 60-75% of HR_{max} and RPE of 4-6. A higher improvement from the GCA group suggests that GCA is a better pedagogical approach as it is fun for children. Self-regulation of exercise intensity using the OMNI RPE scale during both GCA and SA improved fitness and may be a safe way to exercise as the students are not exercising at high RPE (8-10) which may induce injuries.

3757 Board #204 June 3 8:00 AM - 9:30 AM
Nine-year Longitudinal Study Of Obesity In Japanese Young Children

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PURPOSE: Childhood obesity is increasing worldwide. Tracking, or the tendency for an individual to maintain his/her disease risk factor rank level relative to his/her peers through time, leading to adolescence and adult obesity is observed even in early childhood. Childhood obesity is associated with increased risk of mortality due to cardiovascular diseases in adulthood, independent of adult weight. Therefore, intervention, and prevention of obesity in young children is important in reducing the risks of obesity and cardiovascular disease in adulthood. However, little is known about the process and tracking of obesity during the years of young childhood because of a lack of longitudinal studies. Consequently, prevention and treatment of obesity in the young childhood has made little progress. The purpose of this study is to investigate the trends in degree and tracking of obesity in young children over nine years. **METHODS:** The subjects were 58 young children (22 boys and 36 girls). They were followed up for height, weight, and obesity index from 3 to 11 years old. Obesity index ((actual weight - standard weight) / standard weight × 100) was calculated using the standard weight for Japanese children, which was determined according to the formula: Male $y = 1.83 \times 10^{-3}x^2 - 0.071x + 4.43$, female $y = 2.34 \times 10^{-3}x^2 - 0.157x + 7.71$ (y: standard weight, x: height). Obese was defined as having an obesity index of more than +15%. Pearson's correlation coefficients and χ^2 test were used to estimate the effects of age on frequency trend and tracking of obesity. Statistical significance was $p < 0.05$. **RESULTS:** The prevalence of obesity was 17.2% (n=10) in 3-year-old children and 20.7% (n=12) in the same children at 11-years-old. There were no age-related differences in frequency of obesity. The obesity index at 3-years old was significantly correlated with that at 4-years-old ($r=0.861$), 5-years-old ($r=0.774$), 8-years-old

($r=0.630$), 9-years-old ($r=0.548$), 10-years-old ($r=0.559$), 11-years-old ($r=0.512$). Among 10 young children who were obese at 3-years-old, 3 showed tracking of obesity from 11-years-old.

CONCLUSIONS: The status of many obese young children is likely to track, but the chance of a decrease in obesity over nine years is not small in young childhood.

3758 Board #205 June 3 8:00 AM - 9:30 AM
Relationships Between Young Children's Physical Activity And Guardians' Consciousness Regarding It
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Young children's acquisition of the habit of engaging in physical activity (PA) and having a positive attitude to PA are very important to improve children's physical fitness. The acquisition of the habit of engaging in PA translates into an increase in the amount of PA. It is also expected that the improvement of physical fitness supports the development of a positive attitude to PA. However, the amount of PA is changed according to influence of daily lifestyle and guardians' consciousness of children's PA. **PURPOSE:** The purpose of this study was to examine the relationships between young children's PA and guardians' consciousness regarding the same. This study specifically focused on the change in the longitudinal relationships. **METHODS:** The subjects of this study were 77 young children. Data included their PA, daily lifestyle, and guardians' consciousness of children's PA. The amount of PA was measured on all days of a week. The data on 18 items related to daily lifestyle and guardians' consciousness of children's PA were collected using a questionnaire. These data were collected when the children were aged 3 and 5 years, using the same protocol. The subjects were divided into 2 groups, the improvement group and maintain or no-improvement group, based on the change in guardians' consciousness of children's PA. The difference in the amount of PA between these groups was examined using an independent t-test. **RESULTS:** The amount of PA increased on weekdays and decreased on weekends from 3 years old to 5 years old. The amount of PA increased significantly in the improvement group based on the consciousness that "playing outside, exercise, and sports are very important" and "the guardian sometimes takes a walk with the child". Regarding daily lifestyle items, "the frequency of playing using the whole body" was the only item that showed a significant difference in PA. Although statistical significance was not confirmed, PA increased in the improvement group based on "the duration of watching TV/videos" and "duration of playing video games". **CONCLUSIONS:** It was suggested that guardians' consciousness regarding playing outdoors, and engaging in exercise and sports is very important for children's PA. Further, it is necessary to control the duration of watching TV/videos and of playing video games in order to increase children's PA.

3759 Board #206 June 3 8:00 AM - 9:30 AM
Vertical Jump Performance Predicts Selection Of Young Talented Volleyball Players For the Junior National Team
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 (No relationships reported)

PURPOSE: To determine whether anthropometric measurements and fitness test results can discriminate between selected and non-selected junior volleyball players. **METHODS:** Forty three male junior volleyball players (age: 15.0±0.7 yrs) took part in training camp and underwent a selection procedure by coaches of the junior national team. Anthropometric data (body height, body mass and body height with extended arm) and fitness tests results (countermovement jump (CMJ), block jump, spike jump, 10m sprint and 505 agility test) were obtained. Four expert volleyball coaches of the national team evaluated and graded the players in a scale from 0 to 100 during their participation in a volleyball tournament. The coaches selected the best 23 players on the basis of their score (selected players; n=23, height: 186±5 cm, body mass: 72±10 kg) (non-selected; n=20, height: 188±3 cm, body mass: 69.5±7.5 kg). A linear discriminant analysis was conducted on the selected and non-selected groups to determine if the anthropometric and fitness test data could predict the coaches' selection. Anthropometric and fitness test data of the two groups were compared using independent samples t-tests. Statistical significance was set at p<0.05. **RESULTS:** Selected players had higher coaches' scores compared to the non-selected (83.9±7.2 vs. 65.3±7.5, p<0.05). There were significant differences between selected and non-selected in only in vertical jumps (CMJ: 40.5±6.7 vs. 34.4±3.6 cm, block jump: 43.6±6.9 vs. 36.9±3.5 cm, spike jump: 72.8±10.3 vs. 63.4±3.8 cm, all p<0.05), but not in any other anthropometric or fitness test parameter. The multivariate analysis yielded

a discriminant function (Wilk's lambda= 0.69, $\chi^2= 15.12$, p=0.001, $\eta^2=0.12$). CMJ was the main test result that highly loaded the discriminant function ($r=0.85$). Cross validation results showed that selection was correctly predicted in 31 out of the 43 selected athletes (predictive accuracy: 72.1%).

CONCLUSIONS: Vertical jumping ability may be used as an important parameter that largely determines success, since it may discriminate between selected and non-selected junior volleyball players.

3760 Board #207 June 3 8:00 AM - 9:30 AM
Comparison Of Cardiorespiratory Fitness Testing Measures In Young Children
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 (No relationships reported)

Laboratory and field methods of assessing cardiorespiratory fitness in young children provides valuable information to assess the effectiveness of intervention strategies designed to improve overall health outcomes. **PURPOSE:** To compare peak oxygen uptake (VO₂peak; ml·kg⁻¹·min⁻¹) and maximal heart rate (MHR; beats·min⁻¹), from the FitnessGram Progressive Aerobic Cardiovascular Endurance Run (PACER) test to a maximal graded exercise test (GXT; treadmill) in 17 (9 boys) young (10-11 yr old) children. In addition, VO₂peak from the PACER test was compared (mean ± SD) to the estimated VO₂peak using the Topend Sports Beep Test Score Calculator (Topend) equation. **METHODS:** Subjects completed the PACER and GXT in a randomized order 1 week apart while wearing a heart rate monitor and a portable oxygen analyzer. **RESULTS:** The PACER test VO₂peak (30.4 ± 4.6) was not significantly different from the GXT VO₂peak (32.1 ± 5.5) however, MHR GXT (194.8 ± 9.4) and MHR PACER (173.7 ± 20.9) were significantly (p < 0.05) different. Topend VO₂peak (23.8 ± 2.9) was significantly (p < 0.05) lower than the PACER VO₂peak. Both the GXT and the Topend VO₂peak were significantly (p < 0.05) correlated with the PACER ($r=0.75$ and 0.62, respectively). There was no significant correlation between the PACER and GXT MHR ($r=0.40$). **CONCLUSIONS:** The PACER elicits a similar VO₂peak response, however the Topend estimation equation should be used with great caution to estimate the cardiorespiratory fitness of young children. Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment

3761 Board #208 June 3 8:00 AM - 9:30 AM
Comparison of Health Related Fitness Variables between Male and Female Youths in Singapore
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Physical fitness encompasses health-related fitness (HRF) variables such as cardiovascular fitness (CF), lumbar and lower limb flexibility (LLLF), muscular strength (MS) and body fat percentage (BF%). To date, no large study has been conducted on HRF variables among Singaporean youths. **PURPOSE:** To compare HRF variables between male and female Singaporean youths. **METHODS:** One thousand four hundred and fifty-six youths (762 males: age: 13.63 ± 1.35 years, height: 158.36 ± 8.75 cm, weight: 53.82 ± 14.39 kg, BF%: 17.64 ± 10.73 %; and 694 females: age: 13.34 ± 1.21 years, height: 160.73 ± 8.68 cm, weight: 48.82 ± 10.9 kg, BF%: 25.74 ± 7.87 %) from Singapore schools participated in this study. Body Mass Index (BMI) was calculated using standard methods and BF% was measured with a Tanita BC-581 FitPlus Innerscan Scale and Body Composition Monitor. CF, LLLF, and MS were tested using the 15m youth Progressive Aerobic Cardiovascular Endurance Run test (PACER), one-legged sit-and-reach test (SRT), handgrip strength test (HS), and 1-minute sit-up test (SUT) respectively. **RESULTS:** 76.65% of the youths (males: 77.82%, females: 82.56%) were in the healthy BMI range according to the Health Promotion Board of Singapore. Significant differences were found between males and females for all variables (BF %: Males: 17.64 ± 10.73 %, Females: 25.74 ± 7.87 %, p < 0.005; SRT: Males: 52.97 ± 10.04 cm, Females: 55.53 ± 10.03 cm, p < 0.005; HS: Males: 28.35 ± 7.98 kg, Females: 20.77 ± 4.11 kg, p < 0.005; SUT: Males: 43.26 ± 11.29, Females: 33.24 ± 9.16, p < 0.005; PACER: Males: 48.79 ± 24.93 stages, Females: 29.41 ± 12.9 stages, p < 0.005). Males were significantly stronger than females, whereas females were significantly more flexible than males. **CONCLUSIONS:** Generally, youths in Singapore are aerobically fit, with a healthy BF% indicating low obesity rates. If these results of HRF variables are maintained throughout their lifetime, there may be low risk of cardiovascular diseases in Singapore in the future.

Abstracts were prepared by the authors and printed as submitted.

3762 Board #209 June 3 8:00 AM - 9:30 AM
Effects of Backward Walking on Balance in Children
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Injuries caused by falls account for 25% to 40% in morbidity and mortality of children worldwide. Therefore, it is important to identify effective interventions to prevent falls.

Purpose: To investigate the effects of backward walking on balance and fall risk in children.

Methods: Twenty eight healthy boys (6.2±0.5 yrs) were randomly assigned into a control group (n=14) and an intervention group (n=14). Boys in the control group participated in a conventional physical activity program, and those in the intervention group received conventional physical activity plus balance training with backward walking. The programs were provided 30 min/day, 3 days/week for 12 weeks. Balance at baseline and post-intervention was evaluated by using a dynamic training system BTA-200DP which includes anterior/posterior balance index (API), medial/lateral balance index (MLI), and overall balance index (OBI), as well as kinematic parameters in lower extremities. Independent t-tests were performed for group comparisons. Results: There were no significant differences between the control group and the intervention group in each of the parameters before treatment. After 12 weeks of training, the intervention group was significantly better than the control group in API (0.69±0.18 vs. 1.66±0.71, p<0.01), MLI (0.61±0.23 vs. 1.08±0.41, p<0.01), and OBI (0.82±0.15 vs 1.85±0.36, p<0.01). There were no significant group differences in kinematic gait parameters in backward and forward walking between control and intervention group after 12 weeks of training, however, compared with the control group, the intervention group had significantly higher support phase time (0.83±0.07 sec vs. 0.69±0.05 sec, P<0.01), swing time (53.58±11.01 sec vs. 73.77±62.46 sec, P<0.01), step length (53.58±11.01 cm vs 73.77±62.46 cm, P<0.01), step speed (6.19±1.26 m/s vs 8.57±1.74m/s, P<0.01).

Conclusions: Backward walking training improved dynamic balance and motion control ability in children.

Supported by the Sports Medicine key laboratory of General Administration of Sport of China/Sports Medicine key laboratory of Sichuan province Foundation .

3763 Board #210 June 3 8:00 AM - 9:30 AM
Test-retest Reliability Of The 40-yd Dash And Vertical Jump Assessments In Youth Athletes

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Introduction: Limited data exist on the reliability and sensitivity of the 40-yard dash (40-yd) and vertical jump (VJ) tests in youth athletes, which are popular combine performance assessments. **Purpose:** To examine the test-retest reliability for the 40-yd and VJ in youth athletes. **Methods:** Seventy-seven 5-15 year-old athletes (mean height ± SD = 153.0 cm ± 14.9; weight = 45.8 kg ± 16.3) volunteered for the performance assessments during two visits separated by 24-72 hours. Athletes were divided into three age groups (5 - 9, 10 - 11, and 12 - 15 years old). The 40-yd was assessed in seconds (s) with a digital timing gate, and the VJ was assessed in centimeters (cm) with a vertec, both performed on indoor field turf. Intra-class correlation coefficients (ICC) with corresponding 95% confidence intervals, standard errors of measurement (SEM), coefficients of variation (CV), and minimum detectable changes (MDC) were calculated from the repeated measures analysis of variance (ANOVA) from test 1 to test 2 for both assessments. **Results:** There were systematic decreases in 40-yd times from test 1 to test 2 for the 12 - 15 year-old group, but there was no other detectable systematic variability for any other variable. The ICCs ranged from 0.78 to 0.96, which were greater than zero. MDCs (calculated from SEMs) for the 5 - 9, 10 - 11, and 12 - 15 age groups were 0.49, 0.70, and 0.38 s for the 40-yd, and 6.7, 4.3, and 13.7 cm for the VJ, respectively. **Conclusions:** Twelve to fifteen year olds may need a familiarization trial (i.e., test run) for the 40-yd. Based on the age of the athlete, 0.4 - 0.7 s and 4 - 14 cm changes in the 40-yd and VJ, respectively, may be necessary for individual youth athletes to consider their improvements real beyond the errors of the measurements.

3764 Board #211 June 3 8:00 AM - 9:30 AM
Research On The Influence Of Exercise On Brain Structure And Brain Function In The Resting State Of Children With Febrile Convulsion
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PURPOSE: Using the complex brain function and brain structure as an entry point in the resting-state, the research explored the central mechanisms of febrile convulsion, aiming to improve the condition of impaired brain function and the level of physical ability of FC children. **METHODS:** We chose 10 children (group A) and 10 FC children (group B). The group B was intervened by the sensory integration training, which was based on balance and flexibility and coordination. The intervention lasted for 6 months. Adopting BOLD-fMRI technology, regional homogeneity was observed. Based on VBM measurement technology, Cerebral gray matter concentration was measured. The dynamic change of regional homogeneity and gray matter concentration of the whole brain for both A and B group has been observed before and after exercise intervene. **RESULTS:** 1. Compared with group A, the abnormality of regional homogeneity occurred in many encephalic regions for group B. 2. After intervene, group B's regional homogeneity signal changed obviously in SG (P<0.05; P<0.01) and cerebellum (P<0.05; P<0.01), MI (P<0.05; P<0.05), PMA (P<0.05; P<0.05), SMA (P<0.05; P<0.01) and IPL (P<0.05; P<0.05). 3. The gray matter of group B occurred in such encephalic regions as precentral gyrus (BA 4), inferior parietal lobule (BA 40), cuneus (BA 18), precuneus (BA 7), cingulate gyrus (BA 24, 32) encephalic regions improved. 4. Sit and reach (flexibility, P<0.01), walking balance beam (balance ability, P<0.01), cross jump (coordination ability, P<0.05), two feet continuous jump (jump ability, P<0.01) significantly increased for group B. **CONCLUSIONS:** 1. SG was the main encephalic region which resulted in FC children motor function injuries. So it was the main intervene target. 2. MI, PMA, SMA and IPL were the critical regions for FC children to accomplish reorganization and compensation of the brain function in the resting-state. They were the important focus for exercise intervene. 3. the abnormal alteration of ray matter concentration was the main difference among group A and B children' brain structure. It became the material basis of the abnormality of brain function. 4. Sensory integration training and exercise intervene based on the development of balance and coordination ability had the significant effect on improving FC children's physical ability .

3765 Board #212 June 3 8:00 AM - 9:30 AM
Activity and Fitness in Recreational and Competitive Youth Rock Climbers.
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In the search to find activities youth enjoy and to which they will adhere, rock climbing has become increasingly popular; youth climbing teams/programs exist all over the United States (US) and United Kingdom (UK). The US has over 800 climbing gyms, with almost 400 in the UK. From a health-related fitness perspective, climbing appears to be a good option for decreasing sedentary behavior and keeping youth active.

PURPOSE: 1) To determine if recreational (REC) and elite/competitive (EC) youth climbers meet US DHHS (2008) physical activity guidelines during their climbing gym sessions, and 2) to determine if REC and EC youth climbers differ in estimated energy expenditure (EE), fitness, and body composition. **METHODS:** Data were collected between 2009-2013 in the US and UK. Thirteen REC (mean age: 10.7 ± 3.3 yrs) and 18 EC (13.8 ± 2.3 yrs) female climbers were assessed; 17 REC (10.6 ± 1.7 yrs) and 22 EC (13.9 ± 1.9 yrs) males were assessed. Heart rate (HR) monitors were used to collect time of activity (mins), average heart rate (AHR), and peak heart rate (PHR) in beats per minute (bpm) during climbing. Energy expended (kcal) during climbing was estimated from the HR data. Health-related fitness was measured via sit and reach (flexibility), pushups (muscular endurance), and right and left grip strength (muscular strength). Body composition (%fat) was calculated from skinfolds using standardized equations. Differences between groups were tested using ANCOVAs, controlling for age. **RESULTS:** In the REC and EC groups, climbers spent between 73 and 85 mins being active during climbing sessions; the groups did not significantly differ. However, female and male EC climbers, respectively, had higher estimated EE (5.4 ± 1.3 and 6.7 ± 1.7 kcal/min) than female and male REC climbers (3.5 ± 1.4 and 4.3 ± 1.4 kcal/min; p<0.05). Female EC climbers were also stronger than female REC climbers in both right and left grip strength (p<0.01). Once adjusted for age, few other differences existed between REC and EC. **CONCLUSION:** For all groups, AHR ranged between 120-158 bpm, and the exercise intensity approached moderate levels. REC and EC climbers did not differ on most physical or fitness parameters. Additionally, climbers met US DHHS recommendations for duration of cardiorespiratory activity, but intensity did not consistently meet moderate levels.

3766 Board #213 June 3 8:00 AM - 9:30 AM

Effect of Modified Tai Chi Exercise on Physical Function among Chinese High School Students

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PURPOSE: The physical function of high school students has been declined in the last decade. The purpose of this study was to investigate the effect of a modified Tai Chi intervention on physical function among high school students.

METHODS: One hundred-twenty healthy high school students (60 boys & 60 girls aged 16-18 years) volunteered for the Tai Chi intervention. The participants were randomly assigned to four groups (30/group): the boys experimental group (BEG); girls experimental group (GEG); boys control group (BCG) and girls control group (GCG). The experimental groups received the Tai Chi intervention for 20 weeks, 5 days a week and 40 minutes/day. The control groups did not do any exercises. The selected physical function variables: resting heart rate (RHR), vital capacity (VC) and single leg standing with eyes closed balance (SLSECB) were measured at the beginning, and at the end of 10th week and end of 20th week. One-way ANOVA was performed to determine the differences ($p < .05$) between four groups, and repeated ANOVA was employed to examine the differences within the groups over the course of the intervention ($p < .05$).

RESULTS: The results demonstrated that by the end of 20th week, the BEG had a significantly lower RHR than the BCG did (62.06 ± 0.75 vs 69.97 ± 2.89 beats/min), and the similar trend of the RHR was discovered between the GEG and GCG; the BEG had significantly greater improvement in VC than the BCG did ($4,230 \pm 224$ vs $2,865 \pm 143$ ml), and the similar trend was found between the GEG and the GCG. On the SLSECB, the BEG showed significant longer standing time than the BCG did (22.00 ± 1.75 vs 12.04 ± 0.67 s) and the similar trend was observed between the GEG and GCG.

CONCLUSIONS: The modified Tai Chi exercises may improve high school students' physical function in terms of resting heart rate, vital capacity and balance. This modified Tai Chi exercise may be used as an optional exercise for promoting physical function for high school students in China.

3767 Board #214 June 3 8:00 AM - 9:30 AM

Longitudinal Changes in Physical Fitness and Physical Activity in Childhood

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PURPOSE: The purpose of this study was to examine longitudinal changes in infants' physical fitness and physical activity.

METHODS: The participants were 66 three-year-old children (38 boys and 28 girls) attending daycare centers in 2012. For all participants, we made longitudinal measurements of physical fitness and physical activity over three years between the ages of three and five. Physical fitness and physical activity were measured every year in November and December. We evaluated participants' performance with the standing long jump, upright hand standing time, sitting trunk flexion, 25 m dash, ball throwing, side-step, and hand grip, calculating changes through the year. Additionally, participants were given an accelerometer for one week, and we evaluated the number of steps on weekdays and weekends.

RESULTS: On weekdays, the number of steps by five-year-old boys was significantly higher than for boys of other ages (three-year-old: 12848 ± 2330 steps, four-year-old: 12820 ± 2905 steps, five-year-old: 14274 ± 2871 steps, $p < 0.05$), but for the girls, there were no significant differences among all ages. In all test items except the side-step and the sitting trunk flexion, we found significant improvements in physical fitness scores every year. There were significant improvements in the side-step only in the span of three and four years of age (6.3 ± 0.3 , 9.2 ± 0.3 and 9.7 ± 0.3 times/5 sec, $p < 0.05$). No significant changes were observed in sitting trunk flexion. The amount of change between three and four years of age for the 25 m dash and side-step was significantly greater than that between four and five years of age. On the other hand, changes in upright hand standing time, ball throwing, and hand grip were significantly greater between four and five years of age than between three and four years of age. For the amount of change in physical fitness between three and four years of age and between four and five years of age, a negative correlation was observed both for boys in sitting trunk flexion ($r = -0.42$), ball throwing ($r = -0.41$), and side-step ($r = -0.63$) and for girls in sitting trunk flexion ($r = -0.73$), ball throwing ($r = -0.58$), and hand grip ($r = -0.48$).

CONCLUSIONS: Our study suggests that there are distinctive characteristics pertaining to every factor in the improvements observed in physical fitness in childhood.

3768 Board #215 June 3 8:00 AM - 9:30 AM

Salivary Cortisol Responses After A Tennis Match In Adolescent Athletes

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Cortisol can negatively affect athletic performance, potentially causing fatigue and inflammation, while high levels of this hormone have been associated with impaired performance in elite athletes. Monitoring hormones in saliva has distinct advantages over doing it in other biological fluids. However, little is known about the salivary cortisol responses in adolescent athlete, particularly after a tennis match. **PURPOSE:** The purpose of this study was to examine the salivary cortisol responses in elite (finalists of national competition playoffs) adolescent tennis players after a tennis match. **METHODS:** Thirty-two tennis athletes (20 females: age 14 ± 0.5 yrs, height 165 ± 7 cm, mass 52.2 ± 7.6 kg, BMI 19.0 ± 1.6 , and 12 males: 14 ± 0.5 yrs, height 173 ± 10 cm, mass 60.0 ± 8.2 kg, BMI 19.9 ± 1.2) participated in the study. Mean match duration for all participants was 77.5 ± 13.6 min. Unstimulated mixed saliva samples were collected in salivate swabs 15 minutes prior to and 15 minutes after the end of the tennis match. Specifically, the swab was placed in the mouth for one minute, then it was transferred into plastic tubes, centrifuged and the resulted saliva sample was analyzed. Saliva samples were assayed in duplicate using a commercially available ELISA kit for cortisol. Differences between the cortisol levels before and after the match were analyzed using student's T-test. **RESULTS:** Salivary cortisol levels were significantly higher after the completion of the tennis match compared to the baseline levels (4478.9 ± 598.3 pg/ml vs. $976.1 \pm 143.143.7$ pg/ml; $p < 0.001$). No significant differences were found between the mean cortisol responses in males and females ($p > 0.05$). **CONCLUSION:** The findings of the present study suggest that monitoring cortisol in saliva can be a useful, non-invasive and sensitive method to assess this hormonal response in adolescent athletes after a tennis match. Moreover, in contrast to findings of previous studies in adult tennis players, the increased cortisol levels in the adolescent athletes of this study found to be independent of their gender. The possible negative effects of these cortisol responses on the adolescent elite athlete's performance needs to be further investigated.

3769 Board #216 June 3 8:00 AM - 9:30 AM

Physical Exercise Program To Improve The Sport Performance On Speed Skating In Children

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PURPOSE: To investigate the effects of physical exercise program on sport performance of children speed skaters. **METHODS:** A total of 52 children speed skaters (aged=9.09±0.27; 69.2% girls) from Ecuador participated in the study. The ALPHA-Fitness battery was used to analyze the body composition and physical fitness: muscular fitness (hand-grip strength and standing long jump test), speed-agility (4x10-m shuttle run test), and cardiovascular fitness (20-m shuttle run test). Sport performance was measured by the time-marks of the different modalities of the speed skating (combined test, time trial, sprint and hare test). All participants were evaluated before and after 10-weeks of intervention based on a physical exercise program (90-min/ session, 4-days/week). A mixed factorial ANOVA was used to analyze effects and interactions of the study factors age (<10-y and >10-y), sex (boys and girls), and measure moments (baseline and post-intervention) on body composition, physical fitness, and sport performance. **RESULTS:** Post-intervention compared with baseline, weight was lower in girls <10-yr (MD=-0.66±0.30 Kg, $p=0.033$), fat mass was lower in girls <10-yr and >10-yr (MD= 7.37±1.21 Kg, $p<0.001$; MD=7.71±1.71 Kg, $p<0.001$), muscle mass was lower in boys >10-yr (MD=-0.13±0.06 Kg, $p<0.035$) and bone mass was higher in girls <10-yr (MD=0.28±0.09, $p=0.03$). The muscular fitness of upper limbs was higher post-intervention compared with baseline in boys <10-yr (DM=1.55±0.57, $p=0.010$) and girls <10-yr (MD=1.58±0.35, $p<0.01$). For lower limbs, muscular fitness post-intervention was higher in girls <10-yr (MD=5.20±2.28, $p=0.02$). The cardiovascular fitness was higher post-intervention in girls <10-yr (MD=0.65±0.20, $p=0.002$) compared with baseline. The time marks of the combined test post-intervention was lower in boys >10-yr (MD=6.06±2.00, $p=0.004$, in time

trial the time-mark was lower in boys <10-yr (MD=0.71±0.19, p=0.001), girls <10-yr (MD=0.52±0.12, p<0.001) and in girls >10-yr (MD=0.38±0.17 p=0.027) compared with baseline. The time-mark in sprint was lower for girls <10-yr (MD=2.39±1.02, p=0.023) post-intervention. **CONCLUSION:** A 10-weeks physical exercise intervention improves sport performance in children speed skaters, what are directly related with sex and age.

3770 Board #217 June 3 8:00 AM - 9:30 AM

Reliability of the Neuromuscular Fatigue Threshold Measurement across Maturity Status in Boys

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Several studies in adult men and women have demonstrated excellent reliability and sensitivity when measuring neuromuscular fatigue threshold (NFT) during an incremental cycle ergometer test. Recently, the ability to estimate NFT in young boys (11.1±1.1yrs) was demonstrated, which may provide a new noninvasive method to examine training interventions as well as the effect of maturation on changes in motor unit recruitment strategies. However, to date, no one has examined the reliability of estimating NFT in boys. **PURPOSE:** To determine the reliability of estimating the onset of neuromuscular fatigue in boys across maturity status. **METHODS:** Twenty-four boys (age 11 to 17yrs) volunteered with parental consent to complete two graded exercise test (GXT) on a cycle ergometer separated by at least 48 hours. The NFT was estimated during the GXT by way of the maximal distance method using electromyographic amplitude values from the right vastus lateralis vs power output (W). All participants were separated according to their number of years from peak height velocity (PHV), an estimation of somatic maturity status, into PRE- (-1yr), PERI- (between -1 to +1yr) and POST- (+1yr) PHV groups. Test-retest reliability was calculated for PRE-, PERI-, POST-PHV as well as the combined group. Intraclass correlation coefficient (ICC_{2,1}), standard error of the measurement (SEM) and minimum detectable change (MDC) were calculated using a custom written Excel spreadsheet. **RESULTS:** Table 1 summarizes the results. Every group independently and combined demonstrated excellent reliability (ICC>0.75) **CONCLUSIONS:** The current results described in Table 1 are similar to other studies that have reported ICC (0.85 to 0.95), SEM (6W to 14.6W) and MDC (17W to 34W) in adult men. The estimation of NFT, therefore, is reliable in boys regardless of maturity status.

Table 1. Summary of the reliability data

Group	NFT-Trial 1 (w)	NFT-Trial 2 (w)	ICC	SEM (w)	MDC (w)
All (n=24)	161.7+38.0	163.1+39.0	0.96	10.4	23.3
PRE (11.6+0.7yrs; n=6)	123.7+46.0	122.0+48.2	0.99	6.1	14.5
PERI (14.2+1.0yrs; n=7)	157.7+18.4	157.1+12.7	0.80	10.0	23.3
POST (17.0+0.8yrs; n=11)	185.1+24.2	189.4+21.1	0.85	12.5	29.2

3771 Board #218 June 3 8:00 AM - 9:30 AM

Effect Of A Trampoline Training Program In The Power Of Lower Limbs In Children's Gymnasts

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PURPOSE: The recreational and competitive practice of acrobatic sports, that is, trampoline, is growing rapidly around the world. The trampoline is a gymnastic implement used for learning acrobatic skills in children's gymnastics. However, few studies investigating its application for the development of the power of lower limbs. Thus, the aim of this study was to analyze the effect of an intervention program based on trampoline training on lower limbs in children's gymnasts.

METHODS: A total of 20 gymnasts children (age: 8.00±1.71 years) participated in the study. The power of lower limbs was evaluated before and after an intervention of 8 weeks (3 days/week, 1 h/session) based on training trampoline. Leg power was assessed by Bosco test with the battery Squat Jump (SJ) and Countermovement jump (CMJ) by jumping platform (Axon Jump, software 4.0). The jump time, jump height and speed takeoff were evaluated for both batteries jump. The technical implementation of vertical jump in trampoline was evaluated by scoring code of the International Federation of Trampoline (range of score from 0 to 10). The weight, height and the attendance during the intervention were also analyzed. Paired-samples

Student t-test was used for comparing the means of the normal study variables pre and post intervention. Wilcoxon test was used for non-normal variables. Statistical analysis was performed using SPSS (v.22, IBM, USA). The value of significance was p <0.05.

RESULTS: Post-intervention, SJ significantly increased the flight time (MD=39.2±17.19 ms; p<0.001) and the jump height (MD=4.22±1.88 cm, p<0.001). However, there were no significant differences post-intervention in the variable speed off in SJ. In the CMJ, the time of flight and jump height significantly increased (MD=41.8±25.97 ms; p<0.001; MD=4.88±3.13 cm; p<0.001, respectively). Moreover, the takeoff speed decreased significantly (MD=0.73±0.93 ms, p<0.01). There were no significant differences in the technical implementation of vertical jump in trampoline. **CONCLUSIONS:** An 8-weeks of trampoline training improved the power of the lower limbs in gymnasts children increasing the time of flight, height of jump in SJ, and all the variables studied in CMJ.

3772 Board #219 June 3 8:00 AM - 9:30 AM

A Comparison Of Aerobic And Anaerobic Power In High School Individual Sports Athletes

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The maximal oxygen consumption (VO_{2max}) and Wingate test are two of the most popular assessments for aerobic and anaerobic power, strongly associated with overall performance in athletes. **PURPOSE:** To assess differences by sport in VO_{2max} and Wingate peak power weight (WPPW) in middle and high school athletes of five team sports in South Korea. **METHODS:** The maximal oxygen consumption (ml·kg⁻¹·min⁻¹) and the anaerobic PPW (watts·kg) were evaluated in 163 players of swimming, track & field, shooting, golf, and wrestling (Age = 16.9 ± 1.2 years, BMI = 21.7 ± 1.9 kg·m⁻²; mean ±SD). All participants performed a treadmill maximal test using the Bruce protocol and the 30 second Wingate test using Inbar Wingate test protocol. Differences in VO_{2max} and WPPW among the sports were tested through one-way ANOVAs. Post-hoc multiple comparisons were made using Bonferroni tests. Linear associations of VO_{2max} and WPPW with age were also inspected by computing Pearson correlation coefficients. Statistical significance was determined at p<0.05. **RESULTS:** ANOVA showed statistically significant differences among the sports for WPPW and VO_{2max} (respectively: F(4, 158) = 3.25, p<0.013; F(4, 158) = 14.91, p < 0.001). In WPPW, multiple comparisons among the means showed three homogeneous subsets; 1) swimming (13.7 watts·kg) and Shooting (13.9 watts·kg), 2) Golf (14.7 watts·kg) and Track & Field (14.5 watts·kg), and 3) Wrestling (16.7 watts·kg). In VO_{2max}, multiple comparisons among the means also exposed three homogeneous subsets; 1) Track & Field (56.1 ml·kg⁻¹·min⁻¹) and Wrestling (56.9 ml·kg⁻¹·min⁻¹), 2) Golfer (44.6 ml·kg⁻¹·min⁻¹) and Shooting (46.7 ml·kg⁻¹·min⁻¹), and 3) Swimming (51.6 ml·kg⁻¹·min⁻¹). No correlations were found between Age and VO_{2max} and between Age and WPPW (respectively: -0.083, p=0.293; 0.52, p=0.513). **CONCLUSIONS:** The comparisons between sports that reached statistical significance evidenced differences was observed in several groups on VO_{2max}: 1) Wrestling and Golf (p=.001), 2) Wrestling and Shooting (p=.005), 3) Swimming and Golf (p=.001), 4) Shooting & Track & field (p=.001), 5) Track & field and Golf (p=.001). A similar tendency was observed in WPPW, except for the comparison between swimming and Wrestling. Age was poorly correlated to VO_{2max} and WPPW.

3773 Board #220 June 3 8:00 AM - 9:30 AM

Effect of Modified Tai Chi Exercise on Lower Extremity Muscle Strength and Proprioception among Chinese High School Students

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PURPOSE: The effect of Tai Chi exercise on muscle strength and proprioception among high school students has been well documented. The purpose of this study was to investigate the effect of a modified Tai Chi intervention on lower extremity muscle strength and proprioception among high school students.

METHODS: Sixth male and sixty female healthy high school students aged 16-18 years participated in the Tai Chi intervention. The participants were randomly assigned to four groups with 30 per group: the male experimental group (MEG); female experimental group (FEG); male control group (MCG) and female control group (FCG). The experimental groups received the Tai Chi intervention for 20 weeks, 5

days a week and 40 minutes/day. The control groups did not do any exercises. Lower extremity muscle strength (LEMS) of squat, proprioception of ankle inversion (PAI), proprioception of ankle eversion (PAE), proprioception of knee flexion (PKF) and proprioception of knee extension (PKE) were measured at the beginning, at the end of 10th week and the end of 20th week. The proprioception reflected the sensitivity of joint angle changed. One-way ANOVA was used to determine the differences ($p < .05$) between four groups, and repeated ANOVA was employed to examine the differences within the groups over the course of the intervention ($p < .05$).

RESULTS: The results indicated that at the end of 20th week, the MEG had a significantly more increment than MCG did in LEMS (62.12 ± 5.11 vs 53.15 ± 5.78 kg, $p < .05$), and the similar trend was found between the FEG and the FCG on LEMS; the MEG had a significantly better proprioception (PAI & PAE) than the MCG did (PAI: 2.93 ± 0.92 vs 5.81 ± 0.99 deg, $p < .05$; PAE: 2.98 ± 1.04 vs 5.70 ± 1.01 deg, $p < .05$), and the similar trend was observed between FEG and FCG on PAI and PAE; the MEG also showed a significantly better proprioception (PKF & PKE) than the MCG did (PKF: 0.99 ± 0.49 vs 2.69 ± 0.51 deg, $p < .01$; PKE: 0.75 ± 0.51 vs 2.05 ± 0.51 deg, $p < .05$), and the similar trend was discovered between the FEG and FCG on PKF and PKE.

CONCLUSIONS: The modified Tai Chi exercises may improve high school students' lower extremity muscle strength and proprioception at the ankle and knee joints. This modified Tai Chi exercise may be used as an optional exercise for high school students in China.

Supported by Chinese General Administration of Sport 2013B034

G-36 Free Communication/Poster - Late-Breaking Abstracts

Saturday, June 3, 2017, 7:30 AM - 11:00 AM

Room: Hall F

3774 Board #221 June 3 9:30 AM - 11:00 AM The Effects Of Myplate And Paleolithic-based Diets Recommendations, With And Without Exercise, In Women.

Collin Popp, Michelle Bohan Brown, William Bridges, Elliot Jesch. *Clemson University, Clemson, SC.*

(No relationships reported)

A Randomized Clinical Trial on the Effects of MyPlate and Paleolithic-based Diet Recommendations, Both with and without Exercise, on Aerobic Fitness, Muscular Strength and Anaerobic Power in Young, Healthy Women.

Collin Popp¹, Michelle Bohan Brown¹, William C Bridges², Elliot D Jesch¹

¹Clemson University, Department of Food, Nutrition and Packaging Sciences, College of Agriculture, Forestry & Life Sciences, Clemson, SC, USA

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Objective: To determine and compare the effects of MyPlate and Paleolithic-based diet recommendations when combined with and without exercise on aerobic fitness, strength and anaerobic power in healthy, adult women over 8 weeks.

Methods: Participants ($n=20$) were randomized to one of four groups, (1) a MyPlate (MP) diet, (2) Paleolithic-based diet (PD), (3) MyPlate and exercise (MP + Ex) and (4) Paleolithic-based diet and exercise (PD + Ex). The unsupervised exercise recommendation included two days of aerobic exercise and two days of resistance exercise every week at the university recreation center. At baseline and final a graded treadmill test was performed to determine absolute and relative peak oxygen consumption ($\text{abs}\dot{V}O_{2p}$ and $\text{rel}\dot{V}O_{2p}$) and Wingate test were used to determine peak power (PP) and relative peak power (RPP). Leg press and chest press machines were used to estimate upper body (CP1RM), and lower body (LP1RM) strength. Data were analyzed using repeated measures two-way analysis of variance.

Results: The ANOVA indicated that there was no significant interaction between time point (TP)*diet (D)*exercise (Ex) for $\text{abs}\dot{V}O_{2p}$ ($p = 0.093$), strength (CP1RM ($p = 0.753$), LP1RM ($p = 0.427$), PP ($p = 0.732$), RPP ($p = 0.498$)). Based on the ANOVA there was a significant three-way interaction of TP*D*Ex for $\Delta\text{rel}\dot{V}O_{2p}$ ($p = 0.016$) as the MP + Ex group ($\Delta + 4.4 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) had a greater change from baseline compared to the MP group ($\Delta - 2.7 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, ($p = 0.002$)), and PD + Ex group ($\Delta - 0.3 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, ($p = 0.03$)).

Conclusions: MP recommendations when combined with two days of aerobic and two days of resistance exercise are effective at improving aerobic fitness when compared to PD recommendations in young, sedentary women.

3775 Board #222 June 3 9:30 AM - 11:00 AM

Asymmetries In Slowed On-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ Kinetics Are Not A Consequence Of Age In HFpEF

Erik H. Van Iterson, Hector R. Villarraga, Lara F. Nhola, Carolyn M. Larsen, Benjamin S. Simmons, Eric J. Bruhn, Thomas P. Olson, FACSM. *Mayo Clinic, Rochester, MN.*

(No relationships reported)

PURPOSE: Aging, increased ventilation (\dot{V}_{E-}), and reduced pulmonary oxygen uptake ($\dot{V}O_{2-}$) during exercise are hallmark features of heart failure with preserved ejection fraction (HFpEF). The pathophysiology of increased \dot{V}_{E-} and reduced $\dot{V}O_{2-}$ linked to exercise intolerance remains unclear in HFpEF. Aging is associated with prolonged exercise on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ kinetics suggesting abnormal integrated cardiopulmonary and skeletal muscle function. This study aimed to test whether the continuous effect of age explains on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ kinetics in HFpEF during submaximal ergometry.

METHODS: Sixteen HFpEF (age: mean = 69 ± 7 , range = 55-83 years; BMI = 30 ± 4 kg/m²) performed 2 transients of 6 min fixed-load (20 W) square-wave ergometry at 65 rpm transitioning from rest. Breath-by-breath \dot{V}_{E-} and $\dot{V}O_{2-}$ were measured via open-circuit metabolic system. Raw data were linear interpolated to 1 s intervals and time-aligned for ensemble averaging across transients into 10 s bins for analyses. Excluding the cardiodynamic phase (35 s), Phase II on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ kinetics were assessed via single exponential models as, $Y_{b+A_1}[1 - e^{-(t-TD)^{\tau}}]$, where, Y_b = rest; A_1 = steady-state increase in \dot{V}_{E-} or $\dot{V}O_{2-}$ above rest; TD = time delay; τ = time constant.

RESULTS: Resting \dot{V}_{E-} and $\dot{V}O_{2-}$ were 12 ± 1 and 0.36 ± 0.06 L/min, respectively. Phase II $\tau\dot{V}_{E-}$ and $\tau\dot{V}O_{2-}$ were 81 ± 40 and 49 ± 23 s, respectively, whereas TD were -4 ± 23 and 23 ± 6 s, respectively. A_1 for \dot{V}_{E-} and $\dot{V}O_{2-}$ were 13 ± 2 and 0.46 ± 0.08 L/min, respectively. Linear regressions (R^2) between age and $\tau\dot{V}_{E-}$ or $\tau\dot{V}O_{2-}$ were 0.01 and 0.12, respectively (both $P > 0.05$). In contrast, R^2 between $\tau\dot{V}_{E-}$ or $\tau\dot{V}O_{2-}$ with A_1 for \dot{V}_{E-} or $\dot{V}O_{2-}$ were 0.38 ($P = 0.02$) or 0.02 ($P = 0.66$), respectively. Lastly, R^2 between $\tau\dot{V}_{E-}$ and $\tau\dot{V}O_{2-}$ was 0.28 ($P = 0.04$).

CONCLUSIONS: These data suggest that the continuous effects of aging cannot explain prolonged on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ kinetics in HFpEF. However, unique to on-transient \dot{V}_{E-} kinetics, prolonged $\tau\dot{V}_{E-}$ explained the variance in slowed $\tau\dot{V}O_{2-}$ and the increased rise in A_1 for \dot{V}_{E-} . These interactions between on-transient \dot{V}_{E-} and $\dot{V}O_{2-}$ kinetics suggest calibration between pathophysiology at both skeletal muscle and cardiopulmonary levels contributing to exercise intolerance in HFpEF.

Funding: AHA 16POST30260021 (EHV), NIH RO1-HL126638 (TPO).

3776 Board #223 June 3 9:30 AM - 11:00 AM

Effect Of Ankle Plantar Flexion On ACL Strain During Landing From A Jump

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(No relationships reported)

Injuries to the Anterior Cruciate Ligament (ACL) are one of the most common injuries in athletic activities. Landing from a jump is one of the leading athletic activities associated with ACL injuries. Researchers have postulated that landing flat footed (hill contact) is a more detrimental landing posture to ACL health than landing on toes (or ball of foot). In this research, a novel hybrid robotic system utilizing cadaveric legs (six inches above the knee joint to the toes) was designed to simulate lower extremity biomechanics. The robotic system has the ability to raise a cadaveric leg with pre-applied muscle forces and instrumented ACL to a desired height and drop it onto a force plate. Because we have full access to the foot and ankle joint, tests were performed to determine the impact of flat footed versus plantar flexed landing at various hip and knee flexion angles. **PURPOSE:** To compare the strain of the ACL during a one inch jump landing with foot in a toe down, plantar flexion position versus flat footed, with foot parallel to contact surface. **METHODS:** Four cadaveric knees were tested using a hybrid biomechanical device designed to simulate athletic activities such as landing from a jump, or a plant and cut movement. The cadaveric knees were attached to the device by insertion of a threaded rod implanted into the femur. Quadriceps and Hamstring (Q/H) forces were applied by the use of linear pull cables attached to the associated muscle group. Hip flexion angle was controlled allowing comparison of ACL strain at different degrees of hip flexion during flat-footed and plantar flexed landing scenarios. ACL deformation, Ground Reaction Force (GRF), Q/H forces, and Hip Flexion/Extension were measured across all tests. Data was post-processed using MATLAB to find maximum GRF, ACL deformation during impact, and associated muscle forces. T tests were performed comparing ACL strain of flat-footed vs. plantar-flexed landings. **RESULTS:** ACL strain of flat footed landings at all hip flexion angles were significantly higher than the plantar flexed tests ($p = 0.0019$). **CONCLUSION:** Our results indicate that landing from a jump with the foot plantar flexed lowers the strain on the ACL compared to a flat footed jump landing. The main reason for this could be the shock absorbing role of the ankle and foot ligaments during the plantar flexed landings.

3777 Board #224 June 3 9:30 AM - 11:00 AM
Acute Aerobic Exercise Stimulates ATP Production Rate Similarly in Subsarcolemmal and Intermembranar Muscle Mitochondria in Humans

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 (No relationships reported)

Purpose: Mitochondria (MITO) in skeletal muscle are organized in reticulum extending from the subsarcolemmal region (SS MITO) to the intermembranar region (IMF MITO). Animal studies suggest that SS MITO are more responsive to physiological stimuli. The purpose of these studies was to assess whether similar responses are observed in humans that vary in age and obesity status, and specifically with respect to maximal ATP production rate (MAPR).

Methods: Twelve healthy subjects (gender, 7M/5F; age, 19-50 years; BMI, 19-40 kg/m², body fat, 12-42%) had muscle biopsies performed before and 3 hours after 45 min of cycling at 65% VO₂max. SS and IMF MITO were isolated using standard procedures. MAPR in the isolated mitochondria was measured by firefly-luciferase assay, and using the following substrates: Malate+Pyruvate+Glutamate (MPG; complex I activity), Succinate (complex II activity), malate-palmitoyl carnitine (M+PC; fat substrate). Insulin sensitivity of the subjects was evaluated from an oral glucose tolerance test (i.e., Matsuda index), and body composition was determined by bioelectrical impedance analysis.

Results: Insulin sensitivity index ranged from 2.7 to 29.0, and did not correlate with either SS or IMF MAPR ($P > 0.05$). MAPR increased after exercise in both SS MITO (MPG substrate: 322±38 vs 449±40; nmol ATP/min/mg protein) and IMF MITO (MPG substrate: 259±44 vs 427±61; nmol ATP/min/mg protein) (for both $P < 0.05$), and the exercise-induced delta change in MAPR was not different between SS MITO and IMF MITO ($P > 0.05$). Similar results were obtained with the other two substrates. The change in MAPR did not correlate with age, percent body fat, or insulin sensitivity in either SS or IMF MITO ($P > 0.05$). However, this change in MAPR with exercise was inversely correlated with the basal MAPR in the SS MITO for both the MPG (Pearson's $r = -0.60$; $P < 0.05$) and Succinate (Pearson's $r = -0.76$; $P < 0.01$) substrates, but not the M+PC substrate. No such correlations were observed in the IMF MITO ($P > 0.05$).

Conclusions: Acute aerobic exercise stimulates both SS and IMF MITO MAPR in humans. The improvement in mitochondria function is not lower in relation to older age or obesity status. However, the magnitude of the stimulation of MAPR by exercise is lower in SS MITO exhibiting the greatest MAPR prior to the exercise stimulus.

3778 Board #225 June 3 9:30 AM - 11:00 AM
Acute Exercise Increases STARS mRNA in Human Skeletal Muscle

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 (No relationships reported)

Striated Activator of Rho Signaling (STARS) has recently been proposed as link between external stimuli and cellular responses in the adaptation to physical activity. This actin-binding protein is localized in the sarcomere and has been previously shown to modulate Serum Response Factor (SRF) activity which activates transcription of factors important in muscle growth and metabolism. STARS has also been linked to PGC-1 α and ERR α gene expression changes and protein interactions. However, the context and regulation of STARS is still unclear. **Purpose:** To determine how a single bout of physical activity influences STARS mRNA expression over a 24-hour time course. **Methods:** 20 untrained subjects (male and female; aged 20-35) were randomized to either 60 minutes of endurance exercise on a cycle ergometer (20 min at 50% VO₂max + 40 minutes at 65% VO₂max) or no exercise. Muscle biopsies were taken from *M. vastus lateralis* at rest and 30 minutes, 2h, 6h and 24hrs after the end of exercise. cDNA was extracted and gene expression analysed. Fold induction was statistically analysed by ANOVA. **Results:** Exercise induced a significantly higher STARS gene expression increase compared to control ($p=0.048$). Furthermore, after an initial upregulation at 30 minutes (2.8-fold ± 0.5), a time-dependent decrease in expression could be observed at 2h (2.1-fold ± 0.34), 6h (1.4-fold ± 0.38) until baseline was reached after 24hrs. **Conclusion:** Acute endurance exercise upregulates STARS mRNA expression in a time-dependent manner. These data strengthen the possible role of STARS as an important player in the regulation of muscle growth and metabolism.

3779 Board #226 June 3 9:30 AM - 11:00 AM
Occupational And Leisure-time Physical Activity And Risk Of Disability Pension: Prospective Data From The Hunt Study, Norway

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 (No relationships reported)

PURPOSE: To prospectively investigate 1) the association between occupational physical activity (OPA) and disability pension, and 2) the combined association of OPA and leisure-time physical activity (LTPA) with disability pension in a large population-based cohort. **METHODS:** Data on 32 362 persons aged 20-65 years in the Norwegian HUNT2 study (1995-1997) were linked to the National insurance database. To reduce possible reverse causality, we excluded the two first years of follow-up. Cox regression with 95% confidence intervals (CI) were estimated.

RESULTS: Throughout a median follow-up period of 9.3 years and 265 592 person years, a total of 1 574 men (10%) and 2 263 women (13%) received disability pension. Both men and women who reported much walking in their jobs had increased risk of disability pension (adjusted hazard ratio [HR] for men: 1.26, 95% CI 1.09-1.45; women: 1.27, 95% CI 1.13-1.42). The risks were even higher for men and women who performed much walking and lifting (men: 1.46, 95% CI 1.26-1.70; women: 1.41, 95% CI 1.26-1.58) or had heavy physical work (men: 1.48, 95% CI 1.28-1.70; women: 1.42, 95% CI 1.13-1.77). Relative to the reference group with sedentary OPA and were active during leisure-time, all other groups had higher risk of disability pension. The combination of high OPA and being inactive during leisure-time was associated with the highest risk of disability pension (HR: 1.77, 95% CI 1.58-1.98). Several sensitivity analyses corroborated the results.

CONCLUSIONS: We observed a strong positive association between OPA and risk of disability pension, whereas physical activity during leisure-time reduced some, but not all of the unfavorable effect of physically demanding work on risk of disability pension. It could be useful to incorporate policies to reduce the negative health impact of occupational physical activity, as well as encouraging leisure-time physical activity, to reduce work disability.

3780 Board #227 June 3 9:30 AM - 11:00 AM
Physical Activity Level and Androgen Concentrations are Independently and Additively Associated with Cardiovascular Disease Risk in Men.

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 (No relationships reported)

Purpose

Male ageing is associated with increased incidence of cardiovascular disease (CVD) and lower circulating testosterone (T). However, whether physical activity (PA) interacts with hormones to modify CVD risk is unclear. We assessed whether PA and sex hormone concentrations were independently associated with measures of CVD risk in 1649 men.

Methods

Leisure, home, work and total PA were ascertained via questionnaire. At baseline, serum T, dihydrotestosterone (DHT) and estradiol (E2) were assayed. Men were stratified into high PA+high hormone (H/H); low PA+high hormone (L/H); high PA+low hormone (H/L) and low PA+low hormone (L/L) groups.

Results

Mean age was 49.8 years at outset with 415 CVD events and 127 CVD deaths occurring during 20-year follow-up. Men with higher PA and higher T or DHT had lower odds of metabolic syndrome (leisure H/H vs L/L odds ratio [OR] 0.17 $p < 0.001$ for T, 0.26 $p < 0.001$ for DHT). Men with higher PA and E2 had lower risk of metabolic syndrome (leisure PA H/H vs L/L OR 0.51, $p = 0.001$). Men with higher leisure PA and higher DHT had the lowest risk of CVD events (H/H hazard ratio [HR] 0.72 vs L/L, $p = 0.016$) and CVD death (H/H HR 0.52 vs L/L, $p = 0.015$). Men with low leisure PA and higher E2 were at greater risk of CVD death (L/H vs L/L HR 1.67, $p = 0.022$).

Conclusions

Considering PA levels in the context of T, DHT and E2 better informs consideration of cardiovascular risk. A 2x2 factorial RCT assessing PA and T would illuminate the scope for preventing CVD in men.

3781 Board #228 June 3 9:30 AM - 11:00 AM
Building Healthy Communities: A Comprehensive School Health Program to Prevent Chronic Disease
 Erin E. Centeio¹, Nate McCaughtry¹, Whitney Moore¹, Alex Garn², Mariane Fahlman, FACSM¹, Jeffrey Martin¹, Noel Kulik¹. ¹Wayne State University, Detroit, MI. ²Louisiana State University, Baton Rouge, LA.
 (No relationships reported)

INTRODUCTION: Obesity among children is highly prevalent and can lead to risk factors for chronic disease in adulthood. The Institute of Medicine and Centers for Disease Control and Prevention have called on schools to play a larger role by increasing children's physical activity (PA) and nutrition by adopting an overall culture of health.

PURPOSE: This study examined the impact of a socioecological theory driven school-wide nutrition and PA intervention on 5th graders' central adiposity as a primary predictor of chronic disease.

METHODS: Four treatment and two control schools, including 628 (377 treatment, 251 control) 5th grade children participated in the study. Over eight months, children in the treatment schools participated in a comprehensive healthy school transformation program consisting of six components: 1) principal messaging and engagement, 2) classroom nutrition and physical activity lessons, 3) active recess, 4) quality physical education, 5) student leadership teams, and 6) after-school healthy kids clubs. Trained research assistants privately measured height, body weight, and waist circumference. Waist-to-Height Ratio (WHtR) was calculated and used as the measure of obesity. Missingness of data ranged from 0.40% to 15.40%. To reduce parameter estimate bias, as well as improve generalizability and power (Enders, 2010) the full pre-post dataset was imputed ($m = 100$) at the item level.

RESULTS: An ANCOVA controlled for differences between the treatment and control groups at time one. While controlling for age, gender, and race, the ANCOVA revealed a significant difference in WHtR among treatment and control groups at time two (T2) $F_{M1}(24.61, 63.08) = 4.59, p < .001, R^2_{\text{Treatment}} = 0.01$. There were no significant differences in T2 WHtR based on age $F_{M1}(0.02, 63.08) = 0.44, p > .05$, gender $F_{M1}(0.03, 63.08) = 0.001, p > .05$, and race $F_{M1}(0.15, 63.08) = 0.02, p > .05$. A total of 64% of T2 WHtR variance was accounted for by this model.

CONCLUSIONS: The healthy school intervention led to significant differences in central adiposity (obesity) levels, regardless of age, gender, or race, across the 8-month program between 5th grade children in treatment and non-treatment schools. This supports the ability of schoolwide programs to significantly and positively impact student health and chronic disease prevention.

3782 Board #229 June 3 9:30 AM - 11:00 AM
Effects Of Exercise Training And Increasing Non-exercise Physical Activity On Cardiometabolic Risk Factors: Results From The I-can Study
 Damon L. Swift¹, Lesley D. Lutes², Tyara R. Nevels¹, Patricia M. Brophy¹, Chelsey A. Solar¹, Joeseeph D. Houmar, FACSM¹. ¹East Carolina University, Greenville, NC. ²University of British Columbia Okanagan, Kelowna, BC, Canada.
 (No relationships reported)

PURPOSE: Exercise training has known cardiovascular benefits, however little data exists on the potential additive effects of exercise training combined with increasing non-exercise physical activity on cardiometabolic risk factors, especially in a long duration intervention. **METHODS:** We randomized obese adults (N=45) to one of 3 groups: 1) aerobic training (AERO); 2) aerobic training and increasing non-exercise physical activity (AERO-PA) or; 3) a control group for 6 months. Both the AERO and AERO-PA groups participated in aerobic training at 50-75% $\dot{V}O_2$ max at a dose of 12 kcal/kg/week. In addition to exercise training, the AERO-PA group participated in behavioral coaching sessions to determine strategies to increase non-exercise physical activity levels (measured via accelerometer) by 3,000 steps/day. The main outcome of the trial was waist circumference. Secondary outcomes included fitness ($\dot{V}O_2$ max), body composition (dual-energy X-ray absorptiometry), and insulin action (oral glucose tolerance test). **RESULTS:** The study population had a mean (SD) age of 52.6 (7.6) yrs., body mass index of 36.0 kg/m² (4.8) and a physical activity level of 4635.6 (1242.7) steps/day at baseline. A significant higher steps/day was observed in the AERO-PA group (7216.6) compared to the AERO (5662.3, $p=0.007$) or CON (5330.3, $p=0.029$). Intent to treat analyses revealed significant changes in absolute $\dot{V}O_2$ max (0.28 vs. 0.09 L/min), relative $\dot{V}O_2$ max (3.8 vs. 0.91 ml/kg/min) and estimated maximal METs (Est METs) (1.2 vs. 0.52 METs) in the AERO-PA compared to the AERO group (all $p < 0.05$). No effects were observed for waist circumference, body mass, body composition, or insulin action variables. Person correlations showed that change in steps during the intervention in exercisers were associated with improvements in Est METs ($r=0.54, p=0.007$), body weight ($r=-0.43, p=0.03$), waist circumference ($r=-0.54, p=0.005$) and approached significance for body fat ($r=-0.40, p=0.054$). **CONCLUSIONS:** Exercise training and increasing non-exercise physical activity resulted in a greater improvement in fitness compared to aerobic training alone

($\Delta 0.71$ METs), which may be clinically important based on epidemiological data. In addition, higher step levels outside of exercise are supportive for improvements in body composition.

3783 Board #230 June 3 9:30 AM - 11:00 AM
Winning off the Field: The Role of High School Sports Participation in College Physical Activity
 Fiona M. Asigbee¹, LaShaune P. Johnson², Jaimie N. Davis¹. ¹University of Texas at Austin, Austin, TX. ²Creighton University, Omaha, NE.
 (No relationships reported)

PURPOSE: To examine the role of High School (HS) sport participation and specific HS sport involvement on college physical activity (PA) levels.

METHODS: A cross-sectional cohort of 1,339 traditional, full-time degree seeking undergraduate students completed *The High School Physical Activity and College Health Behaviors Survey* (HSPA & CB) survey, consisting of 80-items, to assess health behaviors, including PA levels and HS sport participation. The relationship between HS sport participation (grouped as quintiles) and the likelihood of meeting the Centers for Disease Control and Prevention (CDC) recommendations for PA—number of days of aerobic activity and strength activity—was accessed using logistic regression. ANCOVAs were used to determine if the number of HS sport (in quintiles) was related to the number of days involved in aerobic and strengthening activities.

RESULTS: Results showed that the sum of all sports for all four years of HS was a significant predictor of the likelihood of meeting the CDC recommendations for number of days involved in aerobic (OR=1.08; 95%CI 1.04-1.13; $p < 0.001$), and strength (OR=1.11; 95%CI 1.07-1.16; $p < 0.001$) activities as college adults. Findings were also significant for the number of days involved in aerobic and strength activities for specific HS sports. When compared to other HS sports (competitive dance: 3.04 \pm 0.20 days, cross country: 3.49 \pm 0.31 days, football: 3.06 \pm 0.22 days, soccer: 2.90 \pm 0.17 days, and group "other": 3.48 \pm 0.40 days), HS cheerleaders (1.83 \pm 0.22 days) had lower aerobic and strength activity in college. HS volleyball and softball players (0.88 \pm 0.8 days; 0.86 \pm 0.11 days) had less strength activity in college, compared to other HS sports (baseball: 1.44 \pm 0.11 days, hockey and field hockey: 1.51 \pm 0.14 days, football: 1.52 \pm 0.09 days, and the group "other": 1.59 \pm 0.17 days).

CONCLUSION: Current findings support a strong connection between HS sport involvement and its lasting effects on college PA levels.

3784 Board #231 June 3 9:30 AM - 11:00 AM
Does The Aging Process Influence The Agility Performance In Old People?

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Biomedical Research Centre in Physiopathology of Obesity and Nutrition (CIBEROBn)-AgriFood Institute of Aragon (IA2)-Faculty of Health and Sport Sciences (FCSD), Zaragoza, Spain. (No relationships reported)

There is an association between agility and some neuromuscular functions such as perception capability and decision making. The maintenance of agility across the longevity process will increase the functional independence in old people over 65 years.

PURPOSE: To test the evolution of agility capability across the aging process in seniors aged over 65 years. **METHODS:** In this longitudinal study 152 participants (32 men and 120 women; 70.9 ± 4.5 years) were evaluated in Aragon (Spain) within the framework of the *elderly EXERNET* multi-center study. Agility was measured in all participants using the 8-foot up-and-go test (Senior Fitness Test Battery). The time (seconds) required to get up from a seated position, walk 2.45 m, turn and return to a seated position was registered. The test was performed twice, with at least one minute of rest between repetitions. The best result was recorded. The measurements were registered in 2008-2009 and eight years later, in 2016-2017. A 2-way repeated measures ANOVA test was used to evaluate the changes in this parameter. The sample was divided into three groups (group 1: ≤ 74 years old; group 2: 75-84 years old; group 3: ≥ 85 years old) to observe if there were differences between ages. As no sex-by-time interactions were found, analyses were performed including men and women as a whole group. **RESULTS:** Significant decreases in agility between both measures (5.1 ± 1.9 s vs. 6.4 ± 0.9 s; $p < 0.001$) were found. The average percentage of change during the follow-up was 24%. However, the oldest group showed a larger increase in agility in the 8-year follow-up than the younger groups (12%, 23%, 50%, groups 1, 2 and 3, respectively; $p < 0.001$ between youngest and oldest group). **CONCLUSION:** Agility constantly decreases across the aging process, being this decrease more pronounced after the age of 85. Physical fitness interventions for elderly people should include aspects of agility training in order to increase functional independence and quality of life.

Supported by Ministerio de Trabajo y Asuntos Sociales (104/07), University of Zaragoza (UZ 2008-BIO-01), Centro Universitario de la Defensa (UZCUD2016-BIO-01), Ministerio de Economía y Competitividad (DEP 2016-78309-R) and FEDER funds.

3785 Board #232 June 3 9:30 AM - 11:00 AM

Physical Activity among Navajo Cancer Survivors: A Qualitative Study

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(No relationships reported)

PURPOSE: Physical activity (PA) may improve quality of life and survival among cancer survivors, however, little is known about Navajo cancer survivor PA. We sought to understand Navajo cancer survivor PA habits, perceptions, barriers, and preferences. **METHODS:** Focus groups (N=5 groups, 19 individuals) and individual interviews (N=13) were conducted by a bilingual facilitator using a standardized guide. Discussions were recorded, transcribed and translated. NVivo software was used to summarize major themes. **RESULTS:** Participants were male (N=13) and female (N=19) Navajo cancer survivors (31% breast, 31% colorectal, or other). Treatment side effects reduced PA during and after treatment. However, most reported at least one mode of current PA (N=24; 71% walking). Work and homestead related PA was a common necessity (46%). Cancer survivor PA recommendations were largely unknown, though many survivors understood the benefits of PA and valued resilience, social support, movement, and life balance. Limited access to recreational PA opportunities was cited as a barrier. Fear of "over doing it" and family/friends encouraging rest also limited PA. Preferences for PA programming varied by individual. **CONCLUSION:** In this first qualitative inquiry of PA among Navajo cancer survivors we found that PA education is needed and varied PA opportunities are desired.

3786 Board #233 June 3 9:30 AM - 11:00 AM

The Association Of Leptin With Unique Measures Of Body Composition Distribution In Exercising Women

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(No relationships reported)

Women with functional hypothalamic amenorrhea (FHA) present with suppressed systemic leptin, a signal of nutritional status. Unique measures of regional body composition that reflect subcutaneous (leg and gynoid) versus visceral (trunk and android) fat have varying impacts on leptin. The relationship between leptin and these unique measures has not yet been explored in exercising women with varying menstrual status.

ACSM May 30 – June 3, 2017

Purpose: To examine the relationship between systemic leptin concentration and unique measures of body composition distribution in exercising women with FHA and ovulatory menstrual cycles.

Methods: Leptin and body composition were assessed in exercising women with ovulatory cycles (OV, n=22) and with FHA (AMEN, n=17). Leptin was measured by immunoassay and trunk, leg, android, and gynoid percent fat were measured by DXA with the ratios of trunk/leg (T/L%R) and android/gynoid (A/G%R) fat % calculated. Student t-tests were used to compare demographics. Pearson and Spearman correlations were used to determine associations between leptin and unique body composition variables.

Results: There were no differences between the groups with respect to age, height, weight, BMI, or body fat % ($p > 0.05$). Log leptin was significantly correlated with leg (OV: $r = 0.794$, $p < 0.001$; AMEN: $r = 0.647$, $p = 0.005$), trunk (OV: $r = 0.679$, $p = 0.001$; AMEN: $r = 0.757$, $p < 0.001$), android (OV: $r = 0.673$, $p = 0.001$; AMEN: $r = 0.779$, $p < 0.001$), and gynoid (OV: $r = 0.822$, $p < 0.001$; AMEN: $r = 0.617$, $p = 0.008$) % fat in both groups. AMEN log leptin was significantly correlated with T/L%R ($r = 0.490$, $p = 0.046$) and A/G%R ($r = 0.735$, $p = 0.001$). The regions of strongest association differed between OV and AMEN with a stronger relationship in OV between log leptin and leg and gynoid % fat, whereas in AMEN log leptin was more strongly related to trunk and android % fat.

Conclusion: Ratios of T/L%R and A/G%R were significantly related to leptin concentration in AMEN and body fat distribution measures were related in both groups. Regions of body composition reflecting subcutaneous fat have a greater influence on systemic leptin concentration than regions reflecting visceral fat indicating that the site distribution of adiposity may be more important for systemic leptin than traditional measures of total fat mass and the association may reflect menstrual status.

3787 Board #234 June 3 9:30 AM - 11:00 AM

Dietary Nitrate and Muscle Power with Aging

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(No relationships reported)

Reductions in muscle speed and power are highly predictive of disability, institutionalization, and mortality in the elderly. We have recently demonstrated that ingestion of dietary nitrate (NO_3^-), a source of nitric oxide (NO), increases maximal muscle speed and hence power in healthy younger individuals, in athletes, and especially in patients with heart failure (HF). **PURPOSE** The purpose of the present study was to determine whether dietary NO_3^- improves muscle contractile function in older people, another population (like HF patients) in whom NO production is reduced. **METHODS** Six healthy older subjects (5 men, 1 woman; age 73 ± 6 y, height 1.74 ± 0.10 m, mass 82.4 ± 12.1 kg) were studied using a randomized, double-blind, placebo-controlled, crossover design. On one occasion, subjects were tested 2 h after ingesting a concentrated beetroot juice (BRJ) supplement containing 11.2 mmol NO_3^- . On another, they were tested 2 h after ingesting BRJ depleted of NO_3^- (placebo). Breath NO was measured periodically, and maximal knee extensor force (torque), speed, and power were assessed using a Biodex 4 isokinetic dynamometer. **RESULTS** Dietary NO_3^- ingestion increased breath NO levels, a marker of whole-body NO bioavailability, from 27 ± 10 to 51 ± 26 ppb ($P < 0.05$). On average, this resulted in an increase in the maximal velocity of knee extension of 10% (i.e., from 9.81 ± 1.38 to 10.75 ± 2.42 rad/s), but this difference only approached statistical significance (i.e., $P = 0.13$). On the other hand, maximal knee extensor power did not differ between the NO_3^- and placebo trials (i.e., 4.16 ± 1.18 vs. 4.08 ± 1.22 W/kg; $P = 0.47$). This lack of difference, however, seemed to be due to an inadequate dose of NO_3^- in some subjects, as the relative increase in maximal power was correlated (i.e., $r = 0.78$; $P < 0.05$) with the amount of NO_3^- ingested per kilogram of body mass. In keeping with this conclusion, maximal power increased ($P < 0.05$) by $6.4 \pm 3.9\%$ in the four subjects who ingested > 125 mmol/kg of NO_3^- , but did not improve in the two subjects who ingested less. **CONCLUSION** Acute dietary NO_3^- supplementation appears to improve muscle contractile function in healthy elderly individuals, but only when provided at a dose of > 125 mmol/kg of NO_3^- . The optimal dose of dietary NO_3^- for improving muscle speed and power in older (or younger) persons remains to be determined.

3788 Board #235 June 3 9:30 AM - 11:00 AM

Effect Of Dietary Nitrate Supplementation On The Development Of Neuromuscular Fatigue During Whole Body Exercise

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(No relationships reported)

PURPOSE: To investigate the effect of dietary nitrate supplementation on the development of neuromuscular fatigue during whole body exercise. **METHODS:**

Denver, Colorado

Three healthy, recreationally active males (30 ± 1 yrs) performed fatiguing, constant-load cycling exercise ($80\% W_{peak}$, 243 ± 12 W) following three days of dietary nitrate supplementation (DNS) or a nitrate-stripped placebo (PLA). PLA exercise was performed to task failure, with DNS exercise time matched to that which was achieved during PLA exercise. General quadriceps fatigue was quantified as the pre- to post-exercise decrement in maximal voluntary contraction torque (ΔMVC). Peripheral and central fatigue were quantified as the pre- to post-exercise changes in quadriceps twitch torque (ΔQ_{tw} ; supramaximal electrical femoral nerve stimulation) and voluntary activation (ΔVA), respectively. Prior to each trial, femoral arterial blood flow (Doppler ultrasound, common femoral artery) was quantified during cycling exercise at 50, 75, and 100 W (4 min each). Heart rate, ventilation, and pulmonary gas exchange were recorded throughout exercise. **RESULTS:** Femoral arterial blood flow was similar between conditions at baseline (~ 0.3 L \cdot min $^{-1}$) and all 3 workloads (~ 1.9 , ~ 2.4 , ~ 2.8 L \cdot min $^{-1}$ during cycling exercise at 50, 75, and 100 W, respectively). Furthermore, heart rate (~ 185 BPM), minute ventilation (~ 146 L \cdot min $^{-1}$), O_2 consumption (~ 3.1 L \cdot min $^{-1}$), and CO_2 production (~ 3.4 L \cdot min $^{-1}$) during the final minute of exercise were similar between trials. While nitrate supplementation had no effect on ΔMVC ($\sim 14\%$) and ΔVA ($\sim 4\%$), ΔQ_{tw} was significantly lower in DNS compared to PLA ($-35 \pm 2\%$ vs $-41 \pm 7\%$, respectively). **CONCLUSION:** Dietary nitrate supplementation attenuates the development of peripheral fatigue during whole body exercise. As the treatment did not alter the cardiopulmonary response and bulk locomotor muscle blood flow during cycling exercise, this ergogenic effect is likely determined by intramuscular and/or intracellular mechanisms. Finally, the observed attenuation of peripheral fatigue during endurance exercise might contribute to the documented performance enhancement previously reported with DNS.

3789 Board #236 June 3 9:30 AM - 11:00 AM
Efficacy of a Personalized Hydration Plan on Repeated Countermovement Jump Performance after Exercise-Heat Stress

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 (No relationships reported)

Exercise-induced hyperthermia, dehydration, and fatigue independently impair anaerobic power production, but any synergistic effect on anaerobic power is less known. Further, the efficacy of a personalized hydration plan in maintaining anaerobic power after exercise-heat stress is unclear.

Purpose: To evaluate the effect of exercise-induced hyperthermia, dehydration, and fatigue on anaerobic power during a 20-second repeated countermovement jump (CMJ). Secondly, to assess the efficacy of a personalized hydration plan in maintaining anaerobic power during CMJ after exercise-heat stress. **Methods:** Five males (age: 25.4 ± 5.7 y; height: 175.4 ± 8.2 cm; weight: 78.7 ± 16.8 kg; VO_{2max} : 60.1 ± 6.1 mL \cdot kg $^{-1}\cdot$ min $^{-1}$) completed 50-90 min of exercise in warm conditions (wet bulb globe temperature: $27.0 \pm 2.24^\circ C$) with (EXP) and without (CON) fluid replacement equal to sweat rate in a counterbalanced, randomized, cross-over fashion. Gastrointestinal temperature (T_{gi}) and fatigue (scale of 0-10) were measured throughout exercise. Dehydration was determined by percent body mass loss (BML). Peak power (PP), mean peak power (MPP), and heart rate (HR) were measured during CMJ pre- and post-exercise using dual force plates and a HR strap. Dependent t-tests evaluated post-exercise T_{gi} , fatigue, and BML between groups. Separate two-way repeated measures ANOVA evaluated differences in PP, MPP, and HR with $\alpha=0.05$. **Results:** Subjects achieved $2.59 \pm 0.52\%$ BML in CON and $0.92 \pm 0.41\%$ in EXP ($p < 0.001$). Post-exercise T_{gi} (39.29 ± 0.31 , $39.03 \pm 0.61^\circ C$, $p=0.425$) and fatigue (9 ± 1 , 9 ± 2 ; $p=0.424$) were similar between CON and EXP, respectively. HR response during post-exercise CMJ was greater in CON than EXP (174 ± 7 , 161 ± 11 , $p=0.040$). No differences ($p > 0.05$) were seen in PP or MPP pre-exercise (PP: 53.80 ± 10.78 , 55.80 ± 11.63 ; MPP: 45.20 ± 8.26 , 45.80 ± 8.14) to post-exercise (PP: 52.80 ± 12.05 , 52.20 ± 8.17 ; MPP: 46.40 ± 7.83 ; 44.20 ± 7.29) for EXP and CON, respectively. **Conclusion:** Exercise-induced hyperthermia, dehydration, and fatigue to the levels achieved in this study did not affect anaerobic power. Fluid replacement reduced cardiovascular strain but did not affect anaerobic power during CMJ, likely due to the mild hyperthermia and $< 3\%$ dehydration in CON.

Supported by CSU Fresno Grad. Student Research and Creative Activities Support Award

3790 Board #237 June 3 9:30 AM - 11:00 AM
Alaska Mountain Wilderness Ski Classic: Alterations in Body Composition

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 (No relationships reported)

* **PURPOSE:** The Alaska Mountain Wilderness Ski Classic (AMWSC) is considered to be one of the most challenging endurance events in the world. It has endured for more than 2 decades and various courses have traversed the Wrangell St. Elias, Chugach, Brooks and Alaska mountain ranges. There are no food drops, rest stations,

or marked trails as skiers are free to pick the best route (i.e. 100-150 miles) through the mountainous and remote Alaskan backcountry. Given the combined challenges of chronic activity, mental stress and cold exposure on physiological resilience, the purpose of this study was to evaluate the influence of the 2016 AMWSC that was staged in the Brooks Range on energy expenditure and body composition. A two-tailed paired t-test was used to compare pre- and post-event alterations in lean body mass, fat mass and bone mineral density.

* **METHODS:** 15 male and female skiers (mean \pm SEM; Age = 31.4 ± 0.7 , BMI = 23.7 ± 0.6) were recruited for the study. Lean body mass, total fat mass, and bone mineral density were measured using a General Electric iDXA pre- and post-event. In order to estimate total and daily energy expenditure, all participants wore a Actigraph wGT3X-BT monitor throughout the event.

* **RESULTS:** The first finishing group completed the event in 100 hours and 25 min, and the last individual completed the event at 121 hours and 7 min setting a course record for the closest time range within the finishing groups. Lean body mass and the relative skeletal muscle index (RSMI) increased by 1.7 ± 0.3 kg and 0.22 ± 0.05 kg/m 2 , respectively. While there was a significant reduction (Δ of -1.3 ± 0.2 kg) in total fat mass, there was no change in bone mineral density (Δ of 0.0044 ± 0.0085 g/cm 3). Including a correction for pack weight, daily energy expenditure was 5084 ± 244 , 7314 ± 332 , 7492 ± 422 , 7505 ± 307 , 6538 ± 376 , 3843 ± 592 , 5889 ± 859 kcal, respectively over the course of the event. Total energy expenditure was $37,162 \pm 2174$ kcal.

* **CONCLUSION:** Lean body mass and RSMI increased in all athletes. Previous work using isotopic methodologies during acute exercise showed that urea reincorporation into protein increased during exercise. Future studies are planned with this cohort that will utilize isotopic methodology to measure changes in protein synthesis and skeletal muscle for evaluating the impact of cold exposure on physiological resilience.

3791 Board #238 June 3 9:30 AM - 11:00 AM
Influence of Physical Activity Patterns and Age on Acute Mountain Sickness Incidence during Mt. Kilimanjaro Trek

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 (No relationships reported)

PURPOSE: Physical activity is often noted as a risk factor for the development of AMS. We sought to explore the interaction between age and physical activity patterns on the development of AMS in a group of 27 individuals during a gradual ascent of Mt. Kilimanjaro (19,341 ft).

METHODS: 27 adults (44 ± 15 yrs; 24.45 ± 3.90 BMI; $n=11/27$ Female) climbed over an 11-day period. Use of acetazolamide and NSAIDs were minimized but remained optionally taken as necessary during the ascent. Physical activity was monitored using BodyMedia activity monitors; heart rate and oxygen saturation were monitored with Biovotion devices; AMS incidence was classified from the Lake Louise Questionnaire; and total symptoms were scored from the questionnaire's original five symptoms plus an additional five symptoms. Groups were divided based on age (group 1: 28 ± 2 yrs, 2: 44 ± 8 yrs, and 3: 58 ± 10 yrs). Comparisons were made using ANOVA and independent T-tests, and post hoc analyses were made using Tukey's method.

RESULTS: Throughout the trek, 59% ($n=16/27$) of subjects displayed AMS at least for one day during the climb. Average total symptom scores were 4.2 ± 2.9 , 2.2 ± 1.9 , 3.3 ± 1.5 for group 1 vs. 2 vs. 3 respectively. Focusing on the summit push (day 10), AMS incidence was highest in group 1 (87.5%; $n=7/8$) compared to group 2 (33%; $n=3/9$) and group 3 (25%; $n=2/8$) with an ANOVA statistical significance of $p < 0.05$. Moreover, percentage of climb spent in moderate to vigorous activity (MVPA), hiking speed (KPH), and steps taken per minute were highest for group 1 (MVPA: $65\% \pm 14\%$ vs. $54\% \pm 19\%$ vs. $52\% \pm 14\%$; KPH: 1 ± 0.1 vs. 0.91 ± 0.09 vs. 0.85 ± 0.06 ; Steps/min: 23 ± 5 vs. 22 ± 5 vs. 14 ± 2 ; ANOVA $p < 0.05$ for KPH, steps/min). Average heart rate and SpO2 was higher for group 1 during the climb to summit (HR: 109 ± 13 bpm vs. 88 ± 14 bpm vs. 87 ± 8 bpm; SPO2: $85.5 \pm 5.5\%$ vs. $83.2 \pm 9.4\%$ vs. $81.9 \pm 8.0\%$; $p < 0.05$ for HR). Post hoc analyses depicted a significant difference between group 1 and group 3 in AMS incidence, KPH and steps/min, and a significant difference in HR between group 1 and the rest.

CONCLUSIONS: In this study, the youngest group averaged a higher total symptom score throughout the trek, and exerted greater physical intensity, hiking speed, and activity on summit day. It was found that AMS was more common in young adults, which may be due to being more active and adventurous than older individuals.

3792 Board #239 June 3 9:30 AM - 11:00 AM
The Response Of Plasma Hypoxia-inducible Factor-1 Alpha, Serum Erythropoietin And Plasma Vascular Endothelial Growth Factor During Acute Exposure To Altitude (4300 M)

Roy Salgado, Beth Beidleman. *United States Army Research Institute of Environmental Medicine, Natick, MA.*
 (No relationships reported)

The response of plasma hypoxia-inducible factor-1 alpha, serum erythropoietin and plasma vascular endothelial growth factor during acute exposure to altitude (4300 m) Salgado, R.M.¹ and Beidleman, B.A.² ¹Thermal and Mountain Medicine Division, US Army Research Institute of Environmental Medicine, Natick, MA ²Biophysics and Biomedical Modeling Division, US Army Research Institute of Environmental Medicine, Natick, MA Intracellular hypoxia-inducible factor-1 alpha (HIF-1 α) increases in response to hypoxia and regulates erythropoietin (EPO) and vascular endothelial growth factor (VEGF) expression. However, the response of extracellular HIF-1 α (i.e. plasma HIF-1 α) to acute hypobaric hypoxia (HH) exposure is unclear. **PURPOSE:** To determine whether plasma HIF-1 α and downstream targets such as serum EPO and plasma VEGF increase from sea level (SL) to acute HH. **METHODS:** Venous blood samples from 14 SL residents (M = 10, F = 4, age = 23 \pm 7 years, ht: 179 \pm 10 cm, wt: 74 \pm 12 kg, 46 \pm 6 ml/kg/min; mean \pm SD) were collected after ~20 min of seated rest at SL (~50 m, Natick, MA) and after ~19 hrs of exposure to HH (4300 m, Pikes Peak, CO). Plasma HIF-1 α , serum EPO, and plasma VEGF were measured via ELISA assay. **RESULTS:** From SL to HH, plasma HIF-1 α (SL: 287 \pm 108 pg/mL vs HH: 264 \pm 128 pg/mL, p = 0.51) and plasma VEGF (SL: 74 \pm 55 pg/mL vs HH: 100 \pm 87 pg/mL, p = 0.23) did not change. From SL to HH, serum EPO increased (SL: 14 \pm 15 mIU/mL vs HH: 62 \pm 42 mIU/mL, p < 0.0001). **CONCLUSION:** During the first ~19 hrs of HH exposure plasma HIF-1 α and plasma VEGF do not increase, while serum EPO does increase. While we were the first to measure plasma HIF-1 α during an acute exposure to HH, our results indicate that extracellular HIF-1 α may not represent intracellular HIF-1 α response to HH. Disclaimer: Author's views are not official U.S. Army or DoD policy.

3793 Board #240 June 3 9:30 AM - 11:00 AM
Stress And Well-Being Of Correctional Officers

Kerry S. Kuehl, Diane L. Elliot, FACSM. *Oregon Health & Science University, Portland, OR.*
 (No relationships reported)

Working as a correctional officer (CO) in the U.S. leads to a lower life expectancy than the average U.S. adult, but little research has been done to understand factors leading to these high health risks. **PURPOSE:** To assess mental and physical health characteristics of CO's working in minimum security level prisons as compared to CO's working in maximum security level prisons. **METHODS:** 210 CO's from the Oregon Department of Corrections were assessed by physical measures and survey. Survey included validated measures of stress, diet, physical activity, sleep, pain, disability and injury data, tobacco and alcohol use. Physical measures included fasting lipid and blood glucose, blood pressure, body weight, body composition, waist and hip circumference, flexibility and grip strength. Independent two sample t-tests or chi-square tests were used to assess differences among CO's working in minimum versus maximum security prisons. **RESULTS:** 87% of CO's were overweight or obese and 52% had metabolic syndrome. While years on the job were similar (13 years), CO's working at maximum security prisons reported significantly higher work stress (p=.013) and higher alcohol consumption (p=.040) compared to CO's working at a minimum security level prison. Maximum security level CO's reported greater missed days of work compared to CO's working at a minimum security prison and correlated with increased work stress (p<0.001), less sleep, unhealthy eating habits, and not exercising (p<0.01 for each). **CONCLUSION:** Corrections work is regarded as one of the most difficult and stressful occupations with high morbidity and mortality rates. Our findings indicate CO's working in maximum security prisons have higher mental and physical health risks as compared to minimum security CO's. Specific wellness interventions are needed to improve the well-being of these vulnerable workers. This research was supported by the National Institute on Occupational Safety & Health U19 OH010154-01.

3794 Board #241 June 3 9:30 AM - 11:00 AM
Encouraging Exercise In The Palmetto State: A Descriptive Analysis Of Hiit And Its' Associated Injuries

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 (No relationships reported)

The Exercise Is Medicine® initiative has increased the focus on exercise and its impact on health and wellness. High intensity interval training (HIIT) is an exercise modality that is reported to be gaining popularity. Because physicians, and other medical professionals, are often tasked with encouraging exercise as part of a patient's medical therapy, it is important to understand the risks associated with HIIT so as to provide the best guidance and care possible. **Purpose:** The aim of this study was to describe the HIIT population and their HIIT-related injuries, including incidence, location, duration, and management. **Methods:** A multi-item survey was distributed to various facilities throughout the state of South Carolina promoting and instructing HIIT. Survey results were analyzed using students t-test and Chi-squared tests. **Results:** Sixty-six people met the inclusion criterion of participation in HIIT. The majority were male (56%), in their mid-thirties (33.9 \pm 8.1), with a mean BMI of 25.6 (\pm 4.1). Most reported participation in a beginner's HIIT training program (71%), prior weight lifting training (64%), and some level of previous athletic experience (91%). From these 66 individuals, 70% said they do HIIT \geq 4 times a week, and approximately 44% (n=29) reported at least one HIIT-related injury. Fifty-three total injuries were reported; the most common being shoulder (19%) and lower back (19%). Approximately 38% sustained their injury within 6 months of starting HIIT and 55% within the first year. Most people (62%) self-diagnosed their injury, and 52% did not seek professional treatment. The majority of those injured said they recovered from their injuries within 2 months (83%) following rest (38%) and/or a decrease in exercise intensity (41%). **Conclusions:** Despite introductory training programs and prior athletic and weight lifting experience, approximately half of HIIT participants experienced a HIIT-related injury. Individuals with HIIT-related injuries are most likely to self-diagnose, and/or self-adjust their exercise program prior to resuming HIIT.

3795 Board #242 June 3 9:30 AM - 11:00 AM
Development Of A Novel Grading Scale Based On The ULNT1 And BPTT

Mark W. Butler¹, Mary Lou Galantino², M. Alysia Mastrangelo, FACSM². ¹Nova Care Rehabilitation, Medford, NJ. ²Stockton University, Galloway, NJ.
 (No relationships reported)

Purpose: Upper Limb Neurodynamic Tests assess for mechanosensitivity, with moderate degrees of reliability and validity. The purpose of this study was to assess inter and intra-rater accuracy of a novel standardized grading scale based on neurodynamic tests demonstrated to bias the median nerve and brachial plexus. **Methods:** Participants attending lectures on neural mobilization were instructed in a novel grading scale based on the Upper Limb Neurodynamic Test 1 and Brachial Plexus Tension Test. At least one hour after instruction, participants were shown 7 different videos of a possible 14 test positions in random order and asked to score the tests on a data collection sheet. To determine accuracy in Phase II, at least one month after participating in Phase I, nine of the 307 clinicians were re-tested by again viewing the 7 videos and scoring the tests. **Results:** In Phase I, SPSS 22.1 was used for descriptive statistics and ANOVA data analysis. Fifty eight percent achieved the correct response for all 7 positions, 23.5% for six positions, and 12.1% for five positions 4.6% for 4 positions and less than 2% accurate for 3 or less test positions. Of note, clinicians with 1 – 5 years of experience scored significantly better than clinicians with 15+ years of experience (p<.002). There were no significant differences in accuracy between groups of clinicians based on area of specialty or location. In Phase II a similar analysis included 9 participants, 89% achieved the correct response for all 7 positions, with 100% achieving a correct response to 6 or more positions. **Conclusion:** Previous authors have identified the value of neural mobility testing but have not utilized a specific grading scale. This study is the first step to identifying and testing a clinical scale that may have utility in the clinic. Our results demonstrate good accuracy of responses among all clinicians in their ability to correctly identify test positions in this grading scale. However, there was a significant difference in accuracy between clinicians with 1 – 5 years of experience vs. clinicians with 15+ years of experience. This grading system may provide quantified outcome in neural mobility scoring for clinical utility. Further testing is needed to ascertain why differences exist in two levels of years of experience.

3796 Board #243 June 3 9:30 AM - 11:00 AM
Impact of Attention Deficit Hyperactivity Disorder on Athletes
 Timothy M. Dekker. *Mayo Clinic, Jacksonville, FL.*
(No relationships reported)

Impact of Attention Deficit Hyperactivity Disorder on Athletes
 Timothy Dekker, George G.A. Pujalte, Jennifer R. Maynard, McKennan J. Thurston, Walter C. Taylor, and Mohit Chauhan
Purpose: This systematic review was done to try to uncover Attention deficit hyperactivity disorder's (ADHD) impact on athletics, treatment effects on sports participation, basis for regulation by sports organizations, and approaches to conditions occurring with ADHD.
Methods: A systemic review was done using specific keywords, gathering articles from MEDLINE, Embase, PsycINFO, Cochrane Database of Systemic Reviews and Ovid Interface.
Results: ADHD is a common neurobehavioral disorder, reported as affecting 11% of children, with symptoms persisting into adulthood in up to 15% of individuals. ADHD has been shown to have both beneficial and detrimental effects on athletic performance. Advantages include: Impulsivity, increased aggressiveness, improved pain tolerance, and decreased fatigue. Conversely, children with ADHD were found to have lower total motor composite ($t=-9.32$, $p<.001$) with Bruininks-Oseretsky Motor Performance Test. Sports and exercise have numerous positive effects on those with ADHD, for example, an increase in Dupaul ADHD rating scores of 4.53($p=.04$) were found after a 6 week aerobics program. Stimulants combined with behavioral techniques are known to be superior to behavioral management alone. Return to play is also different in athletes with pre-existing ADHD, especially with concussions due to more persistent memory issues, decreased focus and brain fog after injury. Sport organizations regulate stimulants due to presumed advantages and side effects: Increased thermogenic effects of stimulants, MI, CVA, psychosis, seizures, and even death have been recorded.
Conclusions: Athletes with ADHD should be recognized and managed appropriately. Sports performance can be positively and negatively affected by ADHD, which individual athletes and organizations need to consider. More research is needed to determine how ADHD and medications used affect specific sports.

3797 Board #244 June 3 9:30 AM - 11:00 AM
Understanding Injury and Injury Prevention in Paralympic Sport
 Marcus Fearing¹, Shana Harrington². ¹*Creighton University School of Medicine, Omaha, NE.* ²*University of South Carolina, Columbia, SC.*
(No relationships reported)

PURPOSE: Adaptive equipment technologic advances and increased media attention to the Paralympic Games have led to an increasing number of athletes with disabilities participating in Para sports. Still, little is known about common injuries that occur in Para sport athletes. Even less is known about whether these athletes are currently participating in injury prevention programs. The purpose of this study was to survey swimming, cycling and athletic Para sport athletes to better understand common injuries and whether injury prevention programs were being performed.
METHODS: An electronic survey was created using Qualtrics consisting of 28 questions and emailed to 364 athletes who competed in the US Para Swimming, Cycling and Athletic Trials in Charlotte, NC -July 2016. The following information was collected from the survey: average number of hours trained, number of cross training hours performed each week, descriptive information regarding sport related injuries, pain, and whether athletes received treatment for injuries and descriptive information regarding whether the athletes had participated in an injury prevention program.
RESULTS: A total of 137 surveys were completed. Males represented 58% of respondents and females 42%. Swimming represented 29% of the respondents, cycling 26% and athletics 51%. Over 70% of respondents trained ≥ 11 hours/week; and 45% of athletes reported spending ≥ 6 hours per week cross-training. Forty-two percent of athletes revealed they have current pain, and 34% had missed a competition because of injury. Sixty-two percent reported receiving physical therapy relating to sports injuries and 13% required surgeries for the sports-related injury. Only 24% of athletes participated in an injury prevention program.
CONCLUSIONS: A large percentage of Para sport athletes report injuries and often have to miss training and competition due to these injuries. Despite this, only 24% report participating in an injury prevention program. Results from this study emphasize the need to develop and implement injury prevention programs in para sport athletes to help diminish the impact these injuries have on training and competition.

3798 Board #245 June 3 9:30 AM - 11:00 AM
Minute Porosity of 3D Printed Splints and Casts May Allow Water Entry
 Diana Hall¹, Frank Roquemore¹, Jay Townsend², Bill Bentley³, David Atkins⁴, Lex Schultheis³. ¹*ActivArmor, Pueblo, CO.* ²*Department of Corrections, State of Colorado, Canon City, CO.* ³*Robert E. Fischell Medical Device Institute, College Park, MD.* ⁴*Dept. of Aerospace Engineering, Clarke School of Engineering, University of Maryland, College Park, MD.*
Reported Relationships: D. Hall: *Intellectual Property; Patent holder for ActivArmor technology. Ownership Interest (Stocks, Bonds); Owner of ActivArmor.*

MINUTE POROSITY OF 3D PRINTED SPLINTS/CASTS MAY ALLOW WATER ENTRY
 Acknowledgements: Jorge Hernandez, James Coburn, FDA, Center for Devices and Radiation Health, Office of Science and Engineering Laboratories
PURPOSE: Optical scanning and additive manufacturing of immobilizing devices allow for custom fit without padding, allowing patients to return to wet/athletic activity during recovery. However, no studies have evaluated waterproofing of 3D printed immobilization devices. We hypothesized that water may enter the interior of these devices unless strict manufacturing process controls are followed and claims of waterproofing are verified. **METHODS:** Patient specific ABS polymer casts manufactured using fused filament methods by ActivArmor were evaluated for water penetration and retention. Manufacturing parameters were evaluated. Finished devices with visually smooth unbroken surfaces were immersed in fresh water in depths from 1 to 25 feet for periods ranging from 5 to 30 minutes. Change in gross weight was used to determine the quantity of water retained. Examination of surface features was evaluated by digital optical microscopy and internal structure by micro computed tomography. **RESULTS:** Some casts that appeared completely sealed admitted water at depths as little as one foot, increasing up to 16% of dry weight at depths of 25 feet. Small changes in manufacturing reduced water entry to 3% of dry weight, while increasing extrusion diameter completely waterproofed prints. Optical microscopy revealed fenestrations in lamination at acute angles in geometry of prints in prints that retained water. Micro computed tomography was notable for 17 micron gaps in smooth straight sections of water absorbing prints. **CONCLUSIONS:** Visual inspection of 3D printed devices is not sufficient to verify watertight integrity. Retained water inside devices may support bacterial colonization. However, application of appropriate manufacturing process controls and verification procedures enable custom 3D printed devices support claims of improved hygiene and waterproofing. Supported by FDA, Office of Regulatory Science and Innovation, University of Maryland Center for Regulatory Science Initiative

3799 Board #246 June 3 9:30 AM - 11:00 AM
Creatine Kinase, Glomerular Filtration Rate and Military Physical Activity during 2012 Comandos Course
 NILTON G. ROLIM FILHO. *EB/CNPq/FADEUP, Porto, Portugal.*
(No relationships reported)

Exercise rises muscle serum parameters and thus their interpretation could be helpful in monitoring recovery from acute overload or from muscular trauma. Our understanding of these relationships among Special Operations students is limited. **PURPOSE:** This study aimed evaluate effects of repeated sessions of military training exercises during 2012 Comandos Course on muscle damage (CK, LDH, and AST), renal function (creatinine, urea and estimate glomerular filtration-eGFR) and body composition (skeletal muscle mass, visceral fat area and extracellular water). **METHODS:** Biomarkers from 19 Brazilian Army students (age=28.26 \pm 3.91) were analyzed, once a week, during 14 weeks. Serum CK, LDH, AST, creatinine and urea levels by dry-chemistry method. The eGFR by CKD-EPI, expressed as ml/min/1.73m². The BIA evaluation carried out with *InBody720*. Data analyzed to evaluate the baseline and post-training differences were determined by paired sample t test and their effect size (ES) by Cohen's d. **RESULTS:** The presented results of the paired sample t test were significant ($p<0.05$). In extracellular water $t(18)=10.07$, $ES=3.36$ were a huge increase from the baseline ($M=18.37\pm 2.18$) at the 4th week ($M=19.53, \pm 2.4$), this huge effect also occurs with skeletal muscle mass $t(18)=-12.67$, $ES=4.22$ from baseline ($M=38.42, \pm 4.13$) to $M=40.65 \pm 4.61$. The results demonstrated a huge decrease in visceral fat area $t(18)=12.26$, $ES=4.09$ / baseline ($M=47.61\pm 13.18$) to the 5th week ($M=25.53\pm 9.7$), as well as eGFR $t(18)=4.51$, $ES=1.5$ with baseline ($M=128.18\pm 15.07$) to $M=111.16\pm 20.54$. The eGFR $t(17)=-4.59$, $ES=1.58$ were significant increase from baseline ($M=129.62\pm 14.12$) to 11th week ($M=138.77\pm 10.87$). What concerns creatinine different trends were found with a very large increase $t(18)=-4.05$, $ES=1.35$ from baseline ($M=0.93\pm 0.12$) to 5th week ($M=1.06\pm 0.18$), otherwise creatinine $t(17)=4.99$, $ES=1.71$ had a huge decrease at the 11th week ($M=0.82\pm 0.9$). Significant increase occurs in urea $t(18)=-10.99$, $ES=3.66$ from baseline ($M=32.75\pm 4.37$) to the 5th week ($MD=63.89\pm 13.08$), even as were found a huge effect on CK $t(14)=-6.33$,

ES=2.39 concerning baseline (M=123.13±36.05) to 5th week (M=777.87±408.41).

CONCLUSION: Our results support a significant effect of military physical intervention in muscular protein, eGFR and body composition markers.

3800 Board #247 June 3 9:30 AM - 11:00 AM
Resistance Training Versus General Exercise In Multidisciplinary Rehabilitation Of Low Back Pain: A Randomized Trial

vegard M. Iversen, Ottar Vasseljen, Paul Jarle Mork, Øyvind Salvosen, Marius S. Fimland. *Norwegian University of Science and Technology, Trondheim, Norway.*
(No relationships reported)

PURPOSE: Chronic low back pain (CLBP) is commonly managed through multidisciplinary rehabilitation (MDR). We aimed to assess if the effectiveness of MDR could be improved by replacing general exercise (GE) with progressive resistance training (PRT) with high intensity using elastic bands. **METHODS:** Consenting adults (n=99) with moderate to severe non-specific CLBP were randomized to an intervention (PRT) or a comparative group (GE). Both groups received 3-weeks MDR with either GE or PRT (squats, stiff-legged deadlifts, flies, unilateral rows, reversed flies, lateral shoulder raises and lateral pulldown performed 3 times per week with resistance varying from 15-20 to 8-10 repetitions). Both groups were instructed to continue their respective exercise program for 9 weeks after completing the MDR, in which time participants were offered up to three supervised booster sessions. Researchers were blinded during data collection and analyses. The difference in change between groups at 12-weeks in pain-related disability (Oswestry disability index; ODI: 0-100) was the primary outcome. Secondary outcomes were pain (numerical pain rating scale), limitations in important activities (patient-specific functioning scale; PSFS: 0-10), health related quality of life, work ability, global perceived change, fear-avoidance beliefs and back-extension strength were secondary outcomes. **RESULTS:** Baseline data were missing for 25 patients due to early dropouts. Thus, data from 74 participants (mean age: 45 years, 57% women, mean ODI: 30.4) were obtained at baseline and included in the analyses. Forty-six persons participated at the 12-week follow-up test. There were no difference in change in ODI score between groups at 12 weeks (mean difference 1.6, 95% CI: -3.9-7.0, p=0.570, in favor of GE). The improvement in PSFS was larger in the GE group than in the PRT group (mean difference 1.4, 95% CI: 0.1-2.7, p=0.033). No significant differences between the groups were observed for the other secondary outcomes (p≥0.11). **CONCLUSIONS:** This study provided no evidence in support of replacing GE with PRT in MDR for CLBP. In fact, GE might be slightly more beneficial than PRT in reducing limitations in important activities.

3801 Board #248 June 3 9:30 AM - 11:00 AM
Characterization And Functional Capacity (SPPB) Of Adults Over The Age Of Life Free From Mexico

Nancy Cristina Banda Saucedo, Ricardo López García, Gerardo Garza Sepúlveda, Alma Rosa Lidia Lozano González, Raymundo Ruiz Rivera, Esteban Picazzo Palencia, FACSMM, Rosa María Cruz Castruita. *Universidad Autónoma de Nuevo León, Monterrey, Mexico.*
(No relationships reported)

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 Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, México.

At present, the prevention of disability in the elderly is a priority in research topic because it affects the functionality and consequently the quality of life. Determine which process is toward disability a person is crucial to prevent the advanced stage of the loss of functionality; this loss can be detected clinically by the decline or lack of autonomy and emergence of dependence.

PURPOSE: To determine the features and functionality of the free-living older adults of 60 years and over in the metropolitan area of Nuevo León. **METHODS:** In this study, descriptive and cross-sectional study of 367 adults aged 60 years and over different club houses in the metropolitan area of Nuevo León, was applied an anamnesis, anthropometric measurements such as weight and height and the battery short of physical activity (SPPB) that consists in the realization of three tests of balance (feet together, semitandem and tandem), speed (4 meters, up and sit in a chair five times, the battery allows you to assess the risk of disability, with a total score that ranges between 0 and 12, a score below 10 can determine a high risk of disability. For the statistical analysis we used the SPSS version 21.0, using descriptive statistics mean, median and standard deviation. **RESULTS:** In older adults the average age is 72 ±7.28 years of age, with an average schooling of 5 years, 98% with cognitive ability to answer your interviews, 50.8% are widowed, 55.7% is devoted to the home, 24.2% are pensioners, who are economically dependent on someone are 53.9% situation related to the 70.1% who referred to live together, the most outstanding is the hypertension with 51.3%, according to diabetes mellitus in 31.5% and high cholesterol in a 29.2 %;

the SPPB showed a 12.1% with low performance of physical capacity, 47.3% risk of disability. **CONCLUSION:** In the characterization predominantly female, in a state of widowhood with household activities, presenting an economic dependence, the main pathology is hypertension and there is a significant percentage of risk of disability in this population.

3802 Board #249 June 3 9:30 AM - 11:00 AM
Effect Of Stretching On Intracerebral Oxygen Dynamics And Calculation Capability

Wakako Tsuchida¹, Shigeyuki Suzuki², Shingo Matsuo¹, Sena Wakano¹, Mayu Asakawa¹, Taizan Fukaya², Eiji Yamanaka², Yuji Asai¹. *¹Nihon Fukushi University, Handa, Aichi, Japan. ²Nagoya University, Nagoya, Aichi, Japan.*
(No relationships reported)

Low- to moderate-intensity exercise enhances nerve activity in the prefrontal cortex, thereby improving cognitive function (Byun et al., 2014; Chang et al., 2012). However, few studies have investigated the effects of stretching on cognitive function.

PURPOSE: We examined the effect of stretching on cognitive function using a simple calculation task. We also measured brain oxygenation kinetics using near-infrared spectroscopy (NIRS).

METHODS: Participants were 16 healthy students (8 males, 8 females, average age: 20.3 ± 1.4 years). Participants sat on an isokinetic exercise machine and kept their knee joints at the maximum extension position (hamstring stretch) for 5 minutes (Primus RS, BTE). We used NIRS to analyze brain oxygenation kinetics while participants completed a simple calculation task before, during, and after stretching. We measured oxygenated hemoglobin (oxy-Hb) and deoxygenated hemoglobin (deoxy-Hb) in the bilateral prefrontal cortex, motor area, and somatosensory area, as well as the ratio of oxygenated hemoglobin contained in tissue (TOI).

RESULTS: We observed a significant increase in oxy-Hb in the motor and somatosensory areas during stretching compared with measured values at rest (p<0.05). Although we found no significant differences in the rate of correct answers before vs. after stretching, participants took less time to solve the computational task after vs. before stretching (p<0.05). We found no significant differences in Δoxy-Hb, Δdeoxy-Hb, or ΔTOI in the prefrontal cortex, motor area, or somatosensory area before vs. after stretching.

CONCLUSIONS: Stretching affects brain oxygenation dynamics. Specifically, oxy-Hb increased during stretching in the motor and somatosensory areas. The computation time was shorter after stretching, but stretching did not influence brain oxygenation dynamics during the calculation task. Future work will benefit from the use of neuroimaging methods to investigate the effects of stretching on brain function.

3803 Board #250 June 3 9:30 AM - 11:00 AM
Feasibility and Efficacy of Aerobic Exercise Training in Cognitively Impaired Older Adults

Marcel Turner¹, Takashi Tarumi², Jonathan Riley¹, Justin Repshas¹, Candace Hill¹, Tammy Lewis¹, Rong Zhang².
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(No relationships reported)

Advanced age is a significant risk factor associated with brain structural damage, cognitive impairment, and dementia. Regular aerobic exercise potentially protects the brain from structural and functional damage related to age. Therefore, it is important to investigate whether cognitively impaired individuals adhere and respond to exercise training in a similar manner to their cognitively healthy counterparts.

PURPOSE: To test the hypothesis that cognitively impaired individuals respond to structured, supervised exercise regimentation in a similar manner to healthy controls.

METHODS: 73 sedentary, cognitively normal adults (CN) and 68 sedentary adults diagnosed with mild cognitive impairment (MCI) participated in the study. All participants were assigned to one of the two 1-year intervention groups: a moderate-intensity aerobic exercise training regimen or a low-intensity stretching/toning control group. The exercise regimen mandated a progressive increase in duration and frequency over the course of the first 6 months, followed by a maintenance phase over the second half of the intervention. **RESULTS:** MCI patients were slightly younger (MCI 65 ± 6 years vs. CN 68 ± 5 years, P<0.01) than CN adults. At baseline, MCI patients and CN adults in the exercise and stretching group were not different in terms of maximal oxygen uptake (VO₂max: MCI 22.9 ± 5.4 ml/kg/min vs. CN 22.3 ± 3.7 ml/kg/min, P=0.44). Aerobic exercise training improved VO₂max in both CN and MCI groups (P=0.001 for time x treatment), and the magnitude of improvement was similar in both groups (MCI 11%±15% vs. CN 10%±12%). With adjustment for age, the exercise-related improvement in VO₂max remained significant in both groups. Cognitively normal exercise trained adults showed similar compliance to MCI patients (MCI 75% ± 24% vs. CN 81% ± 14%, P>0.05) and similar dropout rates (MCI 37% vs. CN 26% within treatment). **CONCLUSIONS:** MCI patients showed a similar improvement in VO₂max and compliance to exercise training when compared to their

cognitively normal counterparts. This suggests that aerobic exercise training may be a feasible method for combating further cognitive decline in older adults. Funded by National Institutes of Health.

3804 Board #251 June 3 9:30 AM - 11:00 AM
Recent Illness but Not Prior Heat Injury Affects the Rate of Cooling Following Exertional Heat Stroke

Michelle A. King, Matthew Ward, Bruce Adams, Lisa Leon.
United States Army Research Institute of Environmental Medicine, Natick, MA.
(No relationships reported)

PURPOSE: Anecdotal evidence suggests that certain risk factors may impact the severity of exertional heat injury/stroke (EHI/S) and alter the rates of cooling during treatment.

METHODS: In order to examine this hypothesis we performed a clinical records review of heat casualty reports for 215 cases of EHI/S at Marine Corps Base Quantico, VA from 2012-2015. Documentation included information pertaining to the EHI/S episode and treatment. Treatment for EHI/S consisted of a standardized cooling protocol where individuals were continuously doused with ice water and actively rubbed with ice bags, while receiving a normal saline solution of IV fluid.

RESULTS: The majority of patients that underwent the emergent cooling protocol were male, 23 years of age, and had a body mass index (BMI) of 24.5 kg/m². Patients presented on their 28th day of training with a maximal core temperature (T_c max) of 104°F, pulse rate of 111 beats per minute, blood pressure of 122/63 mmHg, and a respiration rate of 22 breaths per minute. *Rates of cooling:* Individuals with a recent or concurrent illness were cooled faster than those without (P=0.016), even though this group presented with a higher core temperature (T_c) at the initiation of cooling (P=0.034). Duration of cooling (minutes) was not different between these two groups (P=0.0945). Previous EHI/S had no effect on the rate of cooling (P=0.413). Further, BMI did not affect the rate of cooling nor was it predictive of T_c max. *Indicators of severity:* Upon admission blood glucose and pulse rate appeared to be indicators of EHI/S severity. Higher T_c max was positively correlated with both higher blood glucose values (P= 0.027, r = 0.195) and pulse rates (P=0.013, r= 0.176). In this population, restrictions on sleep, diet, or water intake did not affect T_c max. *Return to duty:* T_c max did not correlate with the number of rest days prescribed following injury (P=0.119). Further, those experiencing prior EHI/S or recent illness were prescribed the same amount of rest days as those without (P=0.103 and P=0.156 respectively). **CONCLUSIONS:** Contrary to our hypothesis, individuals with recent illness cooled faster, while prior heat injury had no effect on the rate of cooling. Author view not official US ARMY or DoD policy.

G-37 Free Communication/Poster - Sports Medicine
Fellow Research Abstracts

Saturday, June 3, 2017, 7:30 AM - 11:00 AM
Room: Hall F

3805 Board #252 June 3 9:30 AM - 11:00 AM
Do Female Gymnasts Experience Catch-up Growth During Periods of Rest Following Injury?

Katherine V. Yao, Dai Sugimoto, Nathalie Slick, Cynthia Stein.
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(No relationships reported)

PURPOSE: Several studies report delayed growth and hormonal changes during high intensity training in gymnasts, yet no studies specifically investigate the growth rate of gymnasts during periods of rest. The purpose of this investigation is to determine if an increased growth rate, or "catch-up growth", exists in high level female gymnasts during periods of rest following injury.

METHODS: A 5-year retrospective chart review was conducted at a large pediatric hospital. A search of medical records (1/1/2010-12/31/2015) identified female gymnasts 10-16 years old, training ≥10 hours/week or Junior Olympic level ≥7 who suffered an anterior cruciate ligament (ACL) tear requiring at least 6 months (m) recovery time out of training (Gym-ACL). The 6m growth rate of this group (n=23) was compared to female non-gymnast athletes with ACL injury and similar competitive level (Non-gym-ACL, n=29) and high level gymnasts training with minor injuries (Gym-min, n=27). One-way ANOVA with post-hoc correction was used to analyze the 6m rate of change in height, weight, and BMI of the 3 groups.

RESULTS: There were no differences in mean ages (Gym-ACL: 14.8±1.8; Non-gym-ACL: 14.6±1.2; Gym-min: 13.9±2.0), nor significant differences in 6m changes in weight or BMI among the 3 groups. However, there was significant differences in the 6m height change among the 3 groups (p=0.024). A significantly greater height increase was observed in Gym-ACL (+1.40±2.16cm) compared to Non-gym-ACL (+0.02±1.72cm) groups (p=0.047), but no significant differences were

found between the Gym-min (+1.32±2.27cm) and Non-gym-ACL (p=0.051) groups. **CONCLUSIONS:** The 6m growth rate of high level female gymnasts during periods of rest is greater than non-gymnast athletes, suggesting that catch-up growth does occur during periods of rest for highly active gymnasts. This evidence may help us better understand how growth is affected by training load and timing and help develop future training protocols and growth predictions.

3806 Board #253 June 3 9:30 AM - 11:00 AM
Helmet Design And Hits To The Head: Analysis Of NFL Tackling 1951-present

Kevin N. Blythe¹, David Wang², Taylor Polk¹, Douglass Johnson¹, Jordan Murphy¹, Brian McCormick¹, Alex Webb¹, Andrew Horn¹, David Milzman¹. ¹*MedStar Georgetown University Hospital, Washington, DC.* ²*Georgetown University School of Medicine, Washington, DC.*
(No relationships reported)

PURPOSE: Many anecdotal statements attribute NFL helmet design to changing tackling styles and thus, an increase of helmet to helmet hits and subsequent concussive injury. There are no current studies reviewing changes of tackling style over time in the NFL. This study will examine whether the advent of newer helmet technology has led to an increase in the number of tackles involving the helmet in the NFL. **METHODS:** In this preliminary study, investigators were trained in the NFL definition of a "hit," and 2-3 investigators independently reviewed the TV broadcast or game film of each championship game from seven different decades, (1951-2016). Hits were classified based on the involvement of the helmet of both the offensive player and defensive player. A point-system was developed and mean values were collected for each game and open access sources were used to confirm number of head, neck injuries. Additionally, players' behavior in the aftermath of a helmet hit was determined as "concussive" as defined by a neurotrauma trained emergency physician based on delay in getting up and steadiness of gait. **Results:** Helmet to helmet hits occurred on just 1.28% of hits in the 50s compared to 6.97% of hits in the 10s, a 5.44 fold increase. Such hits have increased every decade, with statistically significant (p<0.05, t-test) after the 1960s and again after the 1980s. These changes correspond with the introduction of energy absorbing plastic helmets in the 1970s and the introduction of molded polycarbonate helmets in the late 1980s. These two helmet changes represent the most significant helmet technology changes in the time period studied. Overall hits involving the helmet of at least one player have increased at a similar rate, indicating a more dangerous tackling style. Additionally, the number of players that were judged to exhibit concussive symptoms after a hit significantly (p<0.05, t-test) increased after the 1980s.

CONCLUSIONS: Helmet-helmet hits have had the greatest jumps in frequency corresponding with helmet innovation in the NFL, with the largest jump occurring in the last three decades. That newer helmets with better technology has potentially led to more dangerous hits suggests that helmets designed to withstand greater impact may actually be a detriment to player safety.

3807 Board #254 June 3 9:30 AM - 11:00 AM
Does CTHRC1 Affect Serum Lipid Profiles in Adults?

James Alex¹, William Dexter, FACSM¹, Christina Holt¹, Amy Haskins¹, Volkhard Lindner². ¹*Maine Medical Center, Portland, ME.* ²*Maine Medical Center Research Institute, Scarborough, ME.* (Sponsor: William Dexter, MD, FACSM)
(No relationships reported)

Purpose: Obesity has become a global public health concern as evidence mounts that it is related to a large variety of life threatening diseases from diabetes to heart disease. The biochemical links between body composition and hypercholesterolemia are a target of ongoing research. The hormone collagen triple helix repeat containing 1 (CTHRC1) has been shown to play an important role in the regulation of body composition in mouse models. This study aimed to compare CTHRC1 and serum lipid panels in human adults. We hypothesized that higher CTHRC1 levels would be associated with both decreased cholesterol and triglycerides (TG).

Methods: This study was done in collaboration with researchers at the University of South Carolina who completed the Energy Balance Study (EBS) on 430 adult subjects age 21-35, with BMI ranging from 20-35. Deidentified baseline plasma samples from the EBS subjects were analyzed with enzymatic calorimetric testing and ELISA to measure lipid panels (total cholesterol, HDL, LDL, triglycerides) and CTHRC1 concentrations respectively. Statistical analysis software was used to compare the data both generally and within clinically accepted subgroups of lipid concentrations.

Results: Of the 430 samples from the EBS subjects, 310 contained sufficient plasma for both CTHRC1 and lipid panel testing. No statistically significant difference in lipid concentrations was found between detectable and undetectable CTHRC1 groups (p=0.17-0.99). Stratification of CTHRC1 into undetectable, middle 75% and top 25% also showed no significant difference in lipid concentrations (p=0.32-0.79), nor did stratification of lipid panel components into clinically relevant subgroups (total

cholesterol $</>200$, HDL $</>40$, LDL $</>100$, TG $</>150$, $p=0.12-0.94$). Lastly, linear regression models showed no correlation between CTHRC1 and lipid concentrations ($p=0.21-0.93$).

Conclusion: This study demonstrates no association between CTHRC1 and lipid concentrations in a sample of relatively healthy human adults. Further research is required to better understand the temporal variation of CTHRC1 levels in vivo and thus, better time the collection of samples from subjects. Furthermore, a broader range of body composition among future subjects will help to better generalize data to the adult population.

3808 Board #255 June 3 9:30 AM - 11:00 AM
Use Of FEV1/FVC For Diagnosis Of Exercise-induced Bronchoconstriction (EIB) in Adolescents
 Rebecca Breslow, Kathryn Ackerman, FACSM, Carter Petty, Katherine Cooper, Dawn Ericson. *Boston Children's Hospital, Boston, MA.* (Sponsor: Kathryn Ackerman, FACSM)
(No relationships reported)

Purpose: Standard asthma therapies must be used judiciously in adolescent athletes to minimize side effects and costs. Current diagnostic criteria for EIB, $\geq 10\%$ decline in forced expiratory volume in the 1st second (FEV1) after exercise challenge, does not predict significant response to bronchodilator after challenge. This suggests some patients diagnosed with EIB may not benefit from standard treatment. We sought to determine if the ratio of forced vital capacity (FVC) to FEV1 could be used as a clinical indicator to help guide management decisions in adolescent patients presenting with EIB.

Methods: Using retrospective chart review, we examined valid EIB-protocol challenges performed by patients 13-18 years old in our Pulmonary Function Test lab between 6/1/11 and 5/30/16. We collected demographic data including age, height, weight, body mass index (BMI), gender, and ethnicity. We calculated maximal % decline in FEV1 and % decline in FEV1/FVC for all tests in which patients received albuterol ($n=139$). We examined % change and volume increase in FEV1 after bronchodilator. We used the standard definition of bronchodilator reversibility, $\geq 12\%$ and/or 0.2L increase in FEV1, to signify a positive response. We used two-sample t-tests and logistic regression to compare patients who did and did not exhibit bronchodilator reversibility.

Results: 84/139 (60.4%) patients met current diagnostic criteria for EIB. The mean % decline in FEV1/FVC was 9.6% (SD=9.0). Within this group, 55/84 (65.5%) displayed a positive bronchodilator response. None of the demographics we looked at were associated with reversibility. The mean % decline in FEV1/FVC in those who did not exhibit bronchodilator reversibility was significantly less than the mean % decline in FEV1/FVC for those who did: 6.2% (SD 5.5%) vs. 11.4% (SD 9.9%), $p=0.01$. Each 10% decline in FEV1/FVC was associated with a 3.36 fold increased odds of bronchodilator reversibility (95% CI 1.28-8.78, $p=0.01$). None of the demographics we examined modified this relationship.

Conclusions: Percent decline in FEV1/FVC may predict a positive response to bronchodilator in adolescent patients presenting for EIB evaluation. This finding may help identify individuals who will respond well to use of standard asthma therapies for this condition.

3809 Board #256 June 3 9:30 AM - 11:00 AM
Joint Injection Teaching of Internal Medicine Residents
 Michael Seifert. *Maine Medical Center, Portland, ME.* (Sponsor: Heather Gillespie, FACSM)
(No relationships reported)

Previous studies have shown that Internal Medicine (IM) residents lack confidence in performing joint injections. They report lack of training as the primary cause for low confidence. We developed a teaching session to see if hands-on teaching of IM residents and faculty would help residents make durable confidence gains in performing joint injections of the knee and shoulder. **PURPOSE:** To assess whether a teaching intervention, performed early in the training year for IM residents, would improve resident confidence in their knowledge of and ability to perform joint injections.

METHODS: A 90 minute resident joint injection workshop occurred in September 2016. Residents were given a pre-course questionnaire to measure their confidence with knee and shoulder injection indications, techniques, and risks and benefits as measured in a five-point Likert scale (1 is low, 5 is high). Following a brief lecture reviewing these topics, the residents then practiced on simulation models. A post-course questionnaire given afterwards assessed whether there was an increase in confidence of knowledge in these procedural skills. The IM faculty were given the same lecture and opportunity to practice on models in October 2016. The longer-term effect of the teaching intervention was measured by re-administering the post-course questionnaire four months later via Survey Monkey®.

RESULTS: 18 IM residents completed the workshop. Confidence for performing knee injections increased from a mean of 2.22 to a mean of 3.78; for shoulder injections the mean increased from 1.61 to 3.78. Confidence in knowledge of the risks and benefits,

supplies needed, and indications increased similarly. Statistically paired t-tests of all measured items showed significant increases. Four months post-workshop, confidence levels were sustained above the pre-testing levels for all areas studied (again $p < 0.001$). Finally, residents indicated they were more likely to perform these injections even after four months.

CONCLUSIONS: Based on this study, our workshop-style teaching session for residents and supervising faculty led to significant and durable increases in resident's confidence of their knowledge and ability to perform two common joints injections. Further development of this model may increase clinical performance and practice confidence.

3810 Board #257 June 3 9:30 AM - 11:00 AM
Athlete Risk Correlation Study: Psychosocial Determinants Of Musculoskeletal Injury Risk
 Vicki Nelson¹, Christina Thompson², Christopher Tangen².
¹Greenville Health System, Greenville, SC. ²University Hospitals Cleveland, Cleveland, OH. (Sponsor: Kyle Cassas, FACSM)
(No relationships reported)

PURPOSE: Several modifiable factors are linked to athletic injury including disordered eating, sleep, team climate, anxiety and life stressors. We hypothesize that characterization of psychosocial factors could help identify at-risk athletes and areas for possible intervention.

METHODS: High school student-athletes aged 14-18 participating in school sponsored athletics were provided with a 31-question survey including perception of athletic pressures, diet and weight, family and personal relationships, academics and sleep. 156 athletes were surveyed with 144 athletes participating (92% response rate). Each athlete indicated whether they had sustained a musculoskeletal injury or concussion requiring time away from sport. Athletes who reported musculoskeletal injury were compared to non-injured peers using fisher's exact test for significance.

RESULTS: Significant association was seen between musculoskeletal injury and a perceived competitive athletic environment including playing multiple sports (82% of injured vs 55% of well athletes, $p < 0.001$), belief that the team depends on them to do well (92% v 77%, $p < 0.02$), and deriving most personal friendships from among teammates (85% v 63%, $p < 0.005$). Injured female athletes were additionally more likely to identify feeling pressure to perform well in their sport and plans to pursue collegiate athletics. Self-identified change in school grades was protective (53% vs 71%, $p < 0.03$), with decreased injury in these students. Additionally, feeling tired upon waking (91 v 77%, $p < 0.02$) and occupation with weight (30 v 15%, $p < 0.04$) correlated with increased injury. This association between injury and occupation with weight was enhanced among female athletes. None of the significant associations were seen among athletes reporting concussion.

CONCLUSIONS: In a cohort of high school athletes screened for psychosocial and behavioral determinants, a more competitive athlete environment, fatigue and preoccupation with weight were found to increase the risk of musculoskeletal injury. The significant survey responses support the hypothesis that psychosocial factors contribute to risk of injury and further studies are warranted.

3811 Board #258 June 3 9:30 AM - 11:00 AM
Preliminary Results from a Prospective Study Using the Female Athlete Triad Cumulative Risk Assessment
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(No relationships reported)

Purpose: Bone stress injuries (BSIs) are a common overuse injury in running athletes. The purpose of this study is to determine whether a nutrition intervention targeting at risk athletes using the Female Athlete Triad Cumulative Risk Assessment (TRIAD R-A) would result in changes in bone health and reduce incidence of BSIs. **Methods and Study Design:** One hundred fifty-five (76 male, 69 female) middle and long-distance runners at two NCAA Division I programs were followed prospectively over four years. The TRIAD R-A was used to identify at risk athletes pre-season followed by nutrition interventions based on these assessments. Running-related BSIs were diagnosed by a physician and confirmed radiographically. **Results:** A subset of twelve returning female athletes with consecutive DXA scans were evaluated at the same program. Five females had $> 2\%$ improvement in L1-L4 DXA BMD (two females with $> 5\%$). Of this same subset over the same year, the number of females identified as high to moderate risk for amenorrhea/oligomenorrhea decreased from nine to six and number of BSI's decreased from four (three high risk) to three (one high risk).

Conclusions: This is the first prospective outcome study using the TRIAD R-A and a nutrition intervention tailored to an athlete's risk. Based on these preliminary

results, use of the TRIAD R-A in conjunction with a nutrition intervention focused on optimizing energy availability led to improvements in bone health and reductions in incidence of BSI. Further research is needed to evaluate the significance and impact of these trends. **Acknowledgements:** The authors would like to thank AMSSM and Pac-12 for helping fund this study.

3812 Board #259 June 3 9:30 AM - 11:00 AM
Improving Prp Production In An Outpatient Sports Medicine Office: A Qi Project

William L. Patterson Jr., William Dexter, FACSM, Christina Holt, Amy Haskins. *Maine Medical Center, Portland, ME.*
(No relationships reported)

PURPOSE: Platelet rich plasma (PRP) is a clinically current topic in sports medicine and orthopedics, and is used for various orthopedic pathologies. Prior studies show that commercial kits consistently yield platelet concentrations of approximately $1,000 \times 10^3$ platelets/ μL , but are prohibitively expensive to most patients. Studies comparing these "kits" vs in-office "do-it-yourself" protocols have found that a desktop centrifuge and phlebotomy tubes can produce similar elevated platelet concentrations. Our office had been using a protocol that had not yet been internally validated. We desired to identify and assess an optimal in office, high quality, accessible protocol to make PRP.

METHODS: We compared whole blood and preparations from 3 separate "in-house" protocols to isolate PRP and quantified amount of platelets in each sample. For protocol 1 (our previous in-office standard protocol) we drew 16.2ml of blood, spun this at 1318g for 10 minutes, and manually removed the buffy coat layer for analysis. For protocol 2 we drew 16.2ml of blood, spun this at 900g for 5 minutes, and manually removed the buffy coat layer for analysis. For protocol 3 we drew 16.2ml of blood, spun this at 900g for 5 minutes, and manually removed the entire supernatant layer including the buffy coat, spun this solution at 1500g's for 15 minutes, discarded the top 2/3rd of the supernatant, resuspended the remaining sample, and sent these samples for analysis. We used T tests to compare means between each method and in comparison to whole blood.

RESULTS: 31 specimens were obtained and put through the 3 protocols above. Whole blood (WB) yielded a mean of 257.1×10^3 platelets/ μL (95%CI 240-274). Protocol 1 yielded a mean of 648.4×10^3 platelets/ μL (95%CI 581-714) (2.5x WB concentration). Protocol 2 yielded a mean of 464.4×10^3 platelets/ μL (95%CI 424-504) (1.8x WB concentration). Protocol 3 yielded a mean of 974.1×10^3 platelets/ μL (95%CI 850-1097) (3.8x WB concentration). All pairwise comparisons of means were highly statistically significant ($p < 0.0001$).

CONCLUSIONS: Highly concentrated platelet rich plasma (PRP) can be consistently obtained using common in-office centrifuges and phlebotomy tubes following protocols, comparable to concentration data previously reported from using professional kits.

3813 Board #260 June 3 9:30 AM - 11:00 AM
Utilization of Emergency Department Services: A Comparison of High Schools With and Without Athletic Trainers

Christine Bender, William W. Dexter, FACSM, Amy Haskins, Christina Holt. *Maine Medical Center, Portland, ME.* (Sponsor: William W. Dexter, FACSM)
(No relationships reported)

Purpose:

The primary aim of this study is to compare utilization of ED services in Maine between students in areas of public high schools with certified athletic trainers (AT) and those without by looking at three common athletic injuries in the high school population of teens aged 14-18.

Methods:

Using 2013 Maine All Claims data, we obtained aggregated counts of ED visits categorized by zip code for three injuries (ankle sprain, concussion, and fracture) based on their respective diagnosis codes. Each zip code was attributed to a high school in Maine. Each high school was contacted directly to determine AT status, number of students, number of athletes, and types of sports. We then calculated the rates of each of the three types of ED visits in schools with and without AT. Chi-square tests were used to compare the ED utilization for each type of injury among high schools with and without ATs.

Results:

The 2013 Maine All Claims Data includes injury data for 346 Maine zip codes. There were a total of 1114 fractures, 826 sprains, and 538 concussions. Preliminary results were obtained from 185 (53.5%) zip codes, representing a total of 620 (55.6%) fractures, 427 (51.7%) sprains, and 305 (56.7%) concussions. These 185 zip codes represent 31992 students, 56.2% of the estimated 56,924 public high school student population in 2013-2014.

In HS w/ AT, the cumulative student population was 28270 and there were 536 fractures, 339 ankle sprains, and 266 concussions. In HS w/o AT the cumulative student population was 3722 and there were 84 fractures, 88 ankle sprains, and 39

concussions. Rates were calculated by injury type per student population for schools w/ and w/o AT and reported per 100 person-time units. Fractures had rates of 1.90 and 2.26 for HS w/ AT and HS w/o AT, respectively, with a p value of 0.1423. Sprains had rates of 1.20 and 2.37 for HS w/ AT and HS w/o AT, respectively, with a p value of < 0.0001 . Concussions had rates of 0.94 and 1.05 for HS w/ AT and HS w/o AT, respectively, with a p value of 0.5223.

Conclusion:

Although data analysis is not yet complete, our preliminary investigation reveals a significant difference in the rates of utilization of ED services for sprains when comparing schools with and without ATs. There was no statistically significant difference found for similar comparisons of fractures and concussions.

3814 Board #261 June 3 9:30 AM - 11:00 AM
Opioid Prescription Practices for Pediatric Musculoskeletal Injuries

Erin Moix Grieb, Jane Gralla, Ariel Kiyomi Daoud, Julie Wilson, Christopher Hoyte. *University of Colorado, Denver, CO.* (Sponsor: John Hill, FACSM)
(No relationships reported)

PURPOSE: Prescriptions of controlled substances for youth, including opioids, nearly doubled from 1994-2007. Previous studies have shown that for patients aged 10-19 years, dentists were the main prescribers, followed by primary care and emergency medicine physicians; however, analgesic prescribing practices among sports medicine and orthopedic providers are unknown. The purpose of this study is to determine opioid prescribing patterns to youth with musculoskeletal (MSK) injuries in various clinical settings.

METHODS: This retrospective case series reviewed patients aged 10-18 years, evaluated within the network of care of a local pediatric hospital, for known or suspected musculoskeletal injury from October 2014 to September 2016. Data was extracted from electronic medical records based on inclusion query terms. 14,172 initial visit records with complete data for provider (Physician, Physician Assistant - PA, Nurse Practitioner - NP), department (ED, Orthopedics which includes Sports Medicine, Primary Care - PC), diagnosis (fracture, no fracture), location of injury (upper extremity - UE, lower extremity - LE), prior opioid prescription, age and sex were included. Data were analyzed using multivariable logistic regression.

RESULTS: Mean age was 13 years. Opioid prescribing was more common for male patients (odds ratio (OR) 1.3, 95% CI 1.1-1.5), fractures (OR 7.1, 95% CI 5.8-8.7), and ED visits (ED vs PC OR 10.3, 95% CI 4.6-23.4; ED vs Ortho OR 8.7, 95% CI 7.2-10.6). Opioids were prescribed in 5.9% of UE injuries, 3.6% of LE injuries, 9.4% of fractures and 1.9% of non-fracture injuries. ED providers ordered 68.9% of opioid prescriptions in the study, and saw 27.7% of patients with MSK injuries. NPs were less likely to prescribe opioids than physicians (OR 0.5, CI 0.4-0.6) and PAs (OR 0.5, CI 0.4-0.7) and there were more NPs in the ED (27.0%) than Ortho (2.2%) or PC (13.0%). Of those patients who received an opioid prescription, 68.3% did not have any prior MSK injury.

CONCLUSIONS: For pediatric patients with MSK injuries, most opioid prescriptions originated from an ED visit. Injury type and provider type also impacted opioid prescribing patterns.

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1008	3699	2298	3699	Elmendorf, Kaeleigh N.	845	Ernst, Monique	3014, 3016		
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